



Chemical Treatment of Flowering Rush in Archibald Lake, WI

By Steve Fleming

Archibald Lake

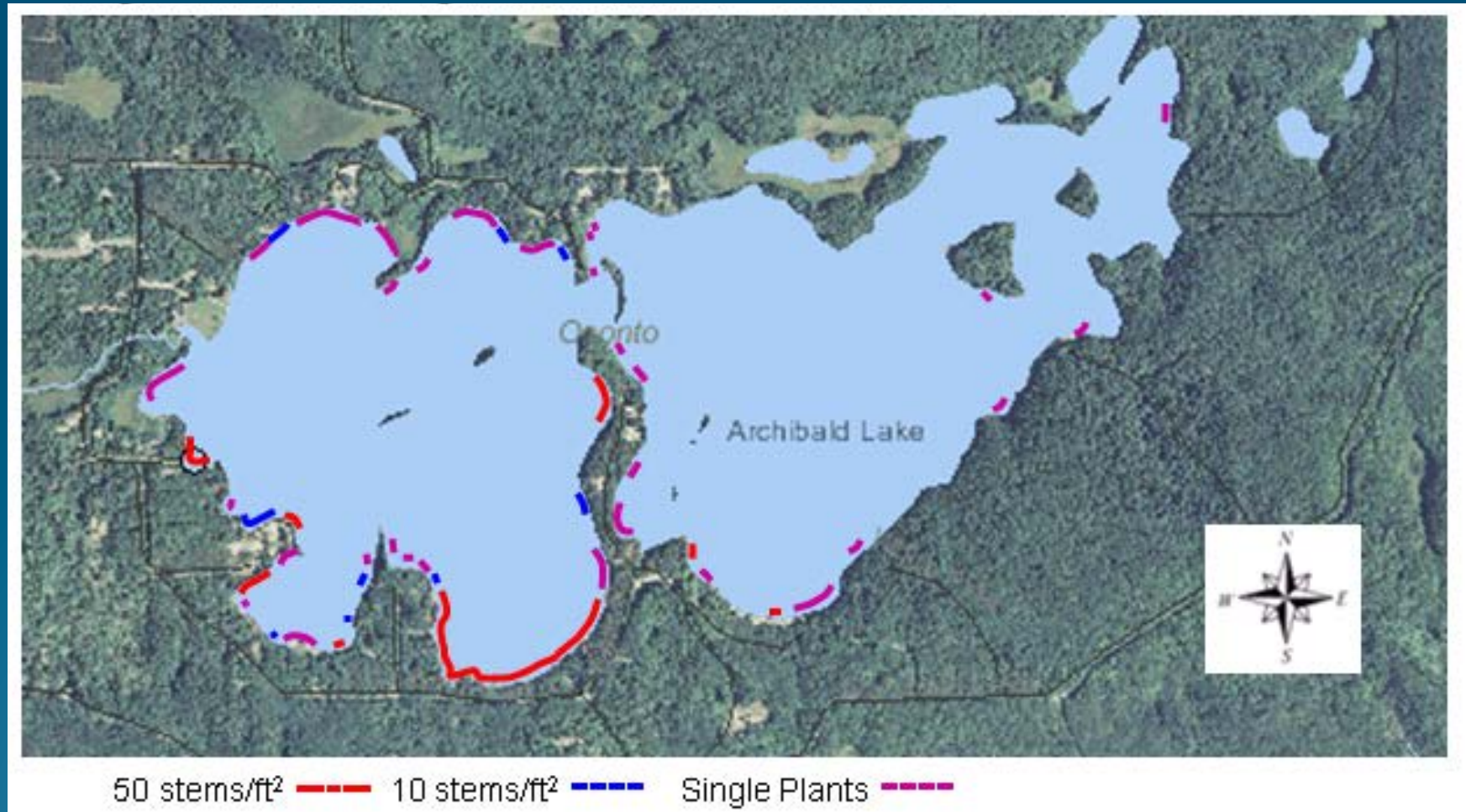
- 430 acre mesotrophic seepage lake in Northeast Wisconsin
- Maximum depth = 50 feet
- Average depth = 19 feet
- 7.5 miles of shoreline
- Two distinct lobes
 - West lobe – highly developed
 - East lobe – >50% undeveloped
- Lake Association has 150 members

Flowering Rush in Archibald Lake

- First observed in early '80s
- Slowly expanding since that time
- 50% or more of flowering rush is submergent
- 2008 - started manual management efforts
 - Cutting flowers
 - Cutting plants several times per year
 - Hand digging smaller areas

Little or No Impact with the Exception of Hand Digging, but VERY Labor Intensive

Distribution of Flowering Rush in Archibald



Flowering Rush in Archibald



Flowering Rush in Archibald



Hand Digging Flowering Rush



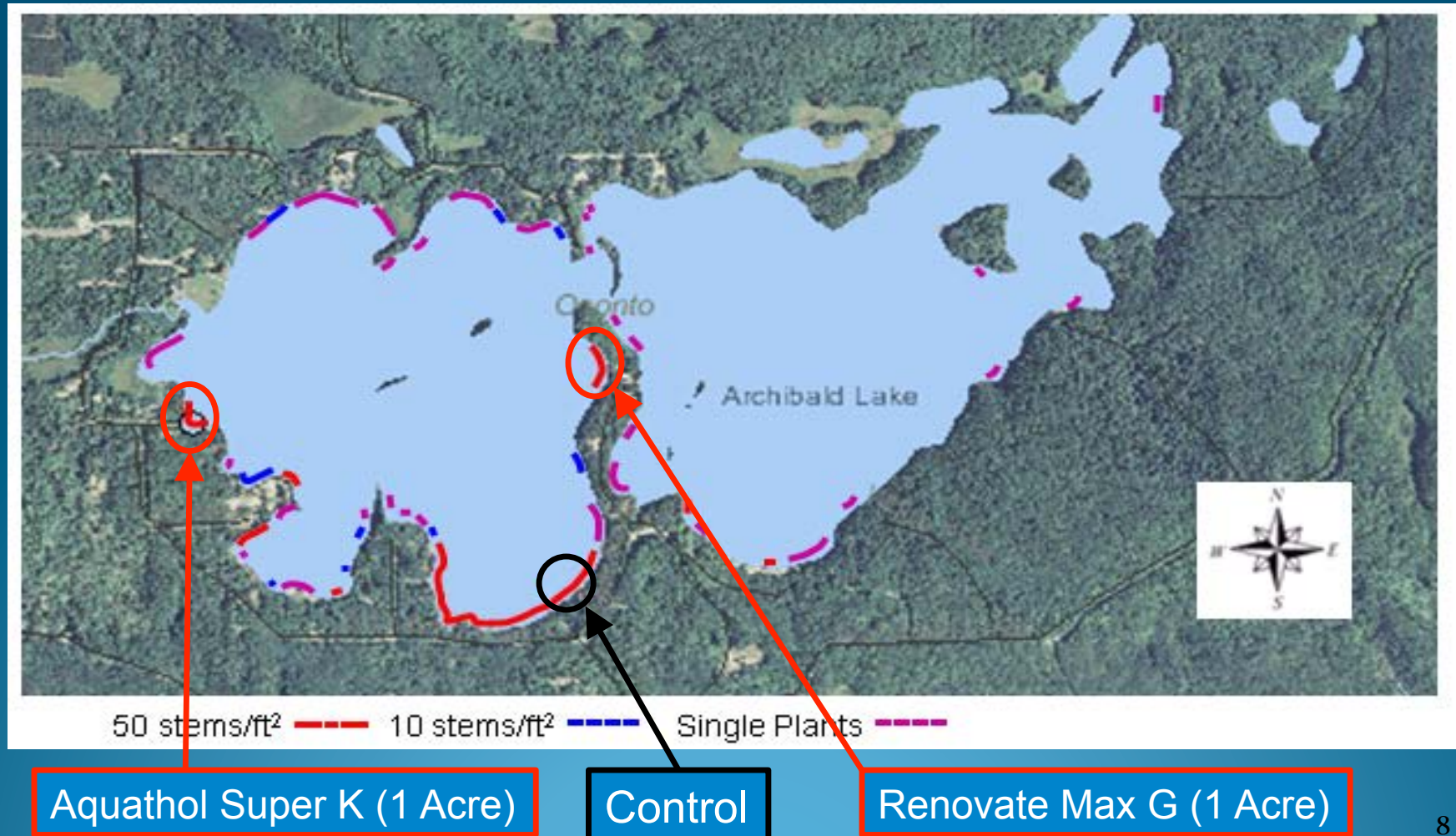
Before



After

2011 – With Guidance from Peter Rice / Wisconsin DNR - Began Chemical Treatment Trials

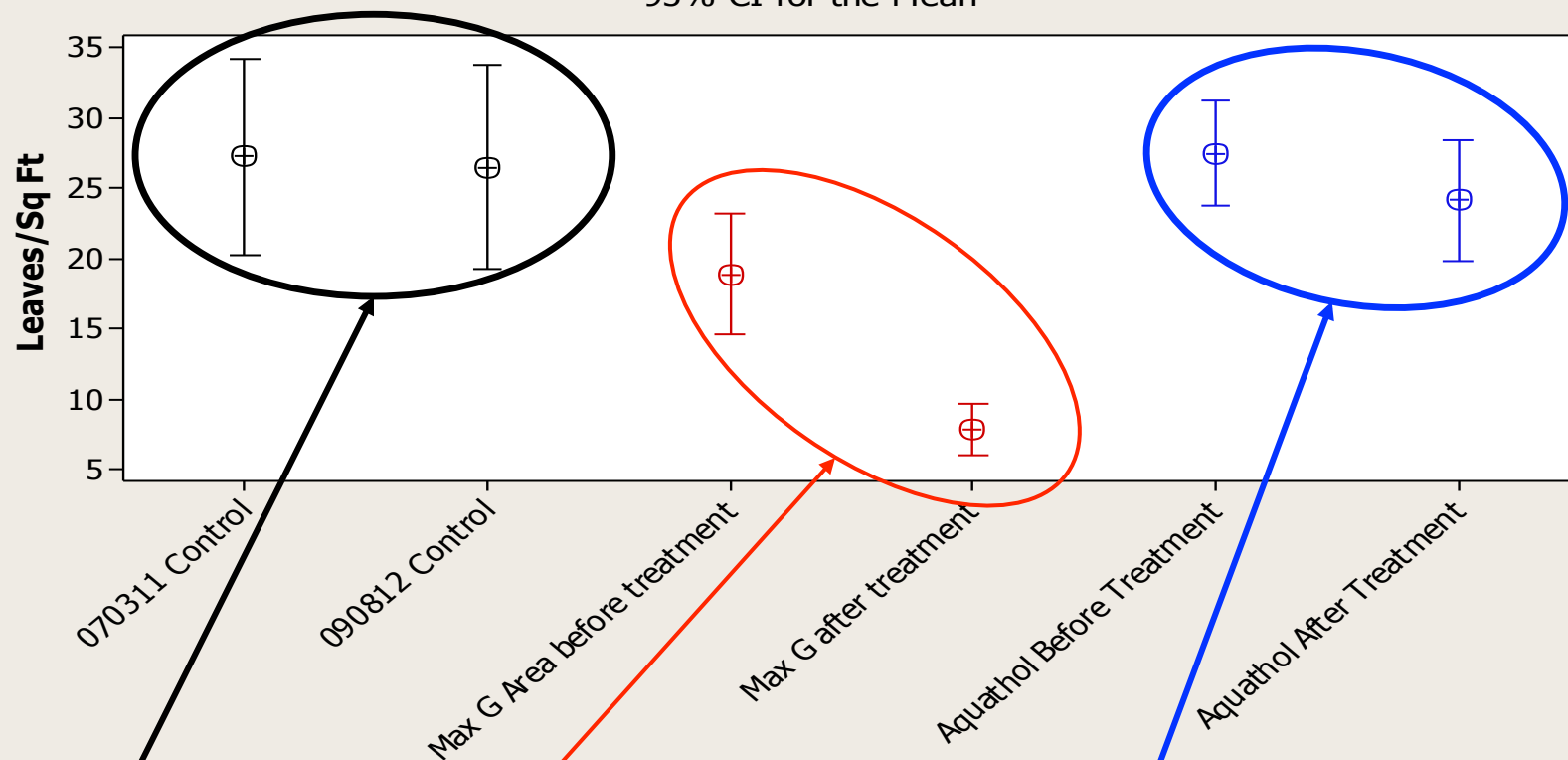
Treatment completed 7/11/11



2012 (1 yr) – Pre / Post Data Collection

ARCHIBALD-FLOWERING RUSH PLANT PRE/POST TREATMENT ANALYSIS

95% CI for the Mean



Individual standard deviations were used to calculate the intervals.

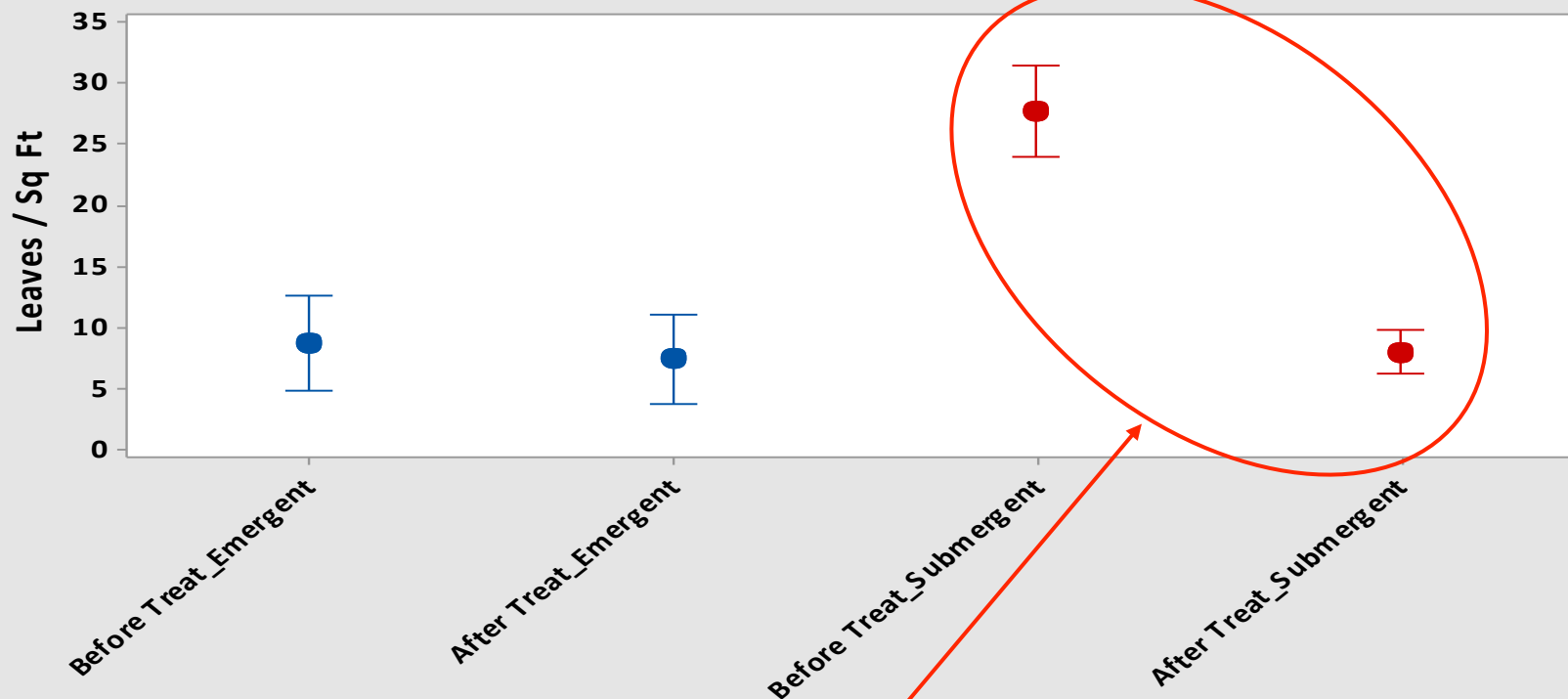
Control Area

Max G (59% Reduction)
5 ppm

Aquathol
5 ppm

2012 – Max G Emergent Vs Submergent Results

Archibald Lake - Flowering Rush - Max G - Emergent/Submergent
95% CI for the Mean



Individual standard deviations were used to calculate the intervals.

**71% Reduction in Submergent
No Difference in Emergent**

Renovate Max G – *Before / After Treatment*



Before Treatment
(2011)

1 Year After Treatment
(2012)



What Did We Learn?

One year, non-replicated trial!

- Aquathol Super K had no impact
- Renovate Max G had significant impact, primarily in submergent plants
- Renovate Max G had little impact in emergent plants

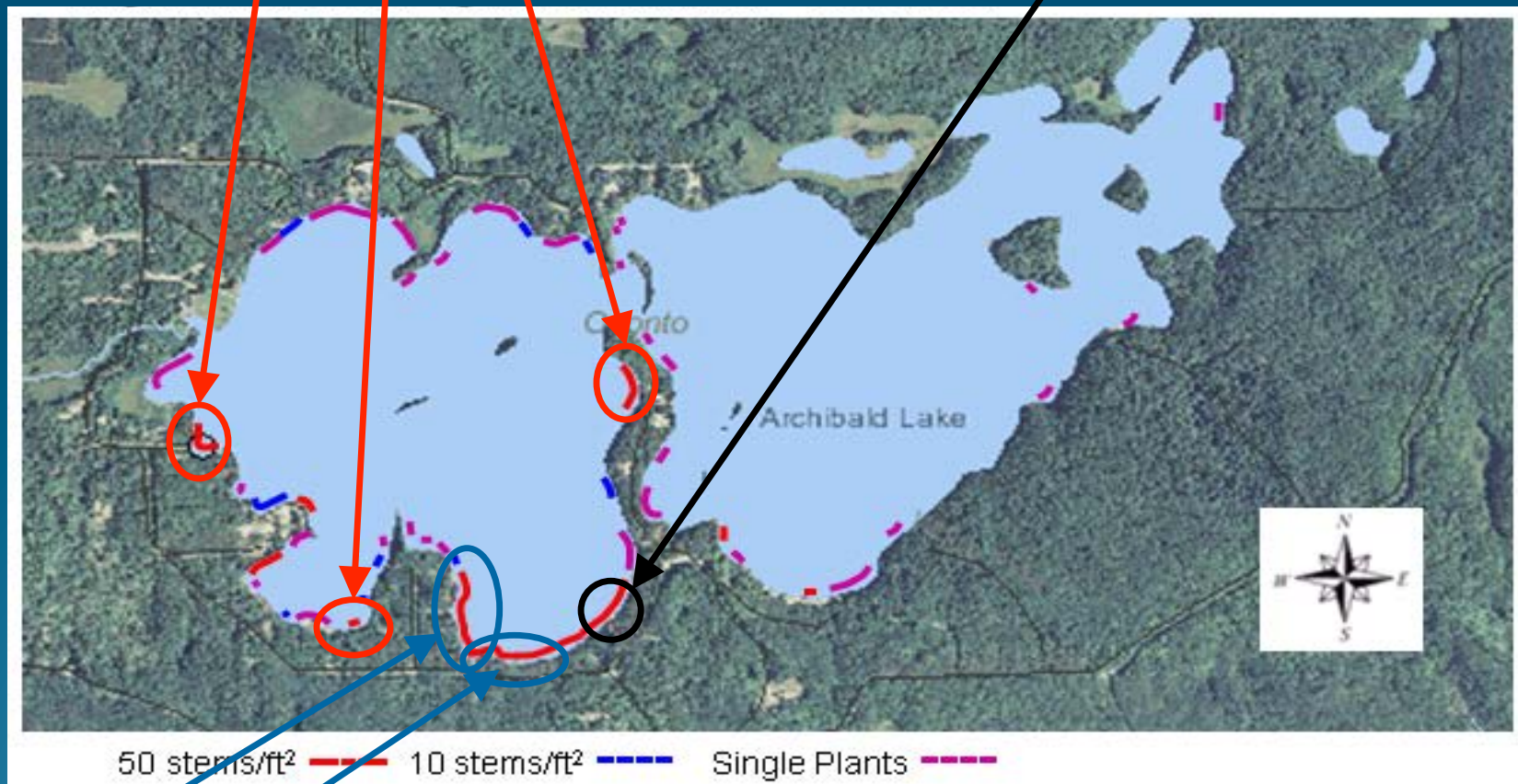
Next Steps

- Repeat larger Renovate Max G trial (starting earlier in spring)
- Start a trial with Diquat

2013 – Chemical Treatment Trials

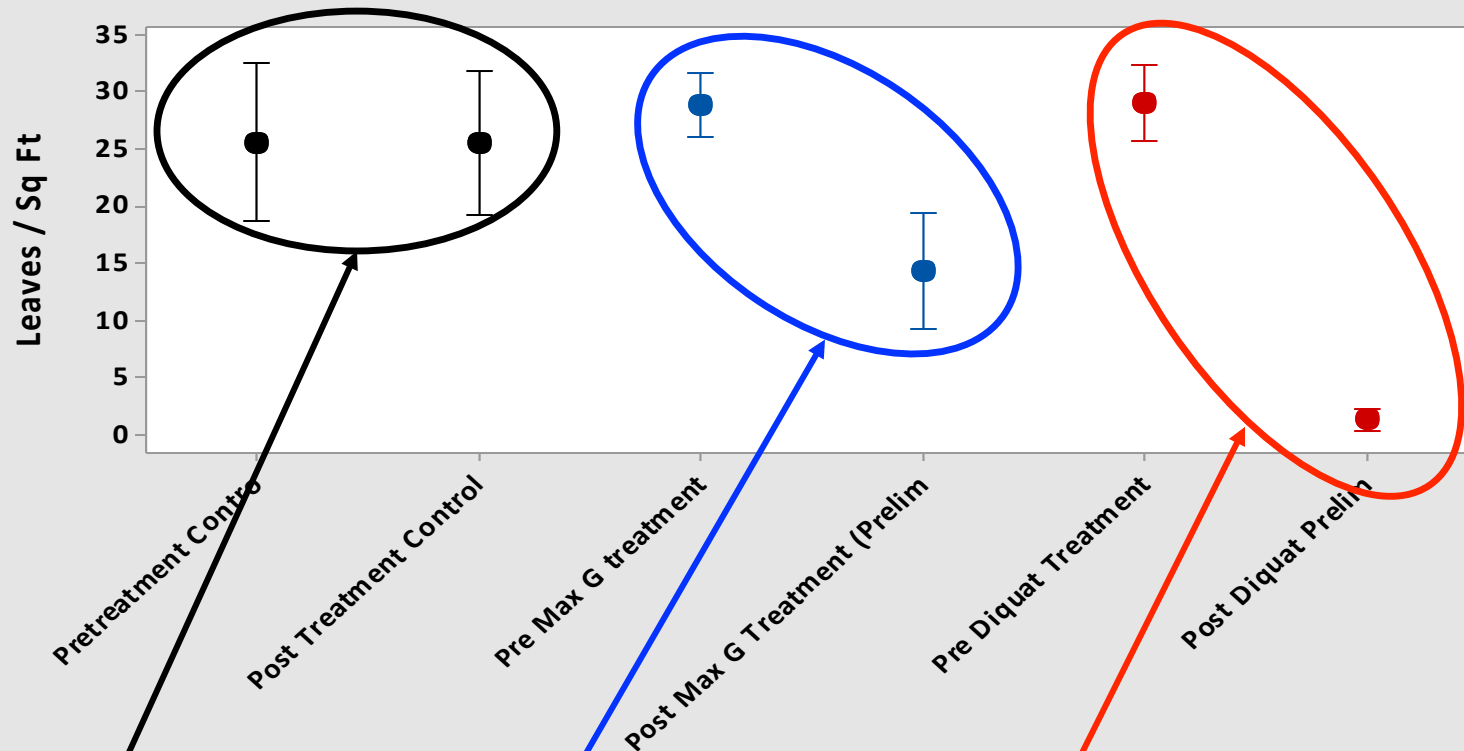
Renovate Max G (2.5 Acres)

Control



2013 –Preliminary (Same Year) Results

Interval Plot of Pretreatment, Post Treatme, Pre Max G tr, ...
95% CI for the Mean



Individual standard deviations were used to calculate the intervals.

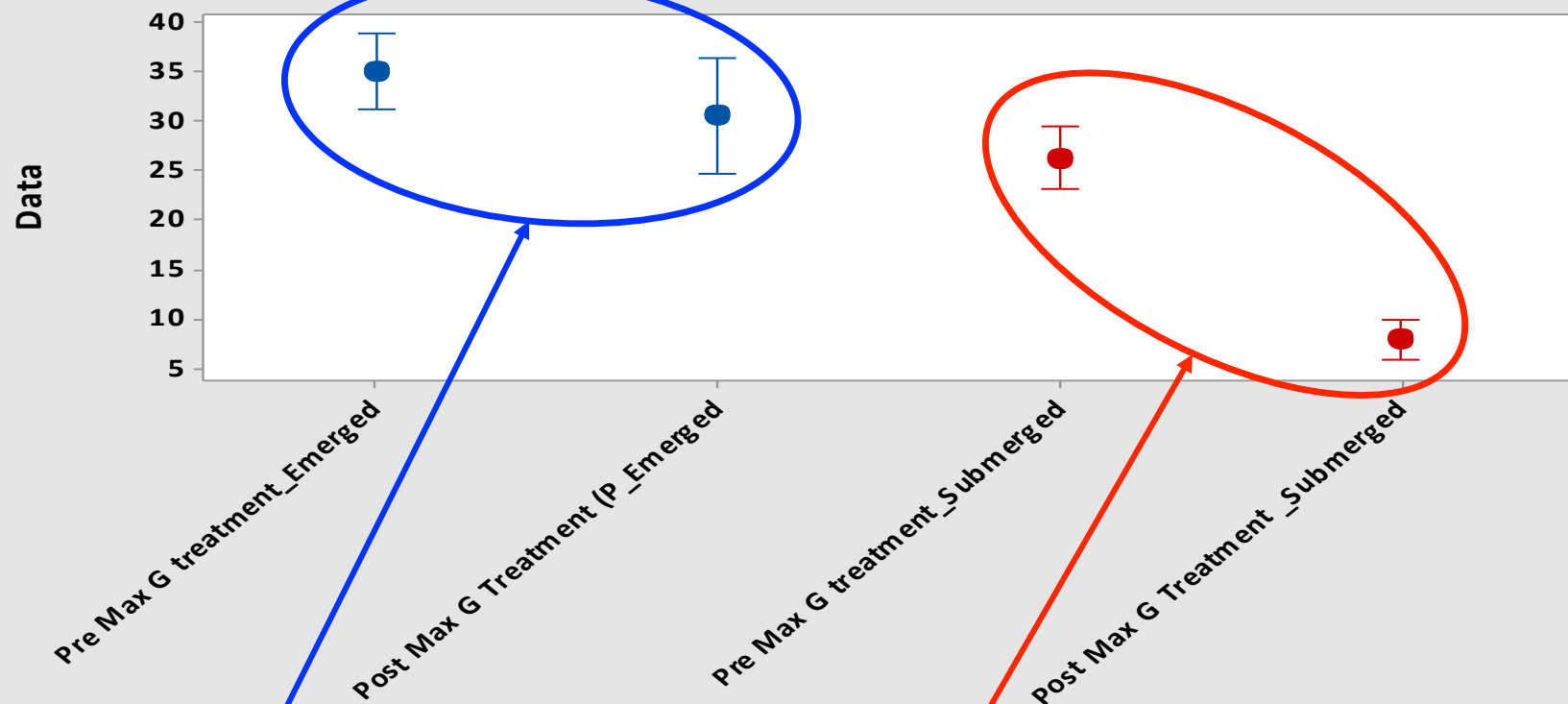
Control Area

Renovate Max G
(3.5 ppm)

Diquat
(0.7369 ppm)

2013 –Max G – Emergent vs. Submergent

Interval Plot of Pre Max G tr, Post Max G T, Pre Max G tr, ...
95% CI for the Mean



Individual standard deviations were used to calculate the intervals.

Renovate Max G Emergent

Renovate Max G Submergent (70%)

What We Learned (*Preliminary Data*)

- Renovate Max G significantly reduces submergent flowering rush
- Diquat – Has similar affect as Max G but also impacts emergent

Next Steps

- Gather complete data - spring of 2014
- Select another larger area for trials
- Assuming spring data collection is in line with preliminary data, repeat Diquat trials

Special Thanks To:

- ***Brenda Nordin / Wisconsin DNR for all their advice, help, and Grant Funding***
- ***Peter Rice, University of Montana, for his many hours of advice***
- ***Patrick Selter, PLM for his advice during the chemical treatment***
- ***John Skogerboe, Army Corps, for his advice and residual analysis***
- ***Mark Heilman, SePRO, his advice, residual analysis, and for some of the Renovate Max G***
- ***Tera Guetter, PRWD for her advice***

Thank you for your time
and attention!

Any Questions?

Backup Information - *Measurement Method*



Backup Information - 2011 Trials

Chemical Treatment

Three locations were chosen, one control area and two chemical trial locations. The two trial locations were over 1,000 feet apart. Plant densities were measured in all three areas before and after treatment.

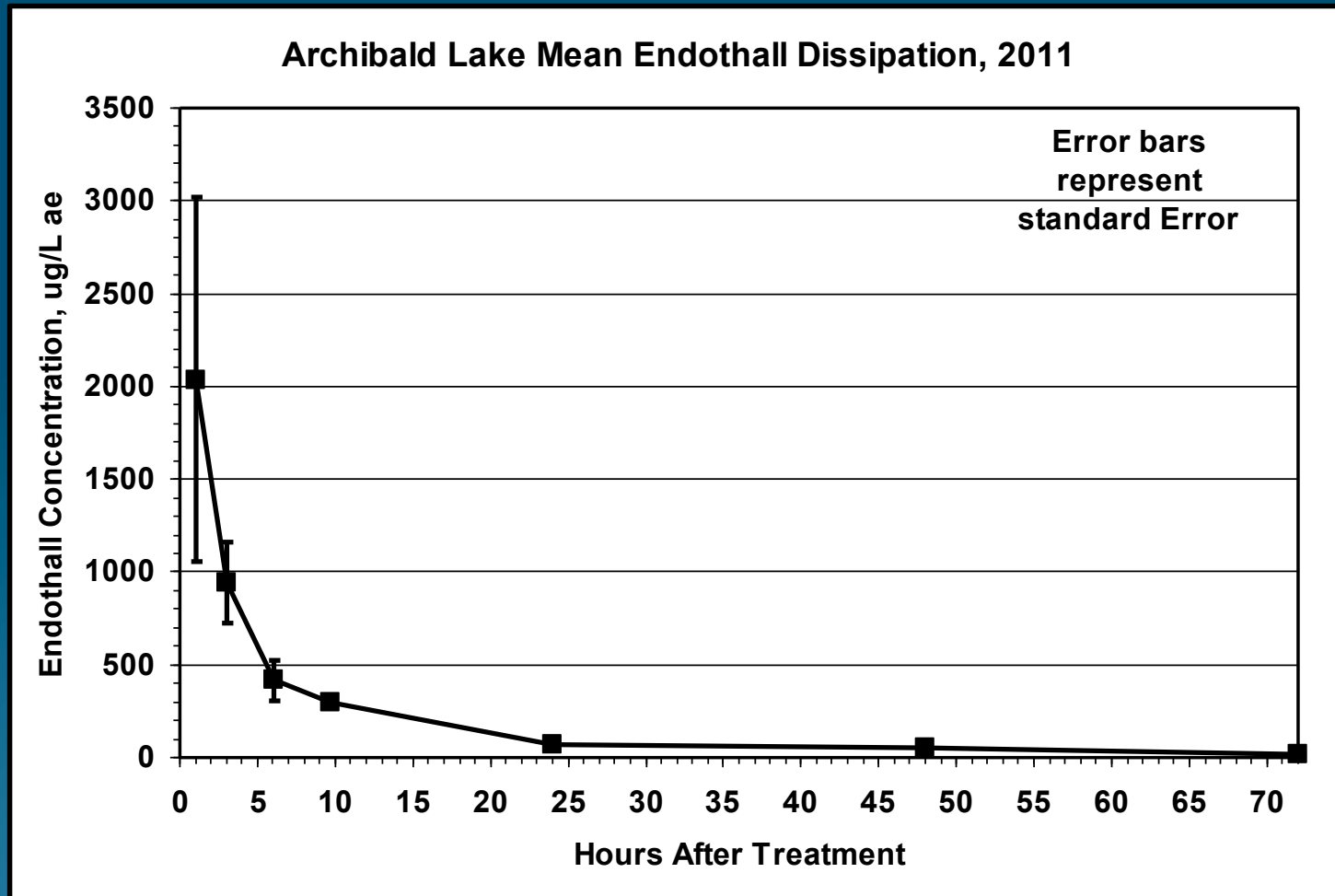
The “Before Treatment” plant densities were taken on 7/3/11 with the chemical application occurring on 7/11/11. Plant densities were measured by dropping a one foot square PVC pipe into the water and counting the number of leaves present inside the square.

Both areas were approximately 0.5 acre in size. 141 pounds of Renovate Max G was applied for a rate of 5 ppm and 33 pounds of Aquathol Super K was applied for a rate of 5 ppm.

Immediately following the treatment water samples were gathered per the instructions provided by Jon Skogerboe and Mark Heilman. The water samples were shipped and analyzed. The results can be found in the Appendix A of this document. Per Mark Heilman, “samples collected on the first day after application indicates that only about 10-15% of the theoretical dose was achieved. The strong decrease in herbicide concentrations to levels <10 ppb by 7/14 (3 days post application) indicates that exposures to effective doses of MAX G were sustained for 1 – 2 days at the most in this high exchange scenario for the treatment. Various research to date by Dr. Peter Rice and others would suggest that the period of exposure measured was insufficient to achieve optimal control of flowering rush.”

The “After Treatment” plant density data was taken on 9/8/12.

Backup Information - 2011 Endothall Dissipation



Backup Information - 2011 Renovate Max G

Archibald Lake Residual Analysis of Renovate Max G provided by Mark Heilman (SePRO)

Sample Site ID	Date Treated	Date Sample Collected	Sample Location	Products	Acres Treated	Rate	Active	Result
1	07/11/2011	07/11/2011		Renovate MAX G - Tri	0	0	Triclopyr	0.135 ppm
1	07/11/2011	07/11/2011		Renovate MAX G - 24D	0	0	2-4D	486.4 ppb
2	07/11/2011	07/11/2011		Renovate MAX G - Tri	0	0	Triclopyr	0.101 ppm
2	07/11/2011	07/11/2011		Renovate MAX G - 24D	0	0	2-4D	375.4 ppb
1	07/11/2011	07/14/2011		Renovate MAX G - Tri	0	0	Triclopyr	0.001 ppm
1	07/11/2011	07/14/2011		Renovate MAX G - 24D	0	0	2-4D	7.7 ppb
2	07/11/2011	07/14/2011		Renovate MAX G - Tri	0	0	Triclopyr	0.000 ppm
2	07/11/2011	07/14/2011		Renovate MAX G - 24D	0	0	2-4D	4.7 ppb
1	07/11/2011	07/18/2011		Renovate MAX G - Tri	0	0	Triclopyr	0.000 ppm
1	07/11/2011	07/18/2011		Renovate MAX G - 24D	0	0	2-4D	3.6 ppb
2	07/11/2011	07/18/2011		Renovate MAX G - Tri	0	0	Triclopyr	0.000 ppm
2	07/11/2011	07/18/2011		Renovate MAX G - 24D	0	0	2-4D	3.8 ppb

Backup Information - 2013 Application Record


Pesticide Application Record				
Aquatics and/or Commercial Aquatic Pest Control Application				
PLM Lake and Land Management Corp.				
<i>Preserving Our Precious Natural Resources</i>				

Applicator's Company Name			Applicator's Company Address		
PLM Lake and Land Management Corp			2509 Business Hwy 371		
Phone	Fax		City	State	Zip
(218) 568-5379	(866) 527-6399		Brainerd	MN	56401

Customer's Name			Customer's Address		
Archibald Lake Association			16570 Appleton Lane		
Phone	Fax		City	State	Zip
(262) 943-4228			Townsend	WI	54915

County Oconto	Lake Name or Other Archibald	DNR Permit No. NE-2013-43-701	Units Treated(acres): 3
Description of Application Site:			
Flowering Rush Treatment for the Season.			

Date Of Application 8/26/2013		Time of application Started: 10:00 AM Finished: 10:30 AM		Area Treated 3 Acres x
Avg Depth of Treatment Area 5 Foot		Water Temp 76.1		
Wind Direction Calm	Wind Speed Calm	Air Temp 78		
Target Pests Nuisance and exotic aquatic plants and/or algae				
Brand Name	EPA Reg No	Quantity	Dosage	
Tribune	100-1390	6	2 Gallon per Acre	
Cidekick II	Not Required	1	.33 Gallon per acre	

Applicator's Name	Applicator's Signature	Applicator's License Number
Patrick Selter		92580

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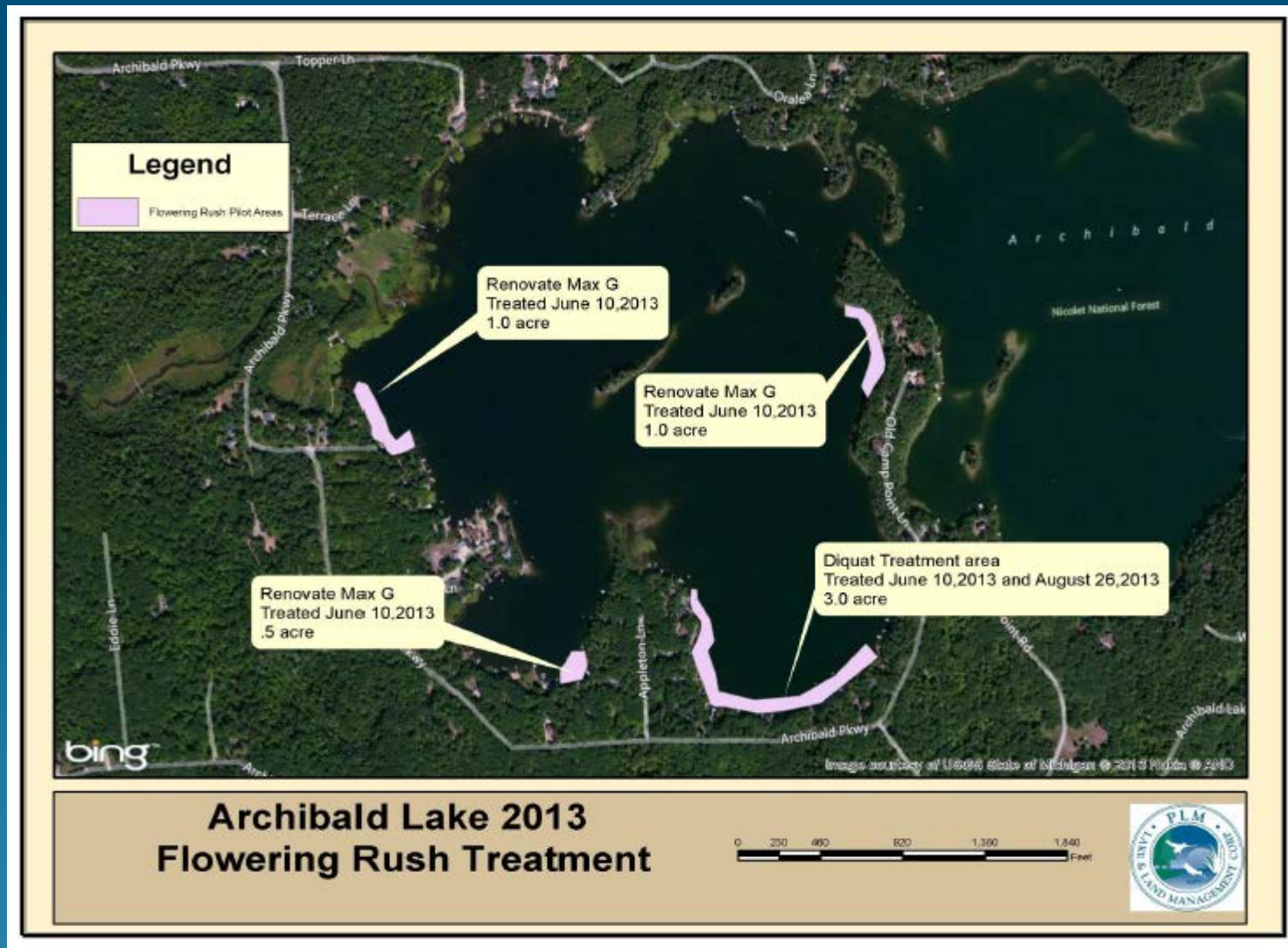
County	Lake Name or Other	DNR Permit No.	Units Treated(acres):
Oconto	Archibald	NE-2013-43-701	5.5
Description of Application Site:			
Flowering Rush Treatment for the Season.			

Date Of Application		Time of application		Area Treated 5.5 Acres x
6/10/2013		Started: 09:00 AM Finished: 11:50 AM		
Avg Depth of Treatment Area		Water Temp		
2.5 -5 Foot		63		
Wind Direction	Wind Speed	Air Temp		
W	3	58		
Target Pests Nuisance and exotic aquatic plants and/or algae				
Brand Name	EPA Reg No	Quantity	Dosage	
Renovate Max G	67690-50	620	248 Pound per Acre	
Tribune	100-1390	6	2 Gallon per Acre	

Applicator's Name	Applicator's Signature	Applicator's License Number
Patrick Selter		92580

Backup Information - 2013 Application Rate

The Rate of application for the Diquat was 2 gal/acre. The application rate on the max G based upon the average depth of 3.75 ft was 3.5 ppm (248 lbs per acre)



Backup Information - 2013 *Residual Analysis*

Data and Analysis provided by US Army Engineer Research and Development Center and WI DNR

Conclusions Provided by John Skogerboe:

- Exposure times in the Archibald Lake treatment were approximately 2 to 3.5 HAT. You could compare this data to the 2012 endothall data.
- The exposure times seen in Archibald Lake are typical for treatment areas of similar size and configuration regardless on herbicide formulation.
- Some re-treatment of a particular site may occur when herbicide or dye from other areas move through. I do not know how to use this information as a management tool.

The following pages includes the detailed data / analysis

Backup Information - 2013 *Residual Analysis*

Data and Analysis provided by US Army Engineer Research and Development Center and WI DNR

DRhodamine WT Dye and 2,4-D Monitoring Summary, 2013

5 February 2014

John Skogerboe

Archibald Lake has an area of 392 acres, maximum depth of 50 ft, and a mean depth of 19 ft. The lake is classified as seepage lake in WI DNR lake finder web page. On 10 June 2013, a number of areas were treated with granular formulation of 2,4-D + triclopyr and one area was treated with diquat to control flowering rush (*Butomus umbellatus*) (Figure 1). In addition rhodamine WT dye was added to the diquat treatments at a target concentration of 10 ppb to measure exposure times instead of direct analysis of diquat concentrations. Water temperature on the day of treatment was 66.3°F (19.1°C) as measured by data sondes deployed prior to initiating the treatment. Wind was reported to be 7 mph from the southeast in Antigo, WI by www.wunderground.com.

Water sample sites were established in two 2,4-D + triclopyr treatment areas R3 and R4 to quantify herbicide dissipation from the treatment areas (Figure 2). Three water sample sites (D1, D2 and C1) were established in the diquat treated area. An additional water sample site, R1, was located in an untreated area. Analysis of diquat in water samples is difficult, therefore Rhodamine WT fluorescent dye was added to the diquat treatments at a target concentration of 10 ppb to quantify the exposure time. The dye concentrations were measured using a Turner Designs Cyclops rhodamine WT sensor and DataBank logger. Two Hydrolab data sondes with rhodamine WT, temperature, dissolved oxygen, and conductivity sensors were deployed to sites D1 and D2, and set to collect readings of all parameters every 10 minutes

Water samples were collected from each sample site in 2,4-D + triclopyr treatment areas using an integrated water sample which collects water from most of the water column. Water samples were specified to be collected at intervals of approximately 1, 2, 3, 4, 5, and 6 hours after treatment (HAT). Samples were taken to shore after completion of each sample interval, and 3 drops of muriatic acid were added to each sample bottle to fix the herbicide and prevent degradation. Samples were then stored in a refrigerator, until shipped to the US Army Engineer Research and Development Center (ERDC) laboratory in Gainesville, FL for analysis.

raft: Archibald Lake, Oconto County,

Backup Information - 2013 *Residual Analysis*

Data and Analysis provided by US Army Engineer Research and Development Center and WI DNR

Exposure times of herbicides applied to diquat treatment area were known to be very short from previous monitoring studies, so dye readings began approximately 40 minutes after the treatment began. Additional water samples were collected as time permitted until the dye concentrations reached the background levels of fluorescence.

Herbicide sample analysis have not yet been received from the analytical laboratory.

Rhodamine WT dye concentrations measure in the diquat treated area ranged from 7.0 to 15.6 ppb at 0.67 to 0.78 HAT compared to the target concentration of 10 ppb (Figure 3). Dye concentrations were approximately equal to the background fluorescent level (1.0 ppb) by 3.37 to 3.5 HAT. Dye was not detected in the untreated area R1.

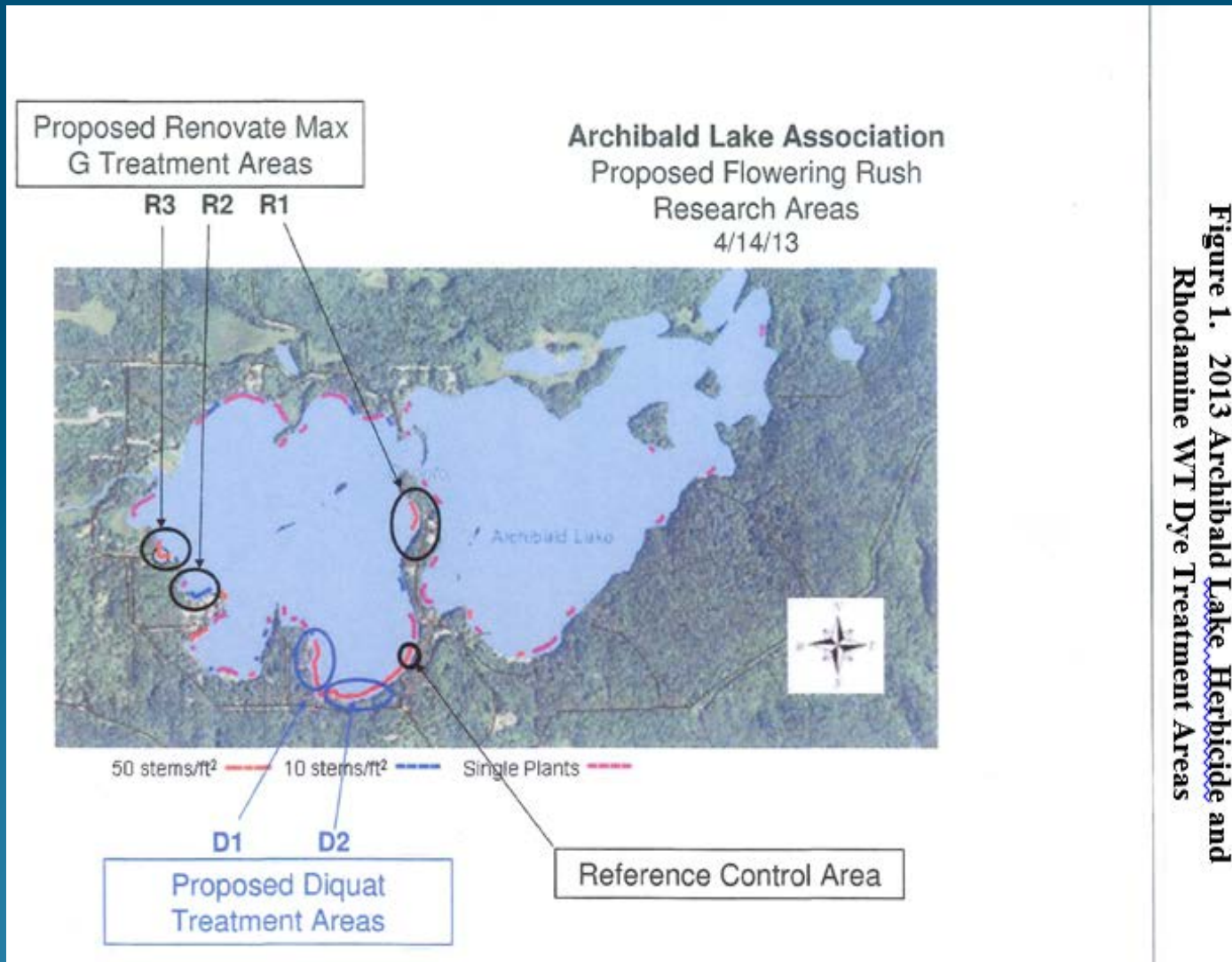
Rhodamine WT dye concentrations were also measured at sample sites D1 and D2, using the data sondes, which began collecting data approximately 50 minutes prior to initiating the

treatment. The peak dye concentrations ranged from 9.92 to 13.54 ppb at 0.25 to 1.08 HAT (Figure 4). Dye concentrations at site D2 were similar to background levels at 1.92 HAT. Dye concentrations at site D1 declined significantly at 2.08 HAT but then increased again and did not reach background levels until 4.75 HAT. A similar increase was observed at site D1 in data collected using the Cyclops and DataBank. Similar observations have been made in other lakes with similar types of dye treatments. Herbicide and or dye applied to other areas may move through the monitored area resulting in a second treatment or double peak in the concentration data. Dye concentration data collected using the data sondes indicated that concentrations can decline dramatically in minutes, indicating that water containing dye and herbicide move as a block called plug flow.

The rhodamine WT dye concentrations demonstrate that dye and herbicide is rapidly dissipated from target areas in Archibald Lake. Exposure times can be expected to range from 2 to 3.5 HAT. Similar exposure times have been seen in numerous other lakes monitored in WI with similar size and configured treatment areas using **both liquid and granular**

Backup Information - 2013 *Residual Analysis*

Data and Analysis provided by US Army Engineer Research and Development Center and WI DNR



Backup Information - 2013 *Residual Analysis*

Data and Analysis provided by US Army Engineer Research and Development Center and WI DNR

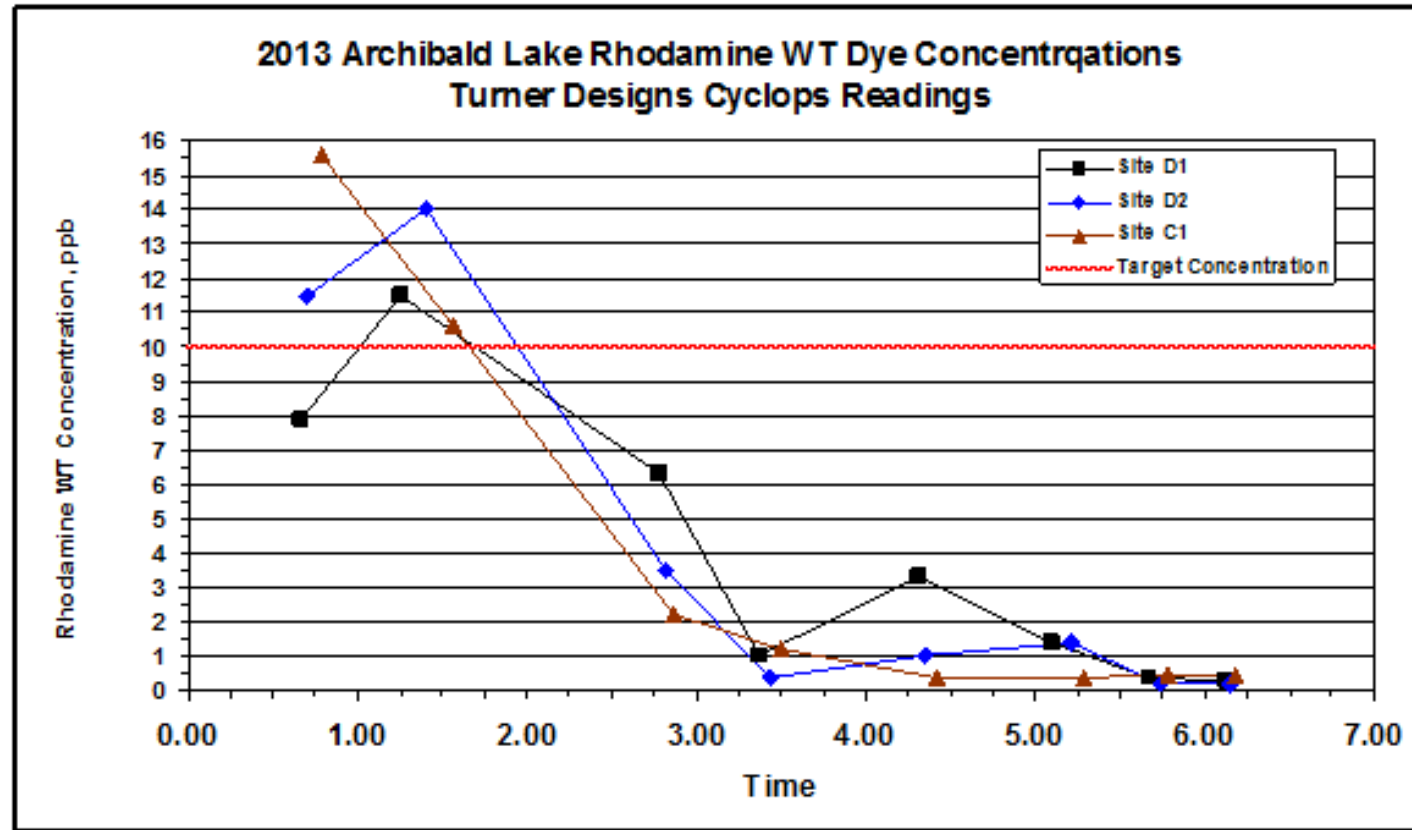
Figure 2. 2013 Archibald Lake Herbicide and Rhodamine WT Dye Treatment Areas Sample Sites



Backup Information - 2013 *Residual Analysis*

Data and Analysis provided by US Army Engineer Research and Development Center and WI DNR

Figure 3



Backup Information - 2013 *Residual Analysis*

Data and Analysis provided by US Army Engineer Research and Development Center and WI DNR

Figure 4

