Draft Fact Sheet: Guidance for Implementing Small Scale Spot Treatments and Design of Herbicide Concentration Monitoring Plans

Objective: Provide guidance on the design of herbicide concentration monitoring plans for small scale spot aquatic herbicide treatments. A small scale spot treatment (SSST) is defined in this document as any aquatic herbicide application or combination of herbicide applications in which the lake wide concentration assuming complete dissipation throughout the water body is insufficient to impact target and non-target aquatic plant species throughout the lake. Lake stratification depth must be considered in determining the theoretical lake wide concentration.

Background: Herbicide exposure time is as critical a consideration as application rates for evaluating potential impacts of a SSST. Herbicide concentration data collected by WI Department of Natural Resources (DNR) and the US Army Corps of Engineers (ACE) have shown that exposure times my vary from minutes after treatment (MAT) to hours after treatment (HAT) or days after treatment (DAT). Factors that affect exposure time include:

- Size of treatment area
- Configuration of treatment area
- Water flow through
- Wind, velocity and direction
- Proximity of other treatment areas

Larger treatment areas generally result in longer exposure times. United Phosphorous Inc (UPI, the manufacturer of endothall) guidance states that the size of the treatment area for endothall (Aquathol K) treatments should be > 5 acres for effective control. The auxin herbicides, 2,4-D and triclopyr have a different mode of action than endothall but have similar application rates, degradation rates, and minimum exposure time requirements (12 to 24 hrs at maximum label rates). Diquat may require shorter exposure times to be effective (~3 hrs). Very small SSST (< 5 acres) frequently have exposure times ranging from < 1 HAT to 3 or 4 HAT. Larger treatment areas (5 to 10 acres) may vary from 3 HAT to 24 HAT, and other factors listed above become more important. Treatment areas greater than 10 acres are uncommon because they frequently dissipate into whole lake or whole basin treatments.

Configuration of treatment areas can be divided into open water, shoreline, and wind protected bays. Open water sites are exposed to wind from all directions where wind direction may not significantly impact exposure times. Shoreline treatments have land on one or two sides of the treatment area that may affect the impacts of wind direction. Wind protected bays are surround by land on two or three sides which reduce the impact of wind velocity and direction on herbicide movement and exposure time.

Water flow through a lake will impact exposure times within a treatment area as well as direction of herbicide movement and impacts to non-target areas. Flowages and some drainage lakes are most impacted by flow. Inflow and out flow points in the lake are the most impacted by water flow, while areas in the main body of the lake may be more impacted by wind.

Wind velocity and direction greatly affect exposure time within a treatment area and exposure to non-target areas. Some herbicide labels specify that treatment should not occur when wind velocity is

greater than 10 or 15 mph. Dye studies conducted in WI indicate that wind velocities greater than 5 mph significantly increase dissipation. Dye studies also indicate that exposure times in treatments conducted on the windward side of a shoreline may have longer exposure times than treatments conducted on the leeward (protected side) of the shoreline. The land on the windward side acts as a blocking force preventing the herbicide from moving down wind. Some data indicate that exposure time, in SSSTs greater than 5 acres, may increase from 2-6 HAT to as much as 12 HAT depending on wind direction.

Often, multiple SSST are conducted simultaneously (in one day) in a lake. Multiple treatment areas are likely to impact exposure time in other treatment areas by dissipating into each other in as little as 3 to 4 HAT after treatments are initiated. The source of herbicide in a specific treatment area can no longer be determined after 4 to 6 HAT based on herbicide analysis.

Guidance for conducting SSST:

Treat blocks > 5 acres. Bigger the better. Squarer is better. Amoeba shaped target areas are bad.
Treat when winds $\leq$ 5 mph
Treat the windward sides of shore lines
Treat before 7 am to maximize time in low wind conditions
Treat with diquat or endothall + diquat in treatments < 10 acres
Treat in early spring or fall ($\leq$ Oct) to maximize selectivity
Use application equipment that maximizes mixing in the water column.

Herbicide Concentration Monitoring Sample Plans:

Herbicide concentration monitoring can provide valuable information on concentration, exposure times in operational treatments to better evaluate success and failure of these management approaches. Future herbicide treatments can be refined with respect to application rates and herbicide selection to provide more cost, effective, selective herbicide treatments to achieve management goals. Diquat may be the recommended herbicide particularly for treatment areas < 5 acres, and analysis is not currently available through State Laboratory of Hygiene (SLOH). Herbicide concentration monitoring therefore is not currently possible when this herbicide is used. Based on previous studies exposure times of 1 to 4 HAT should be assumed for treatment areas < 5 acres.

Approach: An herbicide concentration monitoring plan should include the following information:

- Lake background information
- Sampling site locations
- Sampling intervals
- Instructions for sample collection, sample storage, and shipping
- A copy of the State Laboratory of Hygiene (SLOH) sample data sheet specific to the lake to be sampled
- Contact person(s) coordinating the sampling

Lake Background Information: The following background information for the lake should be included:

- Lake name, county, and WBIC number
- Lake dimensions, area, mean depth, maximum depth, lake volume, and bathymetry if available
- Lake trophic status and lake type, for example eutrophic seepage lake
- Target species: Eurasian watermilfoil, hybrid milfoil, curly-leaf pondweed
- Date and results of DNA testing

Sample site locations:

- One to three sampling sites should be sufficient to characterize herbicide concentration~~s~~, exposure times in most SSST. One sampling site would likely be sufficient in very small treatment areas < 5 acres. Three sampling sites may be required for larger treatment areas 5 to 10 acres and in protected bay sites. Samples should be collected using an integrated sampling device, which can collect water from 0 to 6-10 feet deep. If sensitive non target areas such as wild rice beds and out flow points are a concern, then addition sampling sites should be located in the non-target areas.
- Sample locations should be located precisely on a map using some type of GIS system, and the numerical coordinates should be provided in decimal degrees for use in a GPS.
- Stratification of the lake will likely not be a concern unless the possibility of a whole lake or whole basin treatment exists.

Sample Intervals: Sample dates or intervals should be specified in the sample plan. Some tolerance for change should be allowed for hazardous weather conditions, and unique lake conditions. Sample

intervals are specified in hours after treatment (HAT) and will vary depending on treatment area and configuration. Sample intervals should include:

- Open water and shoreline treatments < 5 acres: 1, 2, 3, 4, and 6 HAT
- Open water and shoreline treatments 5 to 10 acres: 1, 3, 6, 8, 10, and 24 HAT
- Protected bay treatments: 1, 3, 6, 9, 12, 24, 36, 48, 72, 120, and 168 HAT

Instructions for sample collection, sample storage, and shipping:

- Instructions for operating the sampling device should be included. For example, the integrated sampling device is lowered straight down in the water column to 1 ft above the sediment surface. The device is then raised to the surface and emptied into a bucket. A sample bottle is then dipped into the bucket until the bottle is full. Upon return to the shore, an acid is added to each sample bottle according to specific instructions supplied by the SLOH in the sampling kit they provide. The samples are then stored in a refrigerator or freezer until shipped.
- The SLOH will provide a sampling kit which will include bottles, labels, label pens, acid, pipettes, instructions, a shipping cooler, and sample handling instructions.

SLOH Sample Data Sheet: The SLOH will provide an example data sheet for use when collecting water samples. **It is important to use a separate data sheet for each day that you monitor.**

The WI DNR will need to provide the following information for the sample data sheet which can be reprinted by the sampling volunteer for each sample interval (Figure 4):

- Account number
- DNR user number
- Sample matrix (herbicide)
- Project
- WBIC
- Test Request
- Sample site number
- Station ID
- Sample Depth

The sampling volunteers will need to provide the following on a new data sheet for each sample interval:

- Sampling Date
- Sampling Time
- Water Temperature: If water temperature is measured in F, then it should be converted to C using the table included on the data sheet. We suggest printing out the conversion table and bringing it in the field if your thermometer only reads in Fahrenheit.
- Wind Direction and Speed

Figure 4. Example of a State Lab of Hygiene Sample Data Sheet (Wolf Lake)

Wolf Lake, Fond du Lac County, Herbicide Sampling Data Sheets, 2016

Account number:		**Sample Matrix:**	Surface Water (SU)
DNR User ID:		**Project:**	HerbicideMonitoring
WBIC:	**60800**	**Collector Name:**	
		Phone Number:	
Test Requested:	**2,4-D herbicide**		
Sample Interval:			

Site	Station ID	Sample Depth	Date	Time (24:00)	Water Temp in C	Wind Direction and Speed
WO1-10	10041934	Integrated, 0-10 ft				
WO1-20	10041934	20 ft				
WO1-30	10041934	30 ft				
WO2	10041935	Integrated				
WO3	10041936	Integrated				
WO4	10041937	Integrated				

Convert Fahrenheit to Celsius

$T(°C) = (T(°F) - 32) \times 5/9$

Degree F	Degree C	Degree F	Degree C	Degree F	Degree C	Degree F	Degree C
50	10.0	60	15.6	70	21.1	80	26.7
51	10.6	61	16.1	71	21.7	81	27.2
52	11.1	62	16.7	72	22.2	82	27.8
53	11.7	63	17.2	73	22.8	83	28.3
54	12.2	64	17.8	74	23.3	84	28.9
55	12.8	65	18.3	75	23.9	85	29.4
56	13.3	66	18.9	76	24.4		
57	13.9	67	19.4	77	25.0		
58	14.4	68	20.0	78	25.6		
59	15.0	69	20.6	79	26.1		