Memorandum Regarding Wild Rice Sulfate Standard Calculations
Comparing Expected and Observed Sulfide Levels in Field Study Data
and Interpreting Statistical Analysis

Joel Roberts, Ph.D., Professor Emeritus of Mathematics
University of Minnesota
December 16, 2015

1. INTRODUCTION

I am a Professor Emeritus of Mathematics, having retired from the University of Minnesota faculty. My most relevant field of expertise is Applications of Mathematics. My *curriculum vitae* is summarized in Section 8 of this report. On review of the Minnesota Pollution Control Agency's (MPCA) proposal,[1] I was struck by the degree of scatter reflected in the Figure 9 comparison between the modeled levels of porewater sulfide and the levels of sulfide that were actually observed in the field study. I have reproduced the illustrations of this scatter pattern below and provide some discussion of the significance of the fit of the data shown in the *MPCA Proposal.*

In order to further test the predictive power of the proposed MPCA formula to derive sulfide concentrations, I obtained from the MPCA the wild rice, sulfate and sulfide data on which the *MPCA Proposal* is based and replicated the MPCA's calculations of predicted sulfide to compare them with observed sulfide. The spreadsheet containing this analysis is provided in Attachment A and Attachment B, which illustrate different ways of sorting this data. Comparing observed sulfide concentrations in the MPCA field data with predicted sulfide concentrations obtained by applying the MPCA's equation demonstrated to me the poor predictive power of the proposed equation. The lack of consistency in the ratios of predicted and observed sulfide provides no confidence that the MPCA's Proposal will provide a reliable prediction of sulfide levels. Thus, even setting aside questions about the ecology that these predictions represent (a set of issues that are outside my expertise) the MPCA Proposal seems like an unreliable method to protect wild rice from excess sulfide.

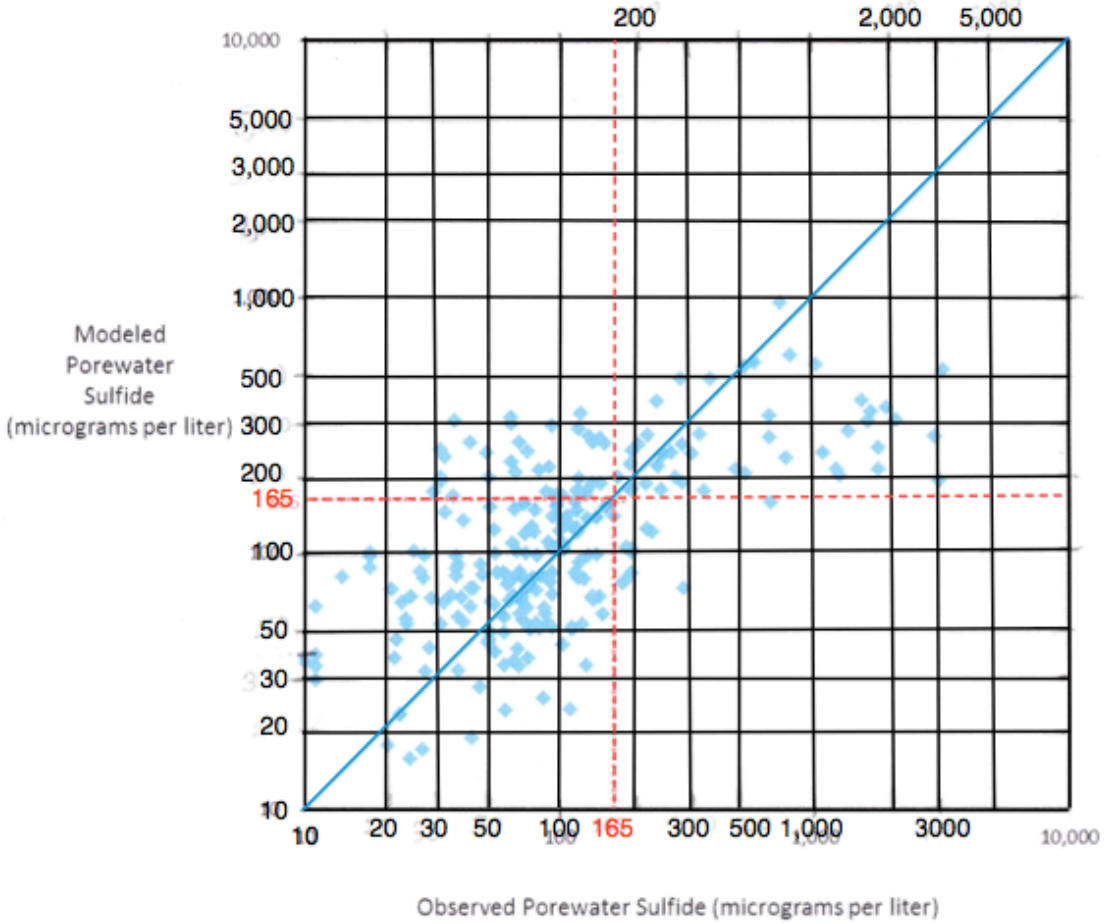
2. GRAPHIC REPRESENTATION AND CHI-SQUARE ANALYSIS OF MPCA DATA

Section 2 of the *MPCA Proposal* is entitled *The relationship between sulfide and sulfate*. The relationship is shown in Figure 9. That figure is reproduced below, with gridlines added to show how the points correspond to actual values. The positions of the gridlines were carefully measured to take account of the logarithmic scale.

The data points tend to cluster around the main diagonal (shown in blue), indicating some degree of relationship. Since this is a log-log plot (logarithmic scale in both variables), however, the relationship is made to appear much closer than what would be seen if the chart had been based on the more commonly used linear scale. Indeed, the measure of closeness actually is the *ratio*

[1] Minnesota Pollution Control Agency, *Proposed Approach for Minnesota's Sulfate Standard to Protect Wild Rice*, March 24, 2015. (hereinafter *MPCA Proposal*)

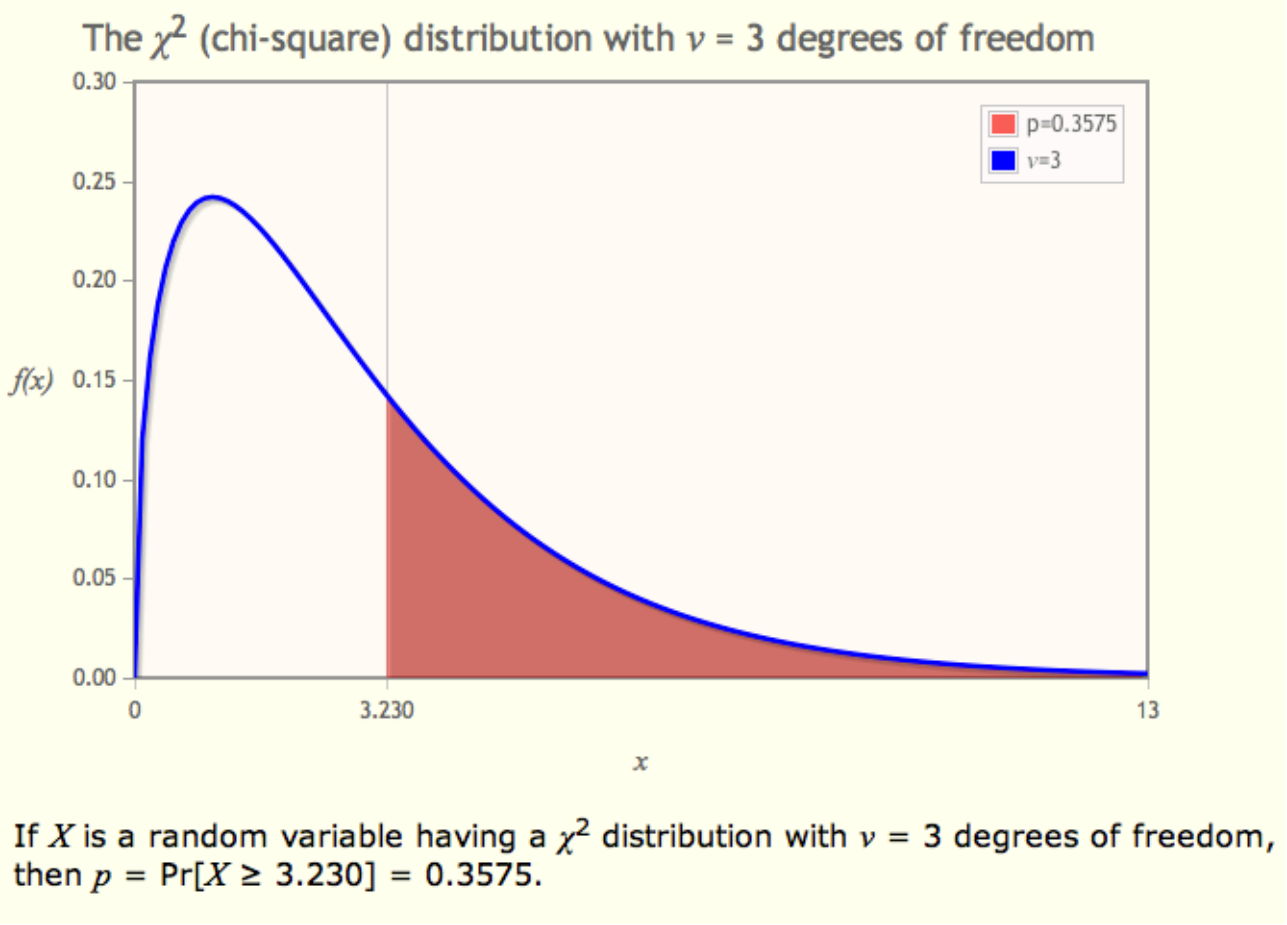
between the expected value and the observed value. This is the ratio that I actually calculated in the spreadsheet reproduced in Attachments A and B.



Some tests of significance are presented in Appendix 1 of the Main Document. The chi-squared statistic is the most basic, since RMSEA (root mean square error of approximation) can be calculated from it. The stated chi squared value is 3.23, with 3 degrees of freedom (essentially the number of independent variables), and N =184. (The number of sites studied in the field study was around 184.) The probability of a chi-squared value with 3 degrees of freedom being greater than 3.23 is given as 0.3572. This means that the value of such a variable being **less** than 3.23 is 0.6428. Now, a better fit to the data corresponds to a **smaller** chi-squared value.

The stated chi-squared value would indicate that the probability of a better fit is 0.6428. In my opinion, the chi-squared calculation presents an inconclusive result. It does not make a compelling case for goodness of fit of the model. In simple terms, using the chi-squared test of the fit of the data, the proposed equation predicts less than half of the variability of the data. Even though it is possible to draw a line through the data points that indicates a potential relationship between the data points, as the MPCA has done, this single line does not provide a powerful predictor of results for specific water bodies/data points.

The figure shown below illustrates the chi-square calculation.



3. Outlying Data and Under-prediction of Porewater Sulfide

I performed some additional analysis to review outlying data points and the potential for under-prediction of porewater sulfide.

In the *MPCA Proposal*, the following formula was presented for calculating pore water sulfide concentration:

. $Sulfide = 7.873\ Sulfate^{0.345}\ Organic\ Carbon^{0.486}\ Sediment\ Iron^{-0.675}$ (Equation 2)

(Sulfate and sulfide are expressed in mg/L; organic carbon is percent total organic carbon in the sediment; iron is micrograms extractable iron per gram sediment).

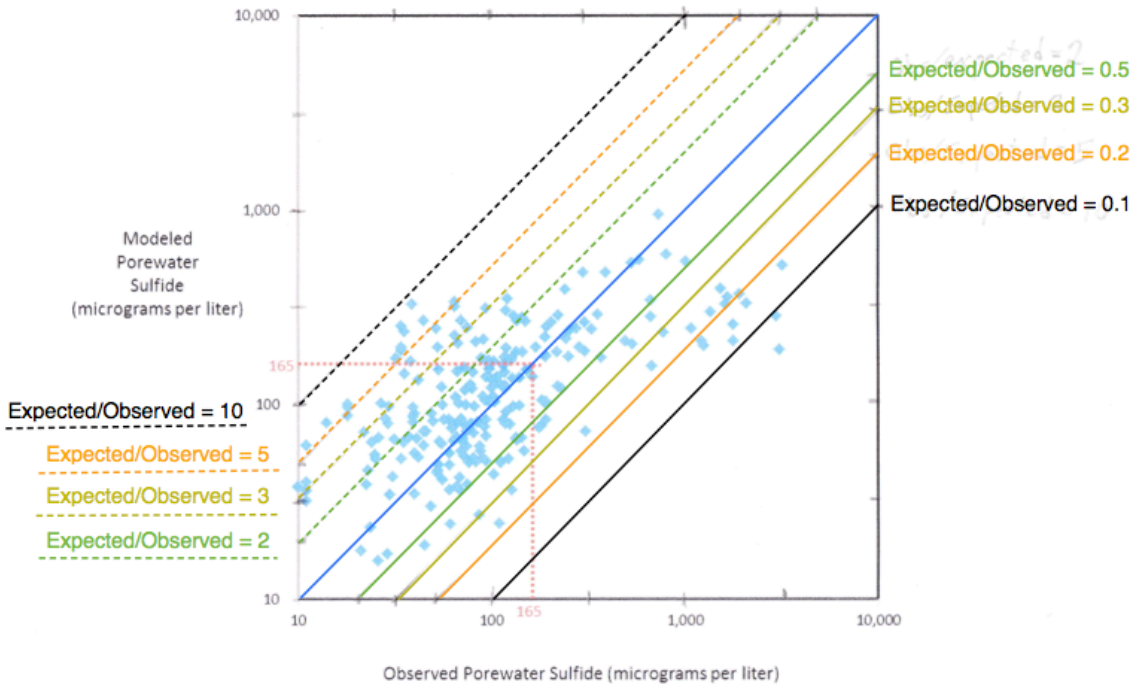
This corresponds to the following logarithmic version:

$$\log(Sulfide) = \log(7.873) + 0.345\ \log(Sulfate) + 0.486\ \log(Organic\ Carbon) - 0.675\ \log(Sediment\ Iron)$$

Thus, the logarithmic version is linear, and the exponents in the original equation are transformed into coefficients in the logarithmic equation. In the linear regression method of fitting an equation to the data, one finds the coefficient values that give the best fit of the equation to the data. In the

MPCA Proposal structural equation modeling was used to derive Equation 2 used to predict expected porewater sulfide, but an equation obtained from linear regression was presented for purposes of comparison.

The following graphic superimposes on Figure 9 of the *MPCA Proposal* diagonal lines corresponding to the ratio of Expected Porewater Sulfide to Observed Porewater Sulfide.

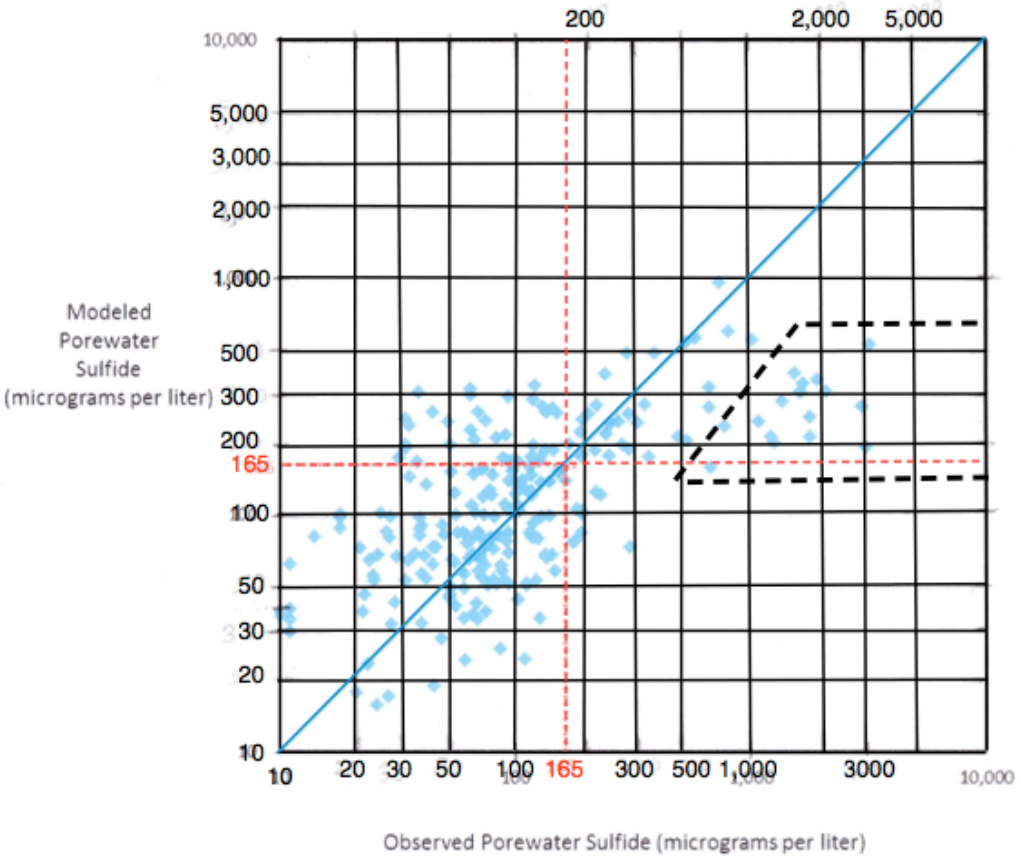


Cases where the Expected/Observed ratio is less than 1 correspond to under-prediction by the model, and cases where the Expected/Observed value is greater than 1 correspond to over-prediction by the model. A solid line and the broken line of the same color, for instance 0.2 and 5, correspond to reciprocal values. The ratio values 3 and 0.3 actually were measured to 3.16 and 0.316 respectively (the square root of 10 and its reciprocal).

A point on the main diagonal (shown in blue) would correspond to a data point where the Observed and Expected (or calculated) values are equal. Points between the solid green line and the dotted green line can be considered to lie in the central region of the diagram. These points correspond to ratio values that are between 0.5 and 2. These values of the ratio correspond to percentage error between 0 and 100% in the case of over-prediction, or between 0 and 50% percent error in the case of under-prediction. These diagonal lines are illustrative and do not consider the range of variation from the ratio of 1 that would be considered acceptable levels of precision in prediction. In addition, it should be noted that for diagonal lines that are farther from the center of the diagram, the logarithmic scale minimizes the distance from the main predictive diagonal (ratio of 1).

Despite this distortion from the use of the logarithmic scale, this graphic representation is useful to identify a cluster where the MPCA equation significantly under-predicts sulfide in waters with high observed sulfide concentrations.

The following diagram graphically shows an outlying cluster where high concentrations of observed porewater sulfide were poorly predicted by the MPCA's equation.



Most of the points with Expected/Observed ratios less than 0.3 have high values of observed porewater sulfide. While it is conceivable that such clustering could happen for purely random reasons, an effort to obtain conclusive results should include investigation of whether or not a peculiarity like this indicates the presence of effects that the model does not account for.

4. Spreadsheet Data Analysis – Methodology and Results

In order to more precisely address the questions raised in Figure 9 of the *MPCA Proposal*, I worked with MPCA staff to obtain the MPCA field study data collected by University of Minnesota researcher Amy Myrbo that provided the basis for Figure 9 and the MPCA Proposal. The specific references used are identified in Section 7 of this report.

I have entered the MPCA field data into my own spreadsheet, and I then programmed Formula 2 of the main document into my spreadsheet, along with a calculation of the ratio of the Expected (or Calculated) Sulfide value to the Observed Sulfide value. My complete spreadsheet is reproduced in Attachment A to my report, which sorts the data according to the Observed Porewater Sulfide level (Column J). A second spreadsheet sorting the data by the Sulfide Ratio Expected to Observed (Column P) for every water body where this calculation could be made is provided in Attachment

B. My methodology in preparing this spreadsheet is described below, then some results of reviewing the spreadsheet data are summarized.

A. METHODS

My complete spreadsheet in Attachment A is explained below.

- Data was provided for every water body on which the MPCA had field data. All quantifiable data was represented.
- The sulfide values (as in the MPCA spreadsheet) are given in milligrams per liter (mg/L) rather than micrograms per liter (µg/L). Hence the EC10 (protective) level of 165 µg/L would appear as 0.165 mg/L.
- Columns A through L give identifying information and observed (measured) values from the Wild Rice Field Survey. Column J, which gives the observed porewater sulfide value is highlighted.
- Column M is the MPCA calculation of the Calculated Protective Sulfate Concentration (CPSC) from its equation. It is the sulfate level that corresponds to the MPCA's proposed EC10 sulfide level of 165 micrograms per liter (ug/L).
- Column N reflects calculation of the CPSC, using the MPCA Equation 1 on page 14 of the MPCA March 2015 proposal (Attachment 2 to this report). This calculation was done to verify accuracy in application of the MPCA formula. As shown by comparing Columns M and N, my results agree closely with those of the MPCA.
- Column O reflects the calculation, using Equation 2 on page 9 of the MPCA March 2015 proposal (Attachment 2) to calculate the porewater sulfide levels that would be predicted from the measured values of sulfate, iron, and total organic carbon. This is the expected sulfide level.
- Column P contains ratios obtained by dividing the calculated porewater sulfide value by the observed value. This is the Expected/Observed sulfide ratio.

In the spreadsheet provided in Attachment B, sorting was done to focus on data points which:

- Sufficient data was given so that the ratio actually could be calculated.
- The value of the Expected/Observed ratio in Column P is 1 or smaller. This allows review of the points where use of the MPCA's equation results in under-prediction of sulfide levels. Column P is also highlighted.
- The data in this spreadsheet is sorted according to the Expected/Observed ratio: wild rice beds with the lowest Expected/Observed ratio value are at the top. Thus, the sites with the highest degree of under-prediction are listed first.

B. RESULTS

Column P ratios of Expected/Observed porewater sulfide levels reflect poor correlation between calculated and observed sulfide levels. Few of the Expected/Observed ratios cluster around the central value of 1, which would be the indicator of a perfect positive correlation. The degree of correlation that would be necessary for this particular application (15% variability, 20% variability or some other percentage variation from perfect correlation) to be deemed protective of wild rice would be a determination that biologists or ecologists would need to make.

However, the spreadsheet results demonstrate a number of situations where the MPCA's Calculated Protective Sulfate Concentration (CPSC) equation would underpredict observed sulfide. In those situations, it is likely that reliance on the formula would insufficiently protect wild rice from elevated sulfide. In Column P, ratios less than 1 correspond to situations where the MPCA formula has under-predicted porewater sulfide.

Nearly every site with Expected/Observed ratios below 0.4 has either no wild rice or very sparse wild rice.[2] For example, applying the MPCA's CPSC equation to Mahnomen Lake (FS-133, line 33 of Attachment A) yields a CPSC of 174.4 mg/L, which suggests that a sulfate limit of 174.4 mg/L of sulfate would be sufficient to protect wild rice in Mahnomen Lake from excess sulfide (levels exceeding 165 ug/L). However, with observed sulfate levels of 16.9 mg/L, porewater sulfide was observed at 308 ug/L. The lake's name suggests this water body once grew wild rice, but MPCA field study data showed no wild rice present.

Sandy Lake in St. Louis County (FS-320, FS-305, FS-348 on Attachment B) was historically a major and abundant ricing site for the Bois Forte Band. Although Sandy Lake has high sediment iron levels, around the 90th percentile among sites that were sampled, Sandy Lake sulfide was significantly underpredicted by the CPSC equation and exceeded the MPCA's proposed protective level of 165 ug/L by more than an order of magnitude: sulfide levels were observed at 3,080 ug/L (FS-320) and at 1,080 ug/L (FS-305). No wild rice was observed at either location.

These two examples of underprediction of sulfide using the MPCA equation do not seem to be anomalies. If one uses a threshold of variability of 20%, for example, the MPCA field data contains at least 77 of the 242 sites for which data was available where the MPCA's CPSC underpredicted sulfide levels or 32% of the sampled sites. Although not specifically analyzed in this report, the MPCA's overprediction of sulfide levels at other sampling sites would also call into questions the use of the proposed CPSC equation.

6. CONCLUSION

Neither MPCA's graphic representation of field study data in Figure 9 of the *MPCA Proposal*, the chi-square analysis of predictive power nor the analysis of underlying field study data in individual water bodies comparing calculated/expected levels of sulfide with observed levels provides any basis for confidence in the use of MPCA's proposed CPSC equation to predict sulfide levels and protect wild rice from excessive levels of sulfide.

[2] Monongalia Lake in Kandiyohi County (FS-379, FS-340, in rows 42 and 82, in Attachment A) has divergent ratios, predictions and sulfide observations in sampling, making it difficult to draw conclusions regarding this lake. For Rice Lake (FS-324), despite under-prediction of sulfide, given sulfate levels of 0.5 mg/L and observed sulfide of 0.045, the presence of wild rice is not at all surprising.

7. References

My calculations are based on MPCA data, obtained from the following pages:
http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-rulemaking/sulfate-standard-and-wild-rice/wild-rice-study-and-process-of-revising-standard.html

http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-rulemaking/sulfate-standard-and-wild-rice/draft-proposal-for-protecting-wild-rice-from-excess-sulfate.html
On this page, follow the link Detailed MPCA proposal for protecting wild rice from excess sulfate (wq-s6-43l), which leads to the .pdf version of the main Wild Rice Study document that is discussed above. The scatter chart in question is figure 9 in that document.

In order to find more detailed MPCA field survey data, I also followed a link labeled ftp://files.pca.state.mn.us/pub/wild_rice/ and connected as a guest with a server called files.pca.state.mn.us. One folder on that server is called Wild Rice Field Survey, which contains spreadsheets used in my analysis, notably MPCA_Field_Survey_Data_with_calculated_protective_sulfate_concentration.xlsx and Wild_field_survey_updated_Feb_6_2015.xlsx.

8. Curriculum Vitae

Joel Roberts was born in Denver, Colorado, and grew up in the Denver area. He majored in mathematics at M.I.T. and received his Ph.D. in mathematics from Harvard University. After teaching at Purdue University for four years, he joined the University of Minnesota mathematics faculty in 1972. He has been a full professor since 1980.

Joel Roberts has had five Ph.D. students and has worked with numerous other graduate students doing thesis research in mathematics, computer science, physical sciences, and engineering. Prof. Roberts has given three different month-long lecture series at the National University of Mexico. He has visited the University of Bergen, Norway, on several occasions for research collaborations, and has been a Visiting Scholar at the University of California, Berkeley.

In recent years he has become interested in the use of computers for calculation with polynomials and also for visualization of algebraic curves and surfaces. This work included participation in the 2005-2006 Special Year on Applications of Algebraic Geometry, held at the Institute for Mathematics and Its Applications.

Mathematic publications are listed below:

1. Generic projections of algebraic varieties, Amer. J. Math. 93 (1971), 191-214.
2. The variation of singular cycles in an algebraic family of morphisms, Trans. Amer. Math. Soc. 168 (1972), 153-164.
3. Chow's moving lemma: an appendix to lectures of S. Kleiman, *Algebraic Geometry, Oslo 1970* (F.Oort, ed.), Groningen, Wolters-Noordhoff, 1972, p. 89-96.
4. Singularity subschemes and generic projections [research announcement], Bull. Amer. Math. Soc. 78 (1972), 706-708.
5. (with M. Hochster) Actions of reductive groups on regular rings and Cohen-Macaulay rings[research announcement], Bull. Amer. Math. Soc. 80 (1974), 281-284.
6. (with M. Hochster) Rings of invariants of reductive groups acting on regular rings are Cohen-Macaulay, Advances in Math. 13 (1974), 115-175.

7. Singularity subschemes and generic projections, Trans. Amer. Math. Soc. 212 (1975), 229-268.
8. (with M. Hochster) The purity of the Frobenius and local cohomology, Advances in Math. 21(1976), 117-172.
9. A stratification of the dual variety, preprint, July 1976.
10. Hypersurfaces with nonsingular normalization and their double loci, J. of Algebra 53 (1978), 253-267.
11. (with A. Holme) Pinch points and multiple locus of generic projections of singular varieties,Advances in Math. 33 (1979), 212-256.
12. Some properties of double point schemes, Compositio Math. 41 (1980), 61-94.
13. (with T. Fujita) Varieties with small secant varieties: the extremal case, Amer. J. Math. 103 (1981),953-976.
14. (with R. Speiser) Schubert's enumerative geometry of triangles from a modern viewpoint, *Algebraic Geometry: Proceedings, University of Illinois at Chicago Circle, 1980* , Springer LectureNotes in Mathematics 862 (1981), 272-281.
15. (with R. Zaare-Nahandi) Transversality of generic projections and seminormality of the image hypersurfaces, Compositio Math 52 (1984), 211-220.
16. (with R. Speiser) Enumerative geometry of triangles, I , Comm. in Algebra 12 (1984), 1213-1255.
17. (with R. Speiser) Enumerative geometry of triangles, II , Comm. in Algebra 14 (1986), 155-191.
18. (with R. Speiser) Enumerative geometry of triangles, III , Comm. in Algebra 15 (1987), 1929-1966.
19. Old and new results about the triangle varieties, *Algebraic Geometry Sundance 1986* , SpringerLecture Notes 1311 (1988), 197-219.
20. (with A. Holme) On the embeddings of projective varieties, *Algebraic Geometry Sundance 1986* ,Springer Lecture Notes 1311 (1988), 118-146.
21. Projective embeddings of algebraic varieties (lecture notes), *Monografías del Instituto deMatemáticas*, no. 19 (1988) Universidad Nacional Autónoma de México.
22. (with J. Weyman) A short proof of a theorem of M. Hashimoto, J. Algebra 134 (1990), 144 - 156.
23. Embeddings of algebraic surfaces in P^4, *Seminari di Geometria 1991-93*, Università di Bologna (1994), pp. 169 - 178.
24. (with A. Holme) Zak's theorem on superadditivity, Arkiv för Matematik 32 (1994), 99 - 120.
25. (with J. Gil de Lamadrid) The Jordan canonical form of a matrix related to a second order systemof ordinary differential equations, preprint, January 1997.
26. (with V. Reiner) Resolutions and the homology of matching and chessboard complexes, J.Algebraic Combinatorics 11 (2000), 135-154.
27. (with H Haghighi and R. Zaare-Nahandi) Some properties of finite morphisms on double points,Compositio Math. 121 (2000), 35 - 53.
28. (with J. Eagon) Minimal resolutions derived from bicomplexes and other Wall complexes, work inprogress.
29. (with A. Holme) The enumerative theory of k-secant (k-1)-spaces, work in progress

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
2	FS-85	Bean	03-0411-00-201	8/21/12	46.9337	-95.8706	0	0.0	85	16.000	1,967	11.85	1.2	1.15	0.725	0.04531
3	P-55	Lady Slipper	42-0020-00-204	9/22/11	44.5702	-95.6274	0		107.71	14.840	2,814	2.09	26.9	26.85	0.266	0.01791
4	FS-177	South Geneva	24-0015-02-208	7/24/12	43.7709	-93.2851	0	0.0	14.1	3.190	1,618	16.71	0.5	0.49	0.526	0.16487
5	FS-320	Sandy	69-0730-00-204	7/9/13	47.6188	-92.5936	0	0.0	118	3.080	19,749	15.43	72.5	72.45	0.195	0.06316
6	FS-184	Rice	73-0196-00-216	7/30/12	45.3864	-94.6309	0	0.0	2.58	2.970	1,523	15.03	0.5	0.50	0.290	0.09752
7	FS-345	Rice	73-0196-00-216	8/7/13	45.3865	-94.6313	0	0.0	6.85	2.080	2,012	14.83	0.9	0.88	0.334	0.16055
8	FS-339	Christina	21-0375-00-315	7/31/13	46.0734	-95.7567	0.3	0.6	14.6	1.930	1,741	8.96	1.3	1.35	0.374	0.1939
9	FS-188	Stella	47-0068-00-204	8/27/12	45.0683	-94.4334	0.3	0.3	18.1	1.790	1,257	2.34	4.7	4.73	0.261	0.14607
10	FS-186	Westport	61-0029-00-204	8/1/12	45.6897	-95.217	0	0.0	7.11	1.790	4,917	20.15	3.3	3.28	0.215	0.11999
11	FS-78	Lady Slipper	42-0020-00-202	7/27/12	44.5699	-95.6275	0	0.0	335	1.680	2,719	1.66	34.8	34.74	0.360	0.21415
12	FS-79	Lady Slipper	42-0020-00-203	7/27/12	44.5723	-95.6216	0	0.0	330	1.630	3,314	1.85	43.9	43.92	0.330	0.20251
13	FS-176	North Geneva	24-0015-00-209	7/24/12	43.7876	-93.271	0	0.0	15.6	1.540	2,212	13.45	1.2	1.21	0.397	0.25768
14	FS-77	Monongalia	34-0158-02-204	7/26/12	45.3331	-94.927	38.8	121.3	21.7	1.370	4,953	18.66	3.7	3.70	0.303	0.22086
15	FS-357	Lower Panasa	31-0112-00-204	8/15/13	47.3026	-93.2561	0	0.0	28.5	1.260	2,347	2.42	15.3	15.31	0.204	0.16186
16	FS-128	Cromwell	14-0103-00-201	8/22/12	46.9651	-96.3171	0	0.0	41.2	1.220	2,948	2.85	19.0	18.99	0.215	0.17622
17	FS-305	Sandy	69-0730-00-204	6/11/13	47.6187	-92.5937	0	0.0	135	1.080	19,094	22.23	40.6	40.53	0.249	0.23051
18	FS-218	Holman	31-0227-00-202	9/13/12	47.3005	-93.3445	0	0.0	24.2	1.010	3,035	29.74	0.7	0.74	0.548	0.54303
19	FS-308	Rice paddy	WT00028	6/12/13	47.8056	-95.674	36.3	85.9	57.1	0.802	2,779	17.1	1.4	1.35	0.598	0.74579
20	FS-181	Rice	66-0048-00-203	7/27/12	44.3332	-93.4734	0	0.0	5.22	0.777	3,829	21.67	1.8	1.81	0.237	0.30476
21	FS-103	Rice paddy	WT00028	6/26/12	47.8053	-95.6732	23.8	58.9	279	0.732	3,367	19.01	1.7	1.70	0.956	1.30635
22	FS-102	Rice paddy	WT00027	6/26/12	47.9265	-95.6313	39.3	93.6	1.61	0.677	4,932	31.82	1.7	1.73	0.160	0.23683
23	P-34	Anka	21-0353-00-201	9/16/11	46.0769	-95.7292	11.3		2.23	0.671	1,485	23.57	0.3	0.25	0.349	0.51956
24	FS-87	Bee	60-0192-00-202	8/23/12	47.6527	-96.0504	18.8	39.8	11	0.670	3,054	13.62	2.2	2.24	0.285	0.42488
25	FS-353	Holman	31-0227-00-202	8/12/13	47.3009	-93.3444	0	0.0	68	0.583	5,094	30.6	1.9	1.95	0.560	0.96047
26	FS-223	Little Sucker	31-0126-00-202	9/14/12	47.3765	-93.246	0	0.0	13.7	0.534	6,297	16.56	7.0	7.01	0.207	0.38799
27	FS-192	Anka	21-0353-00-202	8/29/12	46.07689	-95.7292	1		8.44	0.530	1,498	22.85	0.3	0.27	0.540	1.01953
28	P-35	Anka	21-0353-00-201	9/16/11	46.0769	-95.7377	1.3		2.23	0.493	2,170	14.84	1.0	1.02	0.216	0.43718
29	FS-326	Rice paddy	WT00028	7/17/13	47.8055	-95.6732	100	251.8	28.8	0.390	2,842	18.37	1.3	1.28	0.482	1.23517
30	FS-190	Pine	15-0149-00-205	8/28/12	47.6841	-95.5414	47.5	114.9	14.7	0.368	4,477	7.08	11.9	11.92	0.177	0.48053
31	FS-194	Gilchrist	86-0064-00-201	8/31/12	45.2309	-93.824	0	0.0	6.98	0.355	3,117	20.81	1.3	1.28	0.295	0.83071
32	FS-61	Swan	31-0067-02-206	8/30/12	47.2888	-93.2127	3	12.4	12.5	0.332	5,827	22.71	3.9	3.86	0.247	0.74282
33	FS-133	Mahnomen	18-0126-02-201	9/17/12	46.4985	-93.9958	0	0.0	16.9	0.308	18,746	7.7	174.4	174.34	0.074	0.23869
34	FS-348	Sandy	69-0730-00-204	8/13/13	47.6186	-92.5934	0	0.0	123	0.305	13,216	8.23	80.2	80.11	0.191	0.62517
35	FS-368	Dark	69-0790-00-202	9/5/13	47.6387	-92.7782	6.3	11.1	175	0.305	3,354	1.94	42.1	42.05	0.269	0.88268
36	FS-101	Rice paddy	WT00026	6/25/12	48.2161	-94.6188	4.3	8.3	11.3	0.298	3,284	44.21	0.5	0.49	0.485	1.627
37	P-57	Unnamed	34-0611-00-201	9/23/11	45.2675	-94.865	32.5		6.42	0.286	2,311	6.48	3.7	3.71	0.199	0.6954
38	FS-191	Ina	21-0355-00-202	8/29/12	46.0715	-95.7281	8.5	30.2	7.08	0.274	2,216	9.09	2.1	2.12	0.249	0.91044
39	FS-214	Bowstring	S007-219	9/11/12	47.7024	-94.0608	27.5	69.7	1.34	0.256	1,974	24.34	0.4	0.42	0.245	0.95751

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
40	FS-328	Eighteen	60-0199-00-203	7/18/13	47.6369	-96.0599	27.5	44.2	3.34	0.250	5,106	24.65	2.7	2.66	0.178	0.71181
41	FS-60	Lower Panasa	31-0112-00-205	8/29/12	47.3018	-93.2521	0	0.0	33.6	0.243	8,048	14.12	14.2	14.18	0.221	0.91117
42	FS-379	Monongalia	34-0158-02-203	9/13/13	45.3332	-94.929	62.5	154.4	34.6	0.242	5,436	26.42	2.7	2.72	0.395	1.63325
43	FS-220	Padua	73-0277-00-202	8/7/12	45.623	-95.0186	0	0.0	0.86	0.230	2,291	9.77	2.0	2.04	0.122	0.53075
44	FS-62	Swan	31-0067-02-206	8/30/12	47.289	-93.2124	0.8	3.8	14	0.221	4,821	22.53	2.7	2.69	0.290	1.31367
45	FS-82	Rabbit	18-0093-02-204	8/8/12	46.5313	-93.9285	0	0.0	15.3	0.220	10,903	11.79	33.1	33.12	0.126	0.5726
46	FS-179	Rice	74-0001-00-201	7/25/12	44.0842	-93.0737	0	0.0	3.84	0.217	4,152	19.07	2.5	2.54	0.190	0.87338
47	FS-346	Westport	61-0029-00-205	8/8/13	45.7042	-95.203	4.5	6.7	6.3	0.205	3,262	19.66	1.5	1.52	0.269	1.3099
48	FS-107	Rice paddy	WT00030	6/28/12	47.8521	-95.4953	80	134.3	9.46	0.194	5,647	28.09	2.7	2.69	0.254	1.3078
49	FS-230	Mill Pond	21-0034-00-202	8/16/12	46.0715	-95.2218	21.5	80.9	7.36	0.192	3,969	3.14	29.7	29.64	0.102	0.53004
50	FS-200	Louisa	86-0282-00-205	8/8/12	45.2998	-94.258	0	0.0	7.04	0.192	7,824	8.76	26.3	26.31	0.104	0.54356
51	P-47	Little Birch	77-0089-00-101	9/21/11	45.7747	-94.7996	11.3		3.2	0.191	2,253	8.37	2.5	2.46	0.180	0.94344
52	P-47	Little Birch	77-0089-00-101	9/21/11	45.7747	-94.7996	11.3		3.2	0.191	3,544	5.11	12.0	11.95	0.104	0.54672
53	P-47	Little Birch	77-0089-00-101	9/21/11	45.7747	-94.7996	11.3		3.2	0.191	2,236	1.75	22.0	22.00	0.085	0.44321
54	FS-228	West battle	56-0239-00-204	8/15/12	46.2906	-95.6049	35	144.8	4.03	0.189	3,108	17.37	1.6	1.65	0.224	1.18475
55	FS-321	Sandy	69-0730-00-203	7/9/13	47.6255	-92.5885	0	0.0	122	0.189	36,502	29.51	96.6	96.55	0.178	0.94257
56	FS-129	Mink	86-0229-00-207	8/23/12	45.2767	-94.0299	0	0.0	1.22	0.182	4,247	13.63	4.3	4.27	0.107	0.58651
57	FS-69	St. Louis	S007-208	9/7/12	47.4671	-91.9279	0	0.0	1.33	0.181	11,429	27.16	11.2	11.20	0.079	0.43544
58	FS-208	Miss.R. Pool 8/Genoa	S007-222	8/14/12	43.5758	-91.2334	43.8	41.4	18	0.176	2,178	0.41	161.8	161.72	0.077	0.43885
59	FS-106	Rice paddy	WT00029	6/28/12	47.8523	-95.4732	25	50.6	7.14	0.169	3,242	9.75	4.0	4.04	0.200	1.18478
60	FS-86	Eighteen	60-0199-00-202	8/22/12	47.6397	-96.0607	23.8	40.1	4.29	0.164	1,860	3.1	6.9	6.85	0.140	0.85384
61	FS-90	Sand	S003-249	9/11/12	47.6351	-92.4234	0.8	2.9	15.9	0.152	7,287	9.68	19.9	19.89	0.152	1.0016
62	FS-183	Unnamed	34-0611-00-201	7/30/12	45.2675	-94.865	16.3	64.9	16.8	0.150	2,157	5.61	4.0	3.97	0.271	1.80479
63	FS-315	St. Louis Estuary	S007-444	6/24/13	46.6516	-92.2373	0	0.0	8.1	0.147	6,056	1.68	163.7	163.61	0.058	0.39699
64	FS-231	Rice	02-0008-00-206	8/17/12	45.1604	-93.121	0	0.0	3.6	0.145	2,159	7.98	2.4	2.42	0.189	1.30152
65	FS-216	Big Sucker	31-0124-00-203	9/12/12	47.3919	-93.2658	1.3	3.8	7.78	0.145	3,559	21.45	1.6	1.59	0.284	1.95924
66	FS-187	McCormic	73-0273-00-203	8/2/12	45.722	-94.9121	1.3	8.9	1.54	0.144	1,512	1.1	19.7	19.70	0.068	0.47467
67	P-24	Second	15-0091-00-201	9/7/11	47.8255	-95.3635	16.3		0.87	0.139	3,813	25.67	1.4	1.42	0.139	0.99974
68	P-19	Wolf	69-0143-00-202	9/2/11	47.2586	-91.9618	56.3		1.54	0.139	8,240	25.1	6.6	6.60	0.100	0.71583
69	FS-352	Dark	69-0790-00-202	8/15/13	47.6388	-92.7782	1.3	2.9	173	0.136	5,120	3.61	40.1	40.07	0.273	2.0041
70	FS-195	Fisher	70-0087-00-201	8/31/12	44.7942	-93.4061	25	20.7	6.85	0.136	11,140	5.76	94.9	94.85	0.066	0.48846
71	FS-382	Sandy	69-0730-00-203	9/17/13	47.6255	-92.5885	0	0.0	67.9	0.135	26,645	32.28	46.0	45.97	0.188	1.39268
72	FS-81	Flowage	01-0061-00-204	8/7/12	46.688	-93.337	0	0.0	0.78	0.134	12,470	32.34	10.4	10.38	0.067	0.50215
73	FS-57	Miss. R./ bel. Clay Boswell	S006-923	8/28/12	47.2551	-93.6342	0	0.0	10.3	0.134	4,225	1.2	130.1	130.02	0.069	0.51229
74	FS-322	Dark	69-0790-00-202	7/10/13	47.6389	-92.7781	1.3	3.2	175	0.131	2,480	1.48	34.1	34.12	0.289	2.20907
75	P-29	Padua	73-0277-00-203	9/13/11	45.6202	-95.0192	1.5		0.76	0.130	4,927	20.15	3.3	3.29	0.099	0.76289

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
76	FS-138	Little Round	03-0302-00-203	9/20/12	46.9726	-95.735	46.3	78.0	0.5	0.128	3,069	27.48	0.8	0.84	0.137	1.07328
77	FS-309	Eighteen	60-0199-00-203	6/13/13	47.6369	-96.0599	0	0.0	4.36	0.127	4,478	16.52	3.6	3.61	0.175	1.38175
78	FS-83	Miss.R Crow Wing	S007-205	8/8/12	46.4386	-94.1251	0	0.0	3.13	0.127	13,451	3.88	239.5	239.40	0.037	0.29011
79	FS-59	Upper Panasa	31-0111-00-202	8/29/12	47.306	-93.2652	0	0.0	29.6	0.126	895	0.43	26.6	26.55	0.171	1.35753
80	FS-301	Partridge	S007-443	5/28/13	47.5213	-92.1903	0	0.0	14.8	0.125	9,491	3.94	118.5	118.44	0.080	0.64224
81	FS-251	Sandy	69-0730-00-203	9/21/12	47.6254	-92.5886	1.3	3.8	3.05	0.123	35,905	33.08	79.6	79.59	0.053	0.43361
82	FS-340	Monongalia	34-0158-02-203	7/31/13	45.3331	-94.929	60	87.9	33.6	0.122	5,530	22.1	3.6	3.62	0.355	2.90672
83	FS-105	Second	15-0091-00-202	6/27/12	47.8258	-95.3637	13	48.4	0.74	0.119	2,527	33.3	0.439	0.44	0.197	1.65435
84	FS-350	Ox Hide	31-0106-00-203	8/14/13	47.3351	-93.2132	0	0.0	25.9	0.119	3,889	12.12	4.2	4.24	0.307	2.58002
85	FS-221	Hay Creek Flowage	58-0005-00-202	9/17/12	46.0894	-92.4104	58.8	97.7	1.95	0.119	9,456	22.05	10.4	10.37	0.092	0.77616
86	FS-68	Wolf	69-0143-00-101	9/6/12	47.2564	-91.963	2.3	8.9	2.01	0.119	9,526	17.19	15.0	14.95	0.082	0.69147
87	FS-359	Eighteen	60-0199-00-203	8/20/13	47.6367	-96.06	5.5	21.0	2.83	0.118	5,500	30.88	2.2	2.23	0.178	1.51134
88	FS-139	Welby family farm	86-0231-00-202	9/21/12	45.3592	-94.0782	2	17.2	0.5	0.118	7,267	30.76	3.9	3.88	0.081	0.68731
89	FS-319	Little Round	03-0302-00-203	6/27/13	46.9724	-95.735	5	17.5	0.5	0.117	3,579	39.84	0.7	0.67	0.148	1.26784
90	FS-219	Trout	31-0216-00-212	9/13/12	47.2592	-93.3942	0	0.0	38.6	0.117	12,535	15	31.0	30.99	0.177	1.51591
91	FS-189	Clearwater	S002-121	8/28/12	47.9372	-95.6906	1.8	4.5	23.8	0.117	2,856	1.27	55.8	55.80	0.123	1.04878
92	FS-327	Clearwater	S002-121	7/17/13	47.9371	-95.6906	0.3	0.3	23.7	0.117	3,521	1.82	50.6	50.60	0.127	1.08302
93	FS-93	Turpela	69-0427-00-201	9/12/12	47.4613	-92.2371	0.8	1.0	3.3	0.115	6,979	31.08	3.5	3.53	0.161	1.39674
94	FS-325	Rice paddy	WT00046	7/16/13	47.8481	-95.4865	51.3	79.6	0.46	0.115	4,673	19.28	3.2	3.16	0.085	0.73566
95	FS-67	St. Louis Est. Pok. Bay	S006-928	9/5/12	46.6859	-92.1606	0	0.0	9.97	0.112	14,015	3.66	281.8	281.69	0.052	0.46385
96	FS-331	Partridge	S007-443	7/24/13	47.5212	-92.1904	30	60.5	14.6	0.112	10,082	1.68	443.6	443.39	0.051	0.45262
97	FS-324	Rice	18-0053-00-203	7/15/13	46.3392	-93.8918	27.5	56.7	0.5	0.110	44,704	33.18	121.7	121.67	0.025	0.22442
98	FS-229	Mill Pond	21-0034-00-202	8/16/12	46.0716	-95.2218	30	102.2	7.16	0.109	5,143	7.86	13.5	13.49	0.132	1.21273
99	FS-311	Miss. R Pool 8/Genoa	S007-222	6/20/13	43.5766	-91.2341	10	12.7	29.3	0.107	1,544	0.62	46.1	46.05	0.141	1.31702
100	P-12	Birch	69-0003-00-205	8/30/11	47.7357	-91.9428	30		3.58	0.104	12,431	26.8	13.5	13.45	0.104	1.0011
101	FS-384	Second	S007-220	9/19/13	47.5204	-92.1925	15	27.7		0.104	22,634	3.42		791.54	0.000	0
102	P-20	Gull	04-0120-00-203	9/6/11	47.6559	-94.6944	6.8		0.78	0.103	1,608	5.08	2.6	2.57	0.109	1.05897
103	FS-356	Trout	31-0216-00-212	8/14/13	47.2591	-93.3942	0	0.0	39.1	0.103	11,992	12.59	36.4	36.38	0.169	1.63668
104	FS-75	Mortenson	34-0150-02-201	7/24/12	45.3	-94.9062	0	0.0	0.5	0.103	9,071	12.09	22.3	22.31	0.044	0.43062
105	FS-334	Miss. R Pool 8/Genoa	S007-222	7/29/13	43.5758	-91.2344	28.8	52.8	44.2	0.102	1,969	0.4	137.5	137.46	0.111	1.09193
106	FS-332	Partridge	S007-513	7/24/13	47.5137	-92.1894	53.8	79.6	54.4	0.102	20,512	8.34	185.9	185.77	0.108	1.05537
107	FS-89	Birch	69-0003-00-205	9/10/12	47.7358	-91.943	26.3	33.1	8.61	0.100	16,938	31.2	19.9	19.88	0.123	1.23138
108	FS-303	Second	S007-220	5/30/13	47.5204	-92.1925	0	0.0	303	0.099	13,086	2.2	505.1	504.89	0.138	1.39231
109	FS-316	Partridge	S007-513	6/28/13	47.5137	-92.1899	0	0.0	24.9	0.098	6,291	2.6	95.3	95.22	0.104	1.05717
110	FS-347	Snowball	31-0108-00-202	8/12/13	47.3356	-93.2439	0	0.0	8.2	0.097	1,136	1.19	10.1	10.08	0.153	1.58114
111	P-25	Lower Rice	S006-985	9/8/11	47.3793	-95.4834	50		1.02	0.097	2,337	17.76	0.9	0.91	0.171	1.76084
112	FS-360	Rice paddy	WT00046	8/21/13	47.8479	-95.4866	33.8	66.5		0.094	4,221	14.94		3.71	0.000	0

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
113	FS-313	Monongalia	34-0158-01-203	6/23/13	45.3334	-94.929	32.5	50.0	34.7	0.094	6,028	19.44	5.1	5.13	0.318	3.37795
114	P-28	Raymond	73-0285-00-203	9/12/11	45.629	-95.0234	30		0.82	0.094	3,922	10.06	5.6	5.61	0.085	0.90141
115	FS-63	Caribou	69-0489-00-206	9/3/12	46.8913	-92.3135	0	0.0	1.21	0.094	13,791	29.44	14.4	14.43	0.070	0.74503
116	FS-137	Elk	15-0010-00-204	9/19/12	47.1952	-95.2249	7.3	42.7	0.5	0.094	6,334	10.07	14.3	14.30	0.052	0.55252
117	FS-197	Snowball	31-0108-00-202	9/4/12	47.3355	-93.244	0	0.0	8.4	0.094	4,213	6	13.4	13.37	0.140	1.49735
118	FS-207	Kelly Lake	66-0015-00-204	8/13/12	44.3542	-93.3743	0	0.0	1.92	0.093	4,387	27.33	1.7	1.71	0.171	1.84732
119	FS-310	Second	S007-220	6/14/13	47.5205	-92.1925	25	57.6	316	0.093	31,190	4.22	1102.4	1,101.9	0.107	1.15317
120	FS-306	Sandy	69-0730-00-203	6/11/13	47.6255	-92.5884	0	0.0	11	0.092	35,357	28.53	95.2	95.14	0.078	0.85042
121	FS-204	Big Swan	77-0023-00-207	8/10/12	45.8795	-94.742	55	133.7	5.49	0.091	1,731	5.94	2.4	2.38	0.220	2.40191
122	FS-343	Raymond	73-0285-00-203	8/6/13	45.629	-95.0233	25	61.4	1.92	0.090	3,270	7.59	5.8	5.85	0.112	1.24071
123	FS-330	St. Louis Estuary	S007-444	7/22/13	46.6518	-92.2372	8.8	11.8	6.71	0.090	5,817	1.55	169.5	169.40	0.054	0.59974
124	FS-341	Stella	47-0068-00-205	8/1/13	45.066	-94.4339	28.8	57.6	24.7	0.088	1,786	1.35	20.4	20.44	0.176	1.98834
125	FS-131	Hinken	S007-207	9/5/12	47.7271	-93.9923	18.8	46.8	0.5	0.088	2,960	4.53	10.0	9.96	0.059	0.66915
126	P-45	Hay	31-0037-00-201	9/21/11	47.2874	-93.1017	0		10.24	0.087	12,403	4.36	173.4	173.30	0.062	0.71258
127	FS-333	Embarrass	69-0496-00-203	7/26/13	47.5333	-92.2976	0	0.0	18.2	0.087	11,179	0.47	3271.6	3,270.1	0.027	0.31719
128	FS-312	Miss. R Pool 5/Spring	S007-660	6/21/13	44.2018	-91.8444	23.8	35.7	28.3	0.084	3,563	0.67	212.0	211.90	0.082	0.97423
129	FS-65	Wild Rice	09-0023-00-202	9/4/12	46.6712	-92.6055	0	0.0	0.5	0.083	13,650	28.82	14.6	14.58	0.051	0.61859
130	FS-358	Turtle River, North Branch	S007-662	8/19/13	47.9952	-97.6276	22.5	121.0	198	0.083	4,262	1.52	94.8	94.77	0.212	2.5574
131	FS-355	Miss. R./bel.Clay Boswell	S006-923	8/13/13	47.2553	-93.634	33.8	78.3	10.2	0.082	10,479	8.98	45.0	45.00	0.099	1.20337
132	FS-344	Padua	73-0277-00-202	8/6/13	45.6231	-95.0187	2.5	9.5	0.5	0.081	4,520	12.61	5.4	5.38	0.072	0.89883
133	FS-58	Miss. R/ ab. Clay Boswell	S007-163	8/28/12	47.2386	-93.7197	0	0.0	1.19	0.081	8,636	9.08	30.4	30.34	0.054	0.66756
134	P-30	Stella	47-0068-00-203	9/14/11	45.0659	-94.4339	13.8		7.59	0.080	2,159	2.88	10.2	10.18	0.149	1.85942
135	FS-202	Long Prairie	S007-204	8/9/12	46.0072	-95.2634	8.8	13.4	7.71	0.079	2,897	2.85	18.4	18.36	0.122	1.53865
136	FS-53	Raymond	73-0285-00-203	8/2/12	45.6286	-95.0225	19	61.1	0.5	0.079	1,905	4.79	3.9	3.89	0.081	1.03044
137	FS-52	Blaamyhre	34-0345-00-203	8/1/12	45.364	-95.186	15	102.2	0.62	0.078	3,517	9.33	5.0	5.04	0.080	1.02357
138	FS-213	Gull	04-0120-00-204	9/10/12	47.6558	-94.6945	4.5	9.5	1.14	0.078	3,527	16.01	2.4	2.37	0.128	1.64297
139	FS-125	Tamarac	56-0192-00-203	8/19/12	46.3637	-95.5714	0	0.0	2.33	0.077	21,908	18.41	69.2	69.19	0.051	0.66439
140	FS-198	Ox Hide	31-0106-00-203	9/7/12	47.335	-93.2134	0.3	0.6	26.4	0.075	8,743	24.51	7.7	7.66	0.252	3.35393
141	P-13	Partridge	S007-443	8/31/11	47.5212	-92.1899	28.8		10.39	0.075	11,026	1.44	656.8	656.47	0.039	0.52498
142	FS-226	Louise	21-0094-00-202	8/14/12	45.9331	-95.4148	17	46.5	4.09	0.075	1,833	0.83	42.7	42.70	0.073	0.98284
143	FS-92	Partridge	S007-443	9/12/12	47.5207	-92.1909	1.5	4.1	36.3	0.074	29,463	5.87	619.3	618.96	0.062	0.83423
144	FS-130	Hay	31-0037-00-202	9/6/12	47.2874	-93.102	53.8	141.0	31.7	0.074	13,154	5.79	130.4	130.33	0.101	1.36851
145	FS-182	Hunt	66-0047-00-208	7/27/12	44.3275	-93.4443	0	0.0	17.1	0.073	2,412	1.21	42.9	42.93	0.120	1.64409
146	FS-126	Bray	56-0472-00-202	8/20/12	46.4518	-95.8783	1.8	7.6	1.65	0.072	3,937	21.95	1.9	1.88	0.157	2.18293
147	FS-211	Miss. R Pool 4/Rob'n Lake	79-0005-02-201	8/16/12	44.3611	-91.9897	51.3	57.6	17.7	0.071	9,265	1.55	421.2	421.04	0.055	0.77246
148	FS-300	St. Louis Estuary	S007-444	5/27/13	46.6515	-92.2376	0	0.0	9.4	0.071	4,499	1.26	137.3	137.25	0.065	0.9156
149	FS-209	Miss.R Pool 8/Reno Bot.	S007-556	8/15/12	43.6025	-91.2686	46.3	72.3	18.1	0.071	9,187	2.29	239.0	238.86	0.068	0.9504

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
150	FS-196	Prairie	S007-209	9/3/12	47.2519	-93.4884	16.3	44.6	9.63	0.071	15,071	10.51	73.4	73.37	0.082	1.15106
151	FS-210	Miss. R Pool 4/Rob'n Lake	79-0005-02-202	8/16/12	44.3593	-91.9881	21.3	35.3	15.7	0.070	6,450	1.16	312.1	312.00	0.059	0.8385
152	P-26	Lower Rice	S007-164	9/8/11	47.3817	-95.4926	52.5		0.55	0.070	2,364	6.76	3.7	3.65	0.086	1.22352
153	FS-349	Sandy	69-0730-00-205	8/13/13	47.6191	-92.5898	0	0.0	122	0.070	14,897	20.46	28.1	28.04	0.273	3.91706
154	FS-225	Miltona	21-0083-00-205	8/13/12	46.0496	-95.4217	0	0.0	4.11	0.069	2,624	1.77	29.6	29.61	0.083	1.20025
155	FS-371	Miss. R Pool 5/Spring	S007-660	9/10/13	44.2016	-91.8443	26.3	39.8	34.4	0.069	3,582	0.11	2736.9	2,735.55	0.036	0.52782
156	FS-76	Field	34-0151-00-201	7/25/12	45.2964	-94.9058	0	0.0	0.5	0.069	7,586	8.68	25.1	25.09	0.043	0.62007
157	FS-342	Little Round	03-0302-00-203	8/5/13	46.9721	-95.7358	18.8	58.3	0.5	0.068	4,447	25.16	2.0	1.97	0.102	1.51579
158	FS-323	Second	S007-220	7/11/13	47.5204	-92.1925	45	76.4	405	0.067	10,036	2.91	202.6	202.54	0.209	3.11915
159	FS-134	Bass	31-0576-00-207	9/18/12	47.2844	-93.6276	32.5	64.0	1.01	0.066	3,740	26.12	1.3	1.33	0.149	2.25125
160	FS-314	Clearwater	S002-121	6/24/13	47.9372	-95.6907	0.3	0.6	28	0.066	3,946	2.68	36.7	36.64	0.150	2.25896
161	FS-94	Sturgeon	S004-870	9/13/12	47.656	-92.9315	13.8	37.9	1.62	0.066	2,505	0.65	111.1	111.02	0.038	0.58132
162	FS-318	Height of Land	03-0195-00-210	6/26/13	46.9135	-95.6124	22.5	43.0	1.21	0.066	1,349	1.13	15.2	15.17	0.069	1.04596
163	FS-91	Pike	S006-927	9/11/12	47.7327	-92.3473	23.8	3.5	14.2	0.066	6,565	4.72	44.7	44.65	0.111	1.68919
164	P-57	Unnamed	34-0611-00-201	9/23/11	45.2675	-94.865	32.5		6.42	0.065	1,689	12.6	0.8	0.79	0.340	5.22344
165	P-57	Unnamed	34-0611-00-201	9/23/11	45.2675	-94.865	32.5		6.42	0.065	1,946	13.8	0.9	0.91	0.323	4.96177
166	P-57	Unnamed	34-0611-00-201	9/23/11	45.2675	-94.865	32.5		6.42	0.065	2,193	8.1	2.4	2.44	0.230	3.53304
167	P-7	Itasca	15-0016-00-207	8/25/11	47.2332	-95.1985	8.8		0.26	0.064	1,650	6.01	2.1	2.13	0.080	1.24411
168	FS-136	Itasca	15-0016-00-208	9/19/12	47.2343	-95.2049	7.5	23.6	0.5	0.064	1,496	2.23	7.1	7.12	0.066	1.0352
169	P-10	Pike	S006-927	8/30/11	47.7325	-92.3468	18.8		8.31	0.063	15,572	10.9	74.3	74.30	0.077	1.2258
170	FS-302	Partridge	S007-513	5/30/13	47.5153	-92.1894	0	0.0	43.1	0.062	24,784	6.27	402.3	402.15	0.076	1.21971
171	FS-370	Miss. R Pool 8/Genoa	S007-222	9/9/13	43.5765	-91.2337	11.3	17.8	33.3	0.062	6,558	1.43	240.1	239.95	0.083	1.34327
172	FS-51	Glesne Slough	34-0353-00-201	7/31/12	45.3514	-95.1887	22.5	99.6	0.5	0.061	7,983	3.01	123.5	123.42	0.025	0.40325
173	FS-64	Dead Fish	09-0051-00-202	9/4/12	46.7454	-92.6865	0	0.0	0.71	0.061	14,387	22.4	23.1	23.05	0.049	0.81379
174	FS-175	Maloney	79-0001-00-201	7/23/12	44.2251	-91.9321	0	0.0	3.15	0.061	15,126	4.57	239.2	239.11	0.037	0.60752
175	FS-337	Clearwater	S004-204	7/29/13	47.5175	-95.3906	52.5	69.1	0.95	0.061	14,564	24.58	20.7	20.71	0.057	0.9336
176	FS-336	Miss. R Pool 4/Rob'n Lake	79-0005-02-201	7/30/13	44.3613	-91.9901	30	46.5	55.3	0.060	8,193	1.41	378.5	378.30	0.085	1.40841
177	FS-366	Partridge	S007-443	9/3/13	47.5213	-92.19	17.5	47.7	34.2	0.057	7,671	1.79	237.7	237.57	0.084	1.4795
178	P-44	Dead Fish	09-0051-00-202	9/20/11	46.7451	-92.6863	21.3		0.3	0.056	9,685	16.6	16.2	16.22	0.042	0.74116
179	P-5	Itasca	15-0016-00-208	8/25/11	47.2381	-95.2065	20		0.26	0.056	1,355	7.4	1.1	1.08	0.101	1.79682
180	FS-338	Height of Land	03-0195-00-210	7/30/13	46.913	-95.6116	36.3	94.2	0.5	0.055	2,641	4.58	7.9	7.85	0.064	1.14885
181	FS-199	Rice	S006-208	9/5/12	47.6742	-93.6547	29	75.4	1.57	0.055	3,273	10.88	3.5	3.52	0.124	2.25424
182	FS-372	Mississippi Pool 5 / Spring	S007-660	9/10/13	44.2016	-91.8443	13.8	26.7	34.8	0.054	3,330	0.33	504.1	503.89	0.066	1.22227
183	FS-224	Stone Lake	69-0046-00-201	9/19/12	47.5039	-91.8857	6.3	21.0	3.26	0.053	5,225	18.87	4.1	4.05	0.153	2.86279
184	FS-354	Miss. R/ ab. Clay Boswell	S007-163	8/13/13	47.2376	-93.7187	75	132.7	1.18	0.053	7,052	5.76	38.8	38.78	0.049	0.92679
185	P-1	Height of Land	03-0195-00-209	8/22/11	46.9129	-95.6095	27.5		0.24	0.053	1,298	1.76	7.5	7.53	0.050	0.94601
186	P-14	Miss. R/ ab. Clay Boswell	S007-163	9/1/11	47.2379	-93.7196	71.3		1.09	0.053	7,964	6.43	42.1	42.13	0.047	0.87964
187	FS-205	Big Swan	77-0023-00-207	8/10/12	45.8795	-94.7418	17.5	56.3	5.47	0.053	1,719	4.81	3.2	3.16	0.199	3.77265

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
188	FS-55	Pelkey	49-0030-00-202	8/26/12	45.9962	-94.2273	0	0.0	3.42	0.052	30,642	17.32	145.4	145.35	0.045	0.86373
189	FS-369	Dark	69-0790-00-202	9/5/13	47.6389	-92.7781	12.8	11.8	176	0.052	2,037	0.82	53.4	53.39	0.249	4.77951
190	P-47	Little Birch	77-0089-00-101	9/21/11	45.7747	-94.7996	11.3		3.2	0.050	4,503	4.46	23.1	23.13	0.083	1.66307
191	FS-88	Clearwater	S004-204	8/24/12	47.5174	-95.3904	61.3	148.3	2.04	0.049	9,874	22.17	11.2	11.20	0.091	1.87198
192	FS-80	Mission	S001-646	8/6/12	45.8623	-93.0011	52.3	87.5	0.62	0.049	9,231	4.83	84.2	84.18	0.030	0.6232
193	P-11	Sand	S003-249	8/30/11	47.6348	-92.4235	6.3		7.69	0.046	22,677	17.49	79.6	79.57	0.073	1.59589
194	FS-376	Rice	18-0053-00-203	9/11/13	46.3394	-93.8918	22.5	46.5	0.5	0.045	65,261	33.36	253.2	253.08	0.019	0.42511
195	FS-367	Hay	31-0037-00-202	9/4/13	47.287	-93.1009	83.8	141.0	22.1	0.045	15,436	3.44	371.5	371.33	0.062	1.39045
196	FS-351	Second	S007-220	8/15/13	47.5205	-92.1925	52.5	66.8	838	0.045	7,088	1.84	195.9	195.78	0.272	6.08065
197	FS-66	St. Louis Estuary	S007-206	9/5/12	46.6545	-92.2739	0	0.0	16	0.045	6,169	1.73	162.8	162.76	0.074	1.66149
198	FS-132	Ox Hide	31-0106-00-203	9/7/12	47.335	-93.2134	4	10.5	26.4	0.042	14,936	14.43	46.1	46.11	0.136	3.22953
199	P-42	Monongalia	34-0158-01-201	9/20/11	45.3481	-94.951	2.5		16.51	0.042	46,471	14.76	411.5	411.28	0.054	1.29075
200	P-61	Lily	81-0067-00-202	9/28/11	44.194	-93.6469	22.5		0.66	0.041	6,180	14.06	8.5	8.51	0.068	1.65998
201	P-6	Elk	15-0010-00-203	8/25/11	47.1946	-95.2254	11.3		0.28	0.040	8,480	10.24	24.7	24.71	0.035	0.87637
202	P-17	St. Louis	S007-208	9/1/11	47.4668	-91.9355	30		1.23	0.040	9,654	30.4	6.9	6.87	0.091	2.27037
203	FS-383	Upper Panasa	31-0111-00-204	9/18/13	47.3059	-93.2676	0	0.0	33.6	0.040	19,148	2.86	734.7	734.34	0.057	1.42271
204	FS-365	Partridge	S007-443	9/3/13	47.5212	-92.1901	31.3	76.7	34.1	0.039	9,179	2.5	210.8	210.70	0.088	2.23388
205	FS-374	Little Round	03-0302-00-202	9/10/13	46.9745	-95.738	21.3	37.6	0.12	0.039	2,018	14.8	0.9	0.89	0.082	2.10963
206	FS-203	Long Prairie	S007-203	8/9/12	45.9729	-95.1603	46.3	58.3	6.66	0.039	5,074	4.35	30.3	30.26	0.098	2.49607
207	FS-307	Rice paddy	WT00046	6/12/13	47.8482	-95.4865	4.3	8.3	16.6	0.039	4,292	22.33	2.2	2.17	0.332	8.50213
208	P-23	Gourd	04-0253-00-201	9/7/11	47.812	-94.9654	16.8		0.69	0.038	2,675	27.4	0.6	0.65	0.168	4.42652
209	FS-201	Mink	86-0229-00-206	8/8/12	45.274	-94.0269	0	0.0	1.31	0.037	1,740	1.53	16.3	16.28	0.069	1.85046
210	FS-373	Clearwater	S002-121	9/9/13	47.9372	-95.6909	5	3.2	34.4	0.035	5,315	3.33	48.3	48.30	0.146	4.13469
211	FS-54	Little Birch	77-0089-00-207	8/3/12	45.7779	-94.7978	11.3	70.0	7.4	0.035	1,794	6.02	2.5	2.50	0.239	6.77336
212	P-15	Miss. R./bel.Clay Boswell	S006-923	9/1/11	47.2547	-93.6344	43.8		3.65	0.035	8,667	6.07	53.9	53.92	0.065	1.85623
213	FS-185	Hoffs Slough	76-0103-00-201	8/1/12	45.3255	-95.7059	0	0.0	273	0.034	3,512	0.75	175.8	175.71	0.192	5.58924
214	FS-380	Sandy	69-0730-00-204	9/17/13	47.6187	-92.5939	0.3	0.6	126	0.034	17,868	22.7	34.6	34.56	0.257	7.50964
215	FS-381	Sandy	69-0730-00-204	9/17/13	47.6187	-92.5931	0	0.0	126	0.034	16,172	11.67	72.7	72.66	0.199	5.8133
216	FS-335	Miss. R Pool 5/Spring	S007-660	7/30/13	44.1953	-91.841	42.5	63.0	47.7	0.034	4,362	0.25	1264.4	1,263.8	0.053	1.5553
217	P-3	Little Round	03-0302-00-202	8/24/11	46.9759	-95.7404	25		0.46	0.032	1,689	20.91	0.4	0.38	0.175	5.46618
218	FS-108	Rice paddy	WT00031	6/29/12	46.246	-94.2548	33.8	54.7	0.25	0.031	7,874	37.88	3.4	3.38	0.067	2.13826
219	FS-193	Big Mud	71-0085-00-201	8/30/12	45.4529	-93.7418	4.3	14.3	0.5	0.031	12,943	18.63	24.3	24.30	0.043	1.39776
220	FS-95	Embarrass	69-0496-00-203	9/14/12	47.5334	-92.2979	0	0.0	18.8	0.030	21,847	1.89	1705.2	1,704.4	0.035	1.16622
221	FS-180	Lily	81-0067-00-202	7/26/12	44.1947	-93.647	18.8	38.2	0.5	0.030	5,095	28.07	2.2	2.20	0.099	3.34185
222	FS-250	Little Rice	69-0612-00-201	9/20/12	47.7086	-92.4389	8.8	29.3	1.03	0.029	9,488	26.45	8.1	8.08	0.081	2.75681
223	P-53	Carlos Avery Pool 9	02-0504-00-201	8/19/11	45.3179	-93.0587	18.8		0.35	0.029	37,965	16.51	236.6	236.48	0.017	0.59867
224	FS-377	Mahnomen	18-0126-02-201	9/11/13	46.4986	-93.9956	0	0.0	21.1	0.028	16,540	7.47	142.5	142.43	0.085	3.00714
225	FS-215	Popple	S006-188	9/11/12	47.7254	-94.0817	11.8	36.3	0.5	0.027	2,971	14.42	2.0	1.96	0.103	3.81575

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
226	P-46	Hay	31-0037-00-201	9/21/11	47.2869	-93.1018	0		10.24	0.026	16,139	7.69	130.4	130.31	0.068	2.63005
227	FS-56	Rice	18-0053-00-203	8/27/12	46.3389	-93.8915	3.5	19.4	0.5	0.026	83,421	31.88	436.3	436.11	0.016	0.61353
228	FS-378	Duck Lake WMA	18-0178-00-202	9/12/13	46.7521	-93.8851	42.5	113.0	0.5	0.025	12,151	26.57	13.0	13.02	0.053	2.12693
229	P-16	St. Louis	S006-929	9/1/11	47.4015	-92.3773	0		24.5	0.025	1,488	0.1	561.5	561.24	0.056	2.23849
230	P-31	Cloquet	38-0539-00-201	9/14/11	47.4313	-91.4844	32.5		0.81	0.024	4,252	6.58	12.0	11.95	0.065	2.70841
231	FS-304	Rice	18-0053-00-203	6/10/13	46.3387	-93.8906	2.5	5.7	0.5	0.024	48,287	33.61	139.0	138.93	0.024	0.9992
232	P-36	Wild Rice Reservoir	69-0371-00-204	9/16/11	46.9098	-92.1636	7.5		1.13	0.023	5,555	3.75	44.6	44.54	0.046	2.01392
233	FS-212	Miss. R Pool 5/Spring	S007-660	8/17/12	44.1993	-91.8461	17.5	29.6	17.2	0.022	3,674	0.22	1082.3	1,081.8	0.039	1.76237
234	FS-84	Pleasant	11-0383-00-207	8/10/12	46.9228	-94.4874	0	0.0	0.5	0.022	7,065	23.99	5.2	5.21	0.073	3.36026
235	P-69	Rice	18-0053-00-203	9/27/11	46.3394	-93.8913	18.8		0.23	0.021	50,389	35.55	139.6	139.52	0.018	0.85773
236	P-52	Flowage	01-0061-00-205	9/22/11	46.6895	93.338	53.8		0.56	0.018	3,706	16.52	2.5	2.49	0.098	5.45675
237	P-52	Flowage	01-0061-00-206	9/22/11	46.6895	93.338	53.8		0.56	0.018	4,302	21.79	2.3	2.26	0.102	5.64492
238	P-52	Flowage	01-0061-00-206	9/22/11	46.6895	93.338	53.8		0.56	0.018	4,641	18.1	3.4	3.40	0.088	4.90074
239	P-51	Flowage	01-0061-00-205	9/22/11	46.6896	93.338	70		0.56	0.014	5,627	20.1	4.3	4.28	0.082	5.82175
240	FS-109	Carlos Avery Pool 9	02-0504-00-202	7/3/12	45.3192	-93.0611	23.8	52.8	0.5	0.011	14,736	12.51	54.9	54.92	0.033	2.95463
241	FS-127	Height of Land	03-0195-00-210	8/21/12	46.9133	-95.6095	70	111.1	0.5	0.011	2,112	1.32	29.3	29.28	0.040	3.67555
242	FS-375	Height of Land	03-0195-00-210	9/10/13	46.913	-95.6111	63.8	117.5	0.5	0.011	1,795	0.86	39.0	38.98	0.037	3.33093
243	P-4	Little Flat	03-0217-00-201	8/24/11	46.9981	-95.6641	36.3		0.22	0.011	7,479	33.13	3.7	3.69	0.062	5.64764
244	P-63	Maloney	79-0001-00-201	9/29/11	44.2243	-91.9328	65		1.83	0.010	10,269	4.24	124.7	124.60	0.038	3.83534
245	P-22	Ham	02-0053-00-201	9/6/11	45.2572	-93.2264	0		0.95							
246	FS-104	Gourd	04-0253-00-201	6/27/12	47.8121	-94.965	0	0.0	0.27		1,776	36.87	0.2	0.19	0.185	
247	P-43	Wild Rice	09-0023-00-201	9/20/11	46.6735	-92.6023	0		0.37							
248	P-27	Pleasant	11-0383-00-206	9/9/11	46.928	-94.4757	12.5		0.49		5,331	30.37	2.2	2.15	0.099	
249	P-56	Rice	18-0053-00-203	9/23/11	46.3396	-93.8901	0		0.38							
250	P-37	Ina	21-0355-00-201	9/16/11	46.0822	-95.726	0		2.17							
251	FS-178	Bear	24-0028-00-206	7/25/12	43.5465	-93.5028	0	0.0	18.3							
252	P-33	Pelican	26-0002-00-219	9/15/11	46.0616	-95.8296	0		5.79							
253	P-8	Pelican	26-0002-00-219	8/26/11	46.0616	-95.8296	0									
254	FS-50	Swan	34-0223-00-201	7/30/12	45.326	-95.067	0	0.0	11.7							
255	P-18	Lax	38-0406-00-203	9/2/11	47.3508	-91.2921	0		1.43							
256	P-32	Caribou	69-0489-00-205	9/15/11	46.8991	-92.3217	0		0.63							
257	P-9	Embarrass	69-0496-00-202	8/29/11	47.534	-92.3164	0		6.35							
258	P-39	Grand	69-0511-00-203	9/17/11	46.8872	-92.3988	0		0.83							
259	P-64	Maloney	79-0001-00-201	9/29/11	44.2243	-91.9328	0		1.83		10,382	4.05	135.9	135.79	0.037	
260	P-62	Lily	81-0067-00-202	9/28/11	44.194	-93.6469	0		0.64		5,069	13.39	6.2	6.19	0.075	
261	P-2	Mud	S004-735	8/23/11	46.6266	-95.5751	0									
262	P-41	St. Louis Est. Pok. Bay	S006-928	9/19/11	46.6855	-92.1619	0		2.33							
263	FS-70	St. Louis	S006-929	9/7/12	47.4015	-92.3772	0	0.0	73.8							

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
264	FS-317	Partridge	S007-443	6/26/13	47.5215	-92.1903	0	0.0	7.65							
265	FS-363	St. Louis Estuary	S007-444	8/26/13	46.6518	-92.2372	18.8	31.2			4,761	1.4		132.15		
266	P-40	St. Louis Estuary	S007-444	9/19/11	46.6588	-92.2819	0		4.9							
267	FS-364	Partridge	S007-513	8/30/13	47.5138	-92.1894	57.5	105.7			28,890	8.19		372.42		
268	FS-361	Rice paddy	WT00028	8/21/13	47.8054	-95.6744	68.8	78.6			3,089	12.46		2.60		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
2	P-55	Lady Slipper	42-0020-00-204	9/22/11	44.5702	-95.6274	0		107.71	14.840	2,814	2.09	26.9	26.85	0.266	0.01791
3	FS-85	Bean	03-0411-00-201	8/21/12	46.9337	-95.8706	0	0.0	85	16.000	1,967	11.85	1.2	1.15	0.725	0.04531
4	FS-320	Sandy	69-0730-00-204	7/9/13	47.6188	-92.5936	0	0.0	118	3.080	19,749	15.43	72.5	72.45	0.195	0.06316
5	FS-184	Rice	73-0196-00-216	7/30/12	45.3864	-94.6309	0	0.0	2.58	2.970	1,523	15.03	0.5	0.50	0.290	0.09752
6	FS-186	Westport	61-0029-00-204	8/1/12	45.6897	-95.217	0	0.0	7.11	1.790	4,917	20.15	3.3	3.28	0.215	0.11999
7	FS-188	Stella	47-0068-00-204	8/27/12	45.0683	-94.4334	0.3	0.3	18.1	1.790	1,257	2.34	4.7	4.73	0.261	0.14607
8	FS-345	Rice	73-0196-00-216	8/7/13	45.3865	-94.6313	0	0.0	6.85	2.080	2,012	14.83	0.9	0.88	0.334	0.16055
9	FS-357	Lower Panasa	31-0112-00-204	8/15/13	47.3026	-93.2561	0	0.0	28.5	1.260	2,347	2.42	15.3	15.31	0.204	0.16186
10	FS-177	South Geneva	24-0015-02-208	7/24/12	43.7709	-93.2851	0	0.0	14.1	3.190	1,618	16.71	0.5	0.49	0.526	0.16487
11	FS-128	Cromwell	14-0103-00-201	8/22/12	46.9651	-96.3171	0	0.0	41.2	1.220	2,948	2.85	19.0	18.99	0.215	0.17622
12	FS-339	Christina	21-0375-00-315	7/31/13	46.0734	-95.7567	0.3	0.6	14.6	1.930	1,741	8.96	1.3	1.35	0.374	0.1939
13	FS-79	Lady Slipper	42-0020-00-203	7/27/12	44.5723	-95.6216	0	0.0	330	1.630	3,314	1.85	43.9	43.92	0.330	0.20251
14	FS-78	Lady Slipper	42-0020-00-202	7/27/12	44.5699	-95.6275	0	0.0	335	1.680	2,719	1.66	34.8	34.74	0.360	0.21415
15	FS-77	Monongalia	34-0158-02-204	7/26/12	45.3331	-94.927	38.8	121.3	21.7	1.370	4,953	18.66	3.7	3.70	0.303	0.22086
16	FS-324	Rice	18-0053-00-203	7/15/13	46.3392	-93.8918	27.5	56.7	0.5	0.110	44,704	33.18	121.7	121.67	0.025	0.22442
17	FS-305	Sandy	69-0730-00-204	6/11/13	47.6187	-92.5937	0	0.0	135	1.080	19,094	22.23	40.6	40.53	0.249	0.23051
18	FS-102	Rice paddy	WT00027	6/26/12	47.9265	-95.6313	39.3	93.6	1.61	0.677	4,932	31.82	1.7	1.73	0.160	0.23683
19	FS-133	Mahnomen	18-0126-02-201	9/17/12	46.4985	-93.9958	0	0.0	16.9	0.308	18,746	7.7	174.4	174.34	0.074	0.23869
20	FS-176	North Geneva	24-0015-00-209	7/24/12	43.7876	-93.271	0	0.0	15.6	1.540	2,212	13.45	1.2	1.21	0.397	0.25768
21	FS-83	Mississippi Crow Wing	S007-205	8/8/12	46.4386	-94.1251	0	0.0	3.13	0.127	13,451	3.88	239.5	239.40	0.037	0.29011
22	FS-181	Rice	66-0048-00-203	7/27/12	44.3332	-93.4734	0	0.0	5.22	0.777	3,829	21.67	1.8	1.81	0.237	0.30476
23	FS-333	Embarrass	69-0496-00-203	7/26/13	47.5333	-92.2976	0	0.0	18.2	0.087	11,179	0.47	3271.6	3,270.1	0.027	0.31719
24	FS-223	Little Sucker	31-0126-00-202	9/14/12	47.3765	-93.246	0	0.0	13.7	0.534	6,297	16.56	7.0	7.01	0.207	0.38799
25	FS-315	St. Louis Estuary	S007-444	6/24/13	46.6516	-92.2373	0	0.0	8.1	0.147	6,056	1.68	163.7	163.61	0.058	0.39699
26	FS-51	Glesne Slough	34-0353-00-201	7/31/12	45.3514	-95.1887	22.5	99.6	0.5	0.061	7,983	3.01	123.5	123.42	0.025	0.40325
27	FS-87	Bee	60-0192-00-202	8/23/12	47.6527	-96.0504	18.8	39.8	11	0.670	3,054	13.62	2.2	2.24	0.285	0.42488
28	FS-376	Rice	18-0053-00-203	9/11/13	46.3394	-93.8918	22.5	46.5	0.5	0.045	65,261	33.36	253.2	253.08	0.019	0.42511
29	FS-75	Mortenson	34-0150-02-201	7/24/12	45.3	-94.9062	0	0.0	0.5	0.103	9,071	12.09	22.3	22.31	0.044	0.43062
30	FS-251	Sandy	69-0730-00-203	9/21/12	47.6254	-92.5886	1.3	3.8	3.05	0.123	35,905	33.08	79.6	79.59	0.053	0.43361
31	FS-69	St. Louis	S007-208	9/7/12	47.4671	-91.9279	0	0.0	1.33	0.181	11,429	27.16	11.2	11.20	0.079	0.43544
32	P-35	Anka	21-0353-00-201	9/16/11	46.0769	-95.7377	1.3		2.23	0.493	2,170	14.84	1.0	1.02	0.216	0.43718
33	FS-208	Mississippi Pool 8 at Genoa	S007-222	8/14/12	43.5758	-91.2334	43.8	41.4	18	0.176	2,178	0.41	161.8	161.72	0.077	0.43885
34	P-47	Little Birch	77-0089-00-101	9/21/11	45.7747	-94.7996	11.3		3.2	0.191	2,236	1.75	22.0	22.00	0.085	0.44321
35	FS-331	Partridge	S007-443	7/24/13	47.5212	-92.1904	30	60.5	14.6	0.112	10,082	1.68	443.6	443.39	0.051	0.45262
36	FS-67	St. Louis Estuary Pokegama Bay	S006-928	9/5/12	46.6859	-92.1606	0	0.0	9.97	0.112	14,015	3.66	281.8	281.69	0.052	0.46385
37	FS-187	McCormic	73-0273-00-203	8/2/12	45.722	-94.9121	1.3	8.9	1.54	0.144	1,512	1.1	19.7	19.70	0.068	0.47467
38	FS-190	Pine	15-0149-00-205	8/28/12	47.6841	-95.5414	47.5	114.9	14.7	0.368	4,477	7.08	11.9	11.92	0.177	0.48053

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
39	FS-195	Fisher	70-0087-00-201	8/31/12	44.7942	-93.4061	25	20.7	6.85	0.136	11,140	5.76	94.9	94.85	0.066	0.48846
40	FS-81	Flowage	01-0061-00-204	8/7/12	46.688	-93.337	0	0.0	0.78	0.134	12,470	32.34	10.4	10.38	0.067	0.50215
41	FS-57	Mississippi River below Clay Boswell	S006-923	8/28/12	47.2551	-93.6342	0	0.0	10.3	0.134	4,225	1.2	130.1	130.02	0.069	0.51229
42	P-34	Anka	21-0353-00-201	9/16/11	46.0769	-95.7292	11.3		2.23	0.671	1,485	23.57	0.3	0.25	0.349	0.51956
43	P-13	Partridge	S007-443	8/31/11	47.5212	-92.1899	28.8		10.39	0.075	11,026	1.44	656.8	656.47	0.039	0.52498
44	FS-371	Mississippi Pool 5 / Spring	S007-660	9/10/13	44.2016	-91.8443	26.3	39.8	34.4	0.069	3,582	0.11	2736.9	2,735.55	0.036	0.52782
45	FS-230	Mill Pond	21-0034-00-202	8/16/12	46.0715	-95.2218	21.5	80.9	7.36	0.192	3,969	3.14	29.7	29.64	0.102	0.53004
46	FS-220	Padua	73-0277-00-202	8/7/12	45.623	-95.0186	0	0.0	0.86	0.230	2,291	9.77	2.0	2.04	0.122	0.53075
47	FS-218	Holman	31-0227-00-202	9/13/12	47.3005	-93.3445	0	0.0	24.2	1.010	3,035	29.74	0.7	0.74	0.548	0.54303
48	FS-200	Louisa	86-0282-00-205	8/8/12	45.2998	-94.258	0	0.0	7.04	0.192	7,824	8.76	26.3	26.31	0.104	0.54356
49	P-47	Little Birch	77-0089-00-101	9/21/11	45.7747	-94.7996	11.3		3.2	0.191	3,544	5.11	12.0	11.95	0.104	0.54672
50	FS-137	Elk	15-0010-00-204	9/19/12	47.1952	-95.2249	7.3	42.7	0.5	0.094	6,334	10.07	14.3	14.30	0.052	0.55252
51	FS-82	Rabbit	18-0093-02-204	8/8/12	46.5313	-93.9285	0	0.0	15.3	0.220	10,903	11.79	33.1	33.12	0.126	0.5726
52	FS-94	Sturgeon	S004-870	9/13/12	47.656	-92.9315	13.8	37.9	1.62	0.066	2,505	0.65	111.1	111.02	0.038	0.58132
53	FS-129	Mink	86-0229-00-207	8/23/12	45.2767	-94.0299	0	0.0	1.22	0.182	4,247	13.63	4.3	4.27	0.107	0.58651
54	P-53	Carlos Avery Pool 9	02-0504-00-201	8/19/11	45.3179	-93.0587	18.8		0.35	0.029	37,965	16.51	236.6	236.48	0.017	0.59867
55	FS-330	St. Louis Estuary	S007-444	7/22/13	46.6518	-92.2372	8.8	11.8	6.71	0.090	5,817	1.55	169.5	169.40	0.054	0.59974
56	FS-175	Maloney	79-0001-00-201	7/23/12	44.2251	-91.9321	0	0.0	3.15	0.061	15,126	4.57	239.2	239.11	0.037	0.60752
57	FS-56	Rice	18-0053-00-203	8/27/12	46.3389	-93.8915	3.5	19.4	0.5	0.026	83,421	31.88	436.3	436.11	0.016	0.61353
58	FS-65	Wild Rice	09-0023-00-202	9/4/12	46.6712	-92.6055	0	0.0	0.5	0.083	13,650	28.82	14.6	14.58	0.051	0.61859
59	FS-76	Field	34-0151-00-201	7/25/12	45.2964	-94.9058	0	0.0	0.5	0.069	7,586	8.68	25.1	25.09	0.043	0.62007
60	FS-80	Mission	S001-646	8/6/12	45.8623	-93.0011	52.3	87.5	0.62	0.049	9,231	4.83	84.2	84.18	0.030	0.6232
61	FS-348	Sandy	69-0730-00-204	8/13/13	47.6186	-92.5934	0	0.0	123	0.305	13,216	8.23	80.2	80.11	0.191	0.62517
62	FS-301	Partridge	S007-443	5/28/13	47.5213	-92.1903	0	0.0	14.8	0.125	9,491	3.94	118.5	118.44	0.080	0.64224
63	FS-125	Tamarac	56-0192-00-203	8/19/12	46.3637	-95.5714	0	0.0	2.33	0.077	21,908	18.41	69.2	69.19	0.051	0.66439
64	FS-58	Mississippi River above Clay Boswell	S007-163	8/28/12	47.2386	-93.7197	0	0.0	1.19	0.081	8,636	9.08	30.4	30.34	0.054	0.66756
65	FS-131	Hinken	S007-207	9/5/12	47.7271	-93.9923	18.8	46.8	0.5	0.088	2,960	4.53	10.0	9.96	0.059	0.66915
66	FS-139	Welby family farm	86-0231-00-202	9/21/12	45.3592	-94.0782	2	17.2	0.5	0.118	7,267	30.76	3.9	3.88	0.081	0.68731
67	FS-68	Wolf	69-0143-00-101	9/6/12	47.2564	-91.963	2.3	8.9	2.01	0.119	9,526	17.19	15.0	14.95	0.082	0.69147
68	P-57	Unnamed	34-0611-00-201	9/23/11	45.2675	-94.865	32.5		6.42	0.286	2,311	6.48	3.7	3.71	0.199	0.6954
69	FS-328	Eighteen	60-0199-00-203	7/18/13	47.6369	-96.0599	27.5	44.2	3.34	0.250	5,106	24.65	2.7	2.66	0.178	0.71181
70	P-45	Hay	31-0037-00-201	9/21/11	47.2874	-93.1017	0		10.24	0.087	12,403	4.36	173.4	173.30	0.062	0.71258
71	P-19	Wolf	69-0143-00-202	9/2/11	47.2586	-91.9618	56.3		1.54	0.139	8,240	25.1	6.6	6.60	0.100	0.71583
72	FS-325	Rice paddy	WT00046	7/16/13	47.8481	-95.4865	51.3	79.6	0.46	0.115	4,673	19.28	3.2	3.16	0.085	0.73566
73	P-44	Dead Fish	09-0051-00-202	9/20/11	46.7451	-92.6863	21.3		0.3	0.056	9,685	16.6	16.2	16.22	0.042	0.74116
74	FS-61	Swan	31-0067-02-206	8/30/12	47.2888	-93.2127	3	12.4	12.5	0.332	5,827	22.71	3.9	3.86	0.247	0.74282
75	FS-63	Caribou	69-0489-00-206	9/3/12	46.8913	-92.3135	0	0.0	1.21	0.094	13,791	29.44	14.4	14.43	0.070	0.74503

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	LacCore field ID	Site name	DNR/State ID	Date	Lat	Long	WR ring % cover	Ave. stems /m2	Obs surf water sulfate (mg SO4/L)	Obs pore water Tot Sulfide (TS, mg S/L)	Observed Sediment Fe (µg/g)	Observed Sediment TOC (%)	CPSC (mg/L)	CPSC check	Direct sulfide calc (expect)	Sulfide ratio expect to obs
76	FS-308	Rice paddy	WT00028	6/12/13	47.8056	-95.674	36.3	85.9	57.1	0.802	2,779	17.1	1.4	1.35	0.598	0.74579
77	P-29	Padua	73-0277-00-203	9/13/11	45.6202	-95.0192	1.5		0.76	0.130	4,927	20.15	3.3	3.29	0.099	0.76289
78	FS-211	Mississippi Pool 4/Robinson Lake	79-0005-02-201	8/16/12	44.3611	-91.9897	51.3	57.6	17.7	0.071	9,265	1.55	421.2	421.04	0.055	0.77246
79	FS-221	Hay Creek Flowage	58-0005-00-202	9/17/12	46.0894	-92.4104	58.8	97.7	1.95	0.119	9,456	22.05	10.4	10.37	0.092	0.77616
80	FS-64	Dead Fish	09-0051-00-202	9/4/12	46.7454	-92.6865	0	0.0	0.71	0.061	14,387	22.4	23.1	23.05	0.049	0.81379
81	FS-194	Gilchrist	86-0064-00-201	8/31/12	45.2309	-93.824	0	0.0	6.98	0.355	3,117	20.81	1.3	1.28	0.295	0.83071
82	FS-92	Partridge	S007-443	9/12/12	47.5207	-92.1909	1.5	4.1	36.3	0.074	29,463	5.87	619.3	618.96	0.062	0.83423
83	FS-210	Mississippi Pool 4/Robinson Lake	79-0005-02-202	8/16/12	44.3593	-91.9881	21.3	35.3	15.7	0.070	6,450	1.16	312.1	312.00	0.059	0.8385
84	FS-306	Sandy	69-0730-00-203	6/11/13	47.6255	-92.5884	0	0.0	11	0.092	35,357	28.53	95.2	95.14	0.078	0.85042
85	FS-86	Eighteen	60-0199-00-202	8/22/12	47.6397	-96.0607	23.8	40.1	4.29	0.164	1,860	3.1	6.9	6.85	0.140	0.85384
86	P-69	Rice	18-0053-00-203	9/27/11	46.3394	-93.8913	18.8		0.23	0.021	50,389	35.55	139.6	139.52	0.018	0.85773
87	FS-55	Pelkey	49-0030-00-202	8/26/12	45.9962	-94.2273	0	0.0	3.42	0.052	30,642	17.32	145.4	145.35	0.045	0.86373
88	FS-179	Rice	74-0001-00-201	7/25/12	44.0842	-93.0737	0	0.0	3.84	0.217	4,152	19.07	2.5	2.54	0.190	0.87338
89	P-6	Elk	15-0010-00-203	8/25/11	47.1946	-95.2254	11.3		0.28	0.040	8,480	10.24	24.7	24.71	0.035	0.87637
90	P-14	Mississippi River above Clay Boswell	S007-163	9/1/11	47.2379	-93.7196	71.3		1.09	0.053	7,964	6.43	42.1	42.13	0.047	0.87964
91	FS-368	Dark	69-0790-00-202	9/5/13	47.6387	-92.7782	6.3	11.1	175	0.305	3,354	1.94	42.1	42.05	0.269	0.88268
92	FS-344	Padua	73-0277-00-202	8/6/13	45.6231	-95.0187	2.5	9.5	0.5	0.081	4,520	12.61	5.4	5.38	0.072	0.89883
93	P-28	Raymond	73-0285-00-203	9/12/11	45.629	-95.0234	30		0.82	0.094	3,922	10.06	5.6	5.61	0.085	0.90141
94	FS-191	Ina	21-0355-00-202	8/29/12	46.0715	-95.7281	8.5	30.2	7.08	0.274	2,216	9.09	2.1	2.12	0.249	0.91044
95	FS-60	Lower Panasa	31-0112-00-205	8/29/12	47.3018	-93.2521	0	0.0	33.6	0.243	8,048	14.12	14.2	14.18	0.221	0.91117
96	FS-300	St. Louis Estuary	S007-444	5/27/13	46.6515	-92.2376	0	0.0	9.4	0.071	4,499	1.26	137.3	137.25	0.065	0.9156
97	FS-354	Mississippi River above Clay Boswell	S007-163	8/13/13	47.2376	-93.7187	75	132.7	1.18	0.053	7,052	5.76	38.8	38.78	0.049	0.92679
98	FS-337	Clearwater	S004-204	7/29/13	47.5175	-95.3906	52.5	69.1	0.95	0.061	14,564	24.58	20.7	20.71	0.057	0.9336
99	FS-321	Sandy	69-0730-00-203	7/9/13	47.6255	-92.5885	0	0.0	122	0.189	36,502	29.51	96.6	96.55	0.178	0.94257
100	P-47	Little Birch	77-0089-00-101	9/21/11	45.7747	-94.7996	11.3		3.2	0.191	2,253	8.37	2.5	2.46	0.180	0.94344
101	P-1	Height of Land	03-0195-00-209	8/22/11	46.9129	-95.6095	27.5		0.24	0.053	1,298	1.76	7.5	7.53	0.050	0.94601
102	FS-209	Mississippi Pool 8 at Reno Bottoms	S007-556	8/15/12	43.6025	-91.2686	46.3	72.3	18.1	0.071	9,187	2.29	239.0	238.86	0.068	0.9504
103	FS-214	Bowstring	S007-219	9/11/12	47.7024	-94.0608	27.5	69.7	1.34	0.256	1,974	24.34	0.4	0.42	0.245	0.95751
104	FS-353	Holman	31-0227-00-202	8/12/13	47.3009	-93.3444	0	0.0	68	0.583	5,094	30.6	1.9	1.95	0.560	0.96047
105	FS-312	Mississippi Pool 5 / Spring	S007-660	6/21/13	44.2018	-91.8444	23.8	35.7	28.3	0.084	3,563	0.67	212.0	211.90	0.082	0.97423
106	FS-226	Louise	21-0094-00-202	8/14/12	45.9331	-95.4148	17	46.5	4.09	0.075	1,833	0.83	42.7	42.70	0.073	0.98284
107	FS-304	Rice	18-0053-00-203	6/10/13	46.3387	-93.8906	2.5	5.7	0.5	0.024	48,287	33.61	139.0	138.93	0.024	0.9992
108	P-24	Second	15-0091-00-201	9/7/11	47.8255	-95.3635	16.3		0.87	0.139	3,813	25.67	1.4	1.42	0.139	0.99974