

Timed-Meander Sampling Protocol for Wetland Floristic Quality Assessment

Wisconsin Department of Natural Resources

INTRODUCTION

This standard operating procedure (SOP) describes the methods used by the Wisconsin Department of Natural Resources to conduct timed-meander surveys of wetland plant communities to determine wetland plant community condition. This SOP should be used in conjunction with the Floristic Quality Assessment Methodology for Wisconsin (Bernthal 2003). This SOP is based on and modified from procedures first developed and employed by the Lake Superior Research Institute (LSRI) (LSRI 2013). Possible uses for this protocol include Natural Heritage Inventory (NHI) surveys of State Natural Area wetland plant communities, FQA Benchmark Project surveys, water quality standards compliance surveys, wetland restoration site monitoring and wetland assessments for regulatory purposes.

DESCRIPTION

In this method, wetland types are first identified using aerial photographs and/or site investigations of the potential wetland(s) to be sampled. Assessment Areas (AAs) composed of relatively homogenous vegetation, are defined prior to sampling but can be modified after the survey based upon the conditions and features encountered during the survey. Natural communities, as defined by the NHI natural community classification, serve as the foundational unit of sampling (Table 1). When multiple types are present at a site, multiple AAs must be defined. Assign a wetland AA to the natural plant community type that it most closely resembles. If the AA's plant assemblage does not match any Natural Heritage Inventory community, record the National Vegetation Classification (NVC) type, which includes ruderal/weed communities or describe the dominant vegetation type (e.g., herbaceous, shrub, forested).

Timed-meander start locations should begin far enough from the edge of a community type or from an anthropogenic disturbance (i.e., roadway, residential development, etc.) to avoid including transition zones from other plant communities in the survey. However, if the assessment area is surrounded by roadways, residential development, or other anthropogenic disturbance the timed-meander start location may be located at the edge of the disturbance. The survey consists of a search for all plant species present within a pre- or post- defined AA and an estimate of abundance and percent areal cover for each species at the end of the search period. The search takes place during timed intervals documented by the time keeper. The timer is paused when surveyors need to divert their attention from the search for any reason, such as conferring on an identification, documenting a rare species, or investigating an area with a plant composition different from the target community. The total time spent searching is an indication of search effort. All plant species are recorded when first observed and search intervals are documented on the Data Sheet. After all search intervals are complete, abundance and percent areal cover over the entire AA is estimated for each plant species, and notes on disturbance and other observations are documented.

The AAs must have homogeneous representation of wetland plants associated with each wetland community type. We recommend a minimum AA of 0.25 acres and a maximum 10 acres. If the wetland area to be surveyed is greater than 10 acres, it can be divided into several AAs. If a different wetland community type is encountered during a timed-meander

Timed Meander Sampling Protocol for Wetland FQA

survey of a given targeted community type, the timer is paused and the size of the new plant community is evaluated. If the new type is greater than 900 m² (30m x 30m) (9688 ft², 98ft x 98ft or approximately 0.09 hectare (0.25 acre), then the area is excluded from the AA and the search remains paused until the surveyors return to the targeted plant community. If necessary, the new community would need to be evaluated by a separate survey. If the new type is less than 900 m² in size, the search is resumed and the small pocket can be treated as an inclusion within the primary wetland type.

Invasive plant species and anthropogenic disturbances should be observed during the walk to and from the AA, and noted in comments on the Timed-Meander Survey Data Sheet. Additional condition assessment tools may also be used to evaluate the wetland's health. For regulatory decisions, the Condition Assessment in Section 3 of the Wisconsin Rapid Wetland Assessment Methodology version 2 (Trochlell 2014) should be used. A Disturbance Factor Checklist is used for rating disturbance levels for the FQA Benchmark Project surveys. For future wetland condition surveys the Disturbance Factors Checklist or a modification of it will be used to assess stressors that may be causing an impairment to the wetland.

DEFINITIONS

Assessment Area (AA): Discrete, homogenous area of a target plant community that is to be thoroughly sampled during the timed meander survey. Large wetlands/wetland complexes may contain multiple wetland assessment areas.

EO - Element Occurrence: In the Natural Heritage Inventory, a population of a species or an example of a natural community or natural feature naturally occurring at a specific, ecologically appropriate location.

Search: Locating, identifying and documenting plant species presence, while mentally noting percent cover. Previously un-documented plant species are continuously added until the search interval is paused or ends.

Search Interval: A pre-defined time interval, maintained by the time keeper. The search time may be paused whenever the active search for additional species stops for various reasons, including taking time to work out difficult identifications, documenting rare species, adjusting the Assessment Area or other reasons.

Timed Meander Sampling Protocol for Wetland FQA

PROCEDURE

1. Upon arrival at the site, the survey team of two or more people must completely fill out the top portion of the WDNR Timed-Meander Survey Data Sheet (Data Sheet) in Attachment 1 or other form for the Assessment Area (AA) to be surveyed. Use the Natural Heritage Inventory (NHI) Natural Community Descriptions to determine the appropriate plant community classification for the AA to be surveyed. If the survey involves an existing NHI Element Occurrence note the EO code. If the plant assemblage does not appear to match a natural community, note the dominant vegetation type from Table 1.
2. Start locations on the AA must begin at a point clearly within the target community type, away from transitional areas or anthropogenic disturbance (i.e., roadway, residential development, logging, ditching, etc.). The exception to this is that if an AA is immediately adjacent to an anthropogenic disturbance, then the start location may be located near the edge of this disturbance.
3. Travel to the AA start location and record any disturbance (e.g., invasive plants, logging, ditches) encountered while traveling to the survey start-up point in the notes section of the Data Sheet. This can also be completed at the end of the survey after the entire AA has been surveyed.
4. Take a waypoint at the survey start point using a handheld GPS unit. Record the starting point on the Data Sheet in decimal degrees. Indicate whether the GPS is set to a tracking function. This will create a record of survey locations over the course of the search. It is strongly recommended that either a GPS track be taken or an observed survey area be mapped out shortly after the survey in ArcGIS and saved as a shapefile or Geodatabase to create a location record.
5. Designate a lead observer and a data recorder for each survey; the observer will conduct the taxonomic identification and the recorder will complete the survey Data Sheet and operate the timer.
6. Record the start time (24 hour clock) on the Data Sheet and set the countdown timer on the watch for 5 minutes. Start the stop watch and begin timing the first, 5-minute interval of the timed-meander survey. Standing at the start point, record all plants (ideally to species) that can be seen from the four cardinal directions before moving forward in search of new species. Upon reaching the end of a 5 minute interval, the timekeeper should instruct other observer(s) to stop searching until the next time interval begins.
7. Record plants using the full species name or the Wisconsin State Herbarium taxon code. Because there are numerous and often conflicting resources for accepted plant names (USDA Plants, Flora of North America, various state herbaria lists etc.), it is important to limit confusion caused by using multiple names for the same species. Therefore, this protocol follows the Wisconsin State Herbarium's list of vascular flora, which has recently been updated to reflect the most recent taxonomic information and is available online. The State Herbarium nomenclature should be used for conducting plant surveys in Wisconsin.

Timed Meander Sampling Protocol for Wetland FQA

8. Record on the Data Sheet and collect all unknown, uncertain, and/or difficult-to-identify plant species, which will later be keyed or identified by experts (or eliminated from the analysis if identification is not possible).
9. Advance the search from the start point once the initial plants from the area surrounding the start point are recorded. Proceed walking through the site, taking care to identify all species encountered and making sure to investigate all vegetation layers. The search must always stay within the targeted plant community type for the duration of the survey, with one exception:
 - a. If a different plant community type is encountered during the search, stop the watch to pause the elapsed time and evaluate the size of the community. If the new community type is less than 900 m² (30m x 30m or 0.09 hectares, 9688 ft² (98 ft x 98 ft) or 0.25 acres) the timed meander survey can continue through that community type.
 - b. If the new community type is greater than 900 m², pause the survey until the surveyors have returned to the target plant community.
10. After each 5 minute time interval, the recorder should note on the Data Sheet the time interval in which those plant species were observed (i.e. 0-5 minutes, 5-10 minutes, 10-15 minutes, etc.). At the end of each time interval the observers may wish to briefly confer over any unknown species before resuming the next time interval. This reduces the number of unknown species for later office determination.
11. If an interruption of the process is necessary (e.g., intensive consulting with field guides and conferring with other surveyors over a difficult identification, bathroom breaks, difficult terrain, or vegetation encountered), stop the timer to pause the interval, eliminating these interruptions from the elapsed search time.
12. Pause the search if a rare, threatened, and/or endangered species is observed. Record the plant species on the Data Sheet, the location of the plant using the handheld GPS, take a digital photo of the species, and note associated species and other relevant information needed for the NHI Rare Plant Form. Collect a specimen if authorized and warranted. Resume the stop watch after all field recording is noted. Detailed notes about species may be added to the Notes section of the Data Sheet. Refer to the species number in the note. Notes on hydrology, animals, structure, invasive species, and anthropogenic disturbances may be added during this time.
13. Typically a minimum of 30 minutes of total search time is needed to thoroughly search an AA. Stop the search when:
 - a. A pre-defined area has been completely searched. For some uses of this SOP a search of an entire pre-defined area may be required, regardless of the time it takes, even if no new species are observed in a search interval, OR
 - b. After 30 minutes of search time, one or no new species is found during the most recent 5 minute interval, OR
 - c. After 30 minutes of search time, the number of species observed in the most recent 5 minute interval is less than 5% of the running total of recorded species (including unknowns). For example, if, after the 10th five-minute interval (50

Timed Meander Sampling Protocol for Wetland FQA

minutes of elapsed search time), 100 species have been observed, and 4 or fewer species were observed in the 10th 5-minute interval, the survey should be ended. The justification for ending is that the survey has reached the point of diminishing returns and has likely captured 90-95% of the species richness, and has likely captured 100% of the dominant and common species.

- d. The search may end earlier than 30 minutes only if the entire AA has been thoroughly searched and no new species were found in the final interval.
 - e. Record the total search time in minutes on the Data Sheet.
14. After the last search interval is completed take an end point using a handheld GPS unit. Record the end point on the Data Sheet in decimal degrees.
 15. Once the species list is complete assign each species a percent cover based on an ocular estimate of the percent of the AA covered by the canopy of that species (see Figures 1 and 2). Estimate to the nearest whole number. For species that cover 1% or less, use 1.
 16. For each species, it is optional to assign an abundance code based upon the class categories listed in Table 2 below. Abundance estimates give a qualitative estimate of relative frequency and distribution and can be used to make comparisons with historically gathered site data. They also provide valuable data to compare species with small areal percent cover.
 17. Record other data on the Data Sheet, including soil texture and pH on side 1, if taken. Additional animal species and other observations may be recorded in the Notes section at the bottom of the Data Sheet.

EQUIPMENT LIST

- ◆ Clipboard
- ◆ Compass
- ◆ Digital Camera
- ◆ Field Guides
- ◆ GPS Unit
- ◆ Digital watch with countdown timer
- ◆ Hand Lens (10X objective)
- ◆ Maps
- ◆ Markers
- ◆ Pencils (and sharpener/extra lead)
- ◆ Plant Collection Bags (i.e., Ziploc® Big Bags)
- ◆ Weather-Proof Datasheets

REFERENCES

Bernthal, Thomas W. 2003. Development of a Floristic Quality Assessment Methodology for Wisconsin.

Eggers, S.D. and D.M. Reed. 2015. Wetland Plants and Plant Communities of Minnesota and Wisconsin, Version 3.2. US. Army Corps of Engineers, S. Paul District, St. Paul, MN.

Lake Superior Research Institute (LSRI). 2013. Timed-meander Sampling Protocol for Forested and Non-forested Wetland Floristic Quality Assessment. University of Wisconsin-Superior. Superior, WI.

Trochlell, Patricia A. 2014. Wisconsin Rapid Wetland Assessment Methodology, version 2.

USNVC [United States National Vegetation Classification]. 2016. United States National Vegetation Classification Database, V 2.0. Federal Geographic Data Committee, Vegetation Subcommittee, Washington DC. [usnvc.org] (accessed April 2017)

Figure 1: Comparison chart for visual percentage estimation. NPS US Dept. of the Interior, Damage Assessment Handbook, 2002.

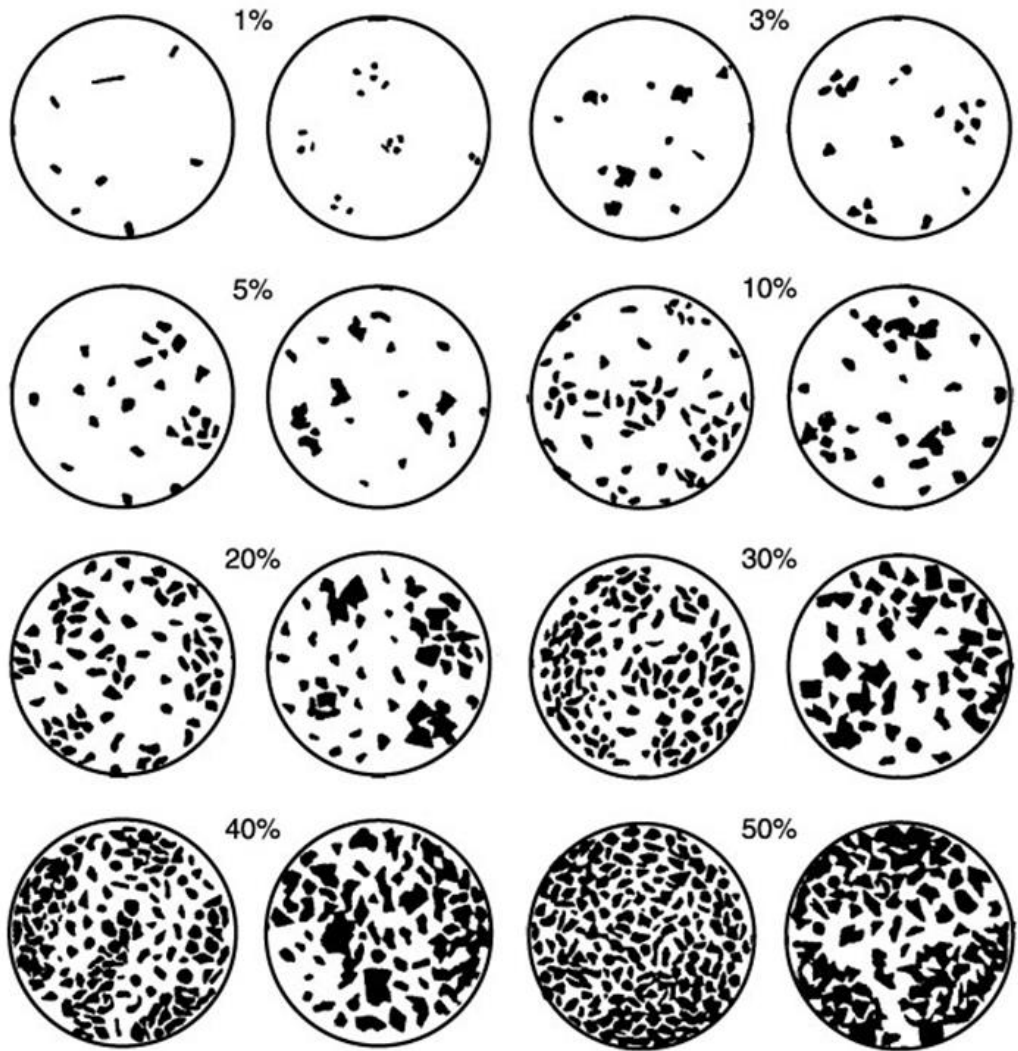


Figure 2: Cover estimates for timed-meander method. LSRI 2013.

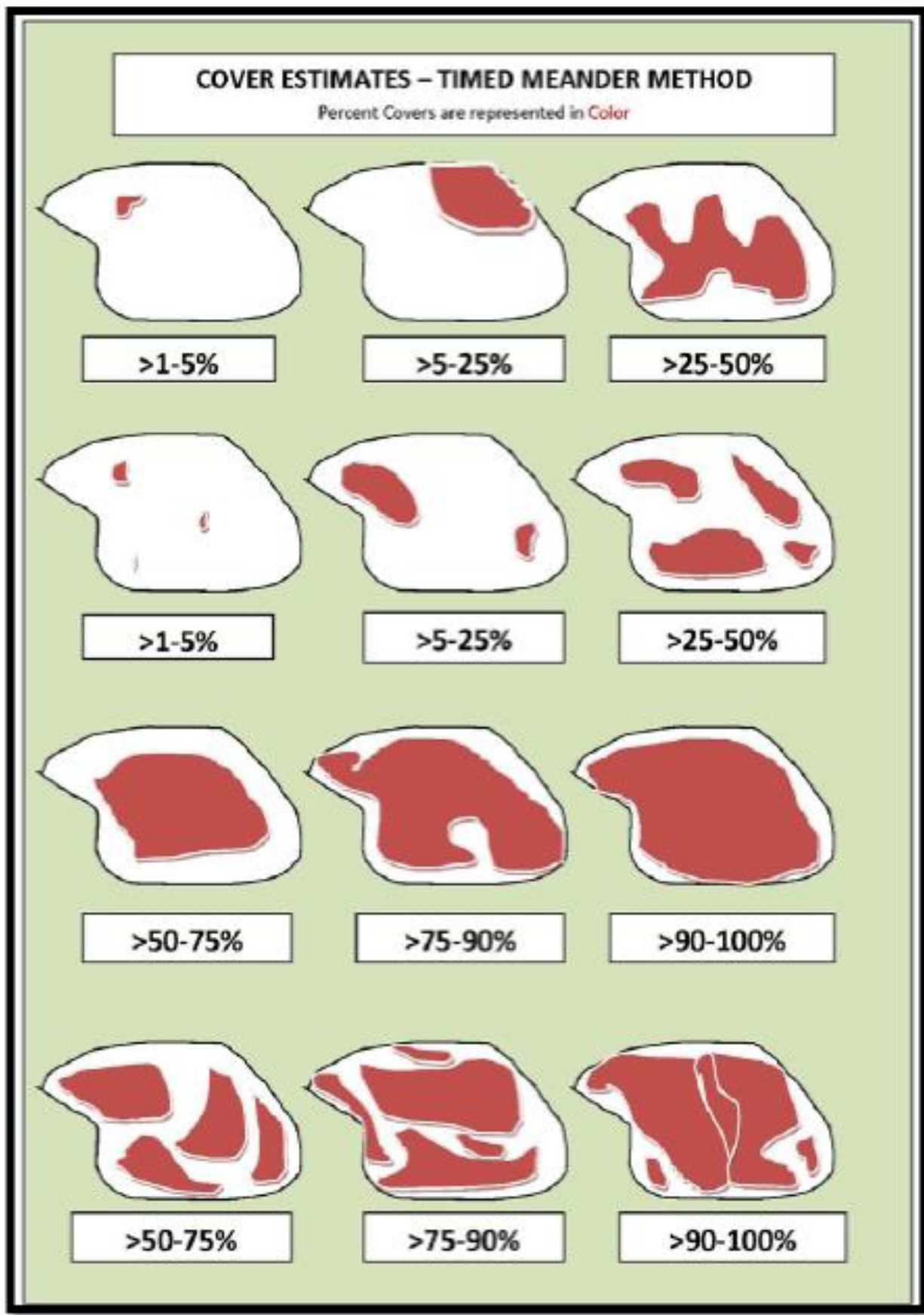


Table 1: Examples of Wetland NHI Natural Communities and Crosswalk to Eggers and Reed (2015) and National Vegetation Classification (USNVC 2.0).¹ (Bolded NHI Communities have FQI benchmarks in development in at least one ecoregion of Wisconsin)

NHI Natural community	Eggers and Reed (2015)	National Vegetation Classification	NVC CODE
Submergent Marsh	Shallow, Open Water Communities	Pondweed Northern Great Lakes Shore Herbaceous Vegetation	CEGL005273
Floating Leaved Marsh		Midwest Pondweed Submerged Aquatic Wetland	CEGL002282
		Southern Great Lakes Submergent Marsh	CEGL005152
		Water-lily Aquatic Wetland	CEGL002386
		Northern Water-lily Aquatic Wetland	CEGL002562
		American Lotus Aquatic Wetland	CEGL004323
Emergent Marsh	Deep and Shallow Water Marsh	Arrowhead - Rice Cutgrass Marsh	CEGL005240
		Northern Great Lakes Shore Emergent Marsh	CEGL005274
		Southern Great Lakes Shore Emergent Marsh	CEGL005112
		Midwestern River Bulrush Marsh	CEGL002221
		Bulrush - Cattail - Bur-reed Shallow Marsh	CEGL002026
		Midwest Mixed Emergent Deep Marsh	CEGL002229
		Midwest Cattail Deep Marsh	CEGL002233
		Wild Rice Marsh	CEGL002382
Northern Sedge Meadow	Sedge Meadow or Fresh (Wet) Meadow (native subtype)	Laurentian & Northeast Bluejoint Wet Meadow	CEGL005448
		Midwest Lake Sedge Wet Meadow	CEGL002256
		Northern Sedge Wet Meadow	CEGL002257
Southern Sedge Meadow		North-Central Bluejoint Wet Meadow	CEGL005449
		Midwest Lake Sedge Wet Meadow	CEGL002256
		Upright (Tussock) Sedge Wet Meadow	CEGL002258
		Upright (Tussock) Sedge Fen	CEGL005241
Wet-mesic Prairie	Wet to Wet-mesic Prairie	Lakeplain Wet-Mesic Prairie	CEGL005095
Wet Prairie		Central Wet-Mesic Tallgrass Prairie	CEGL002024
Ephemeral pond	Seasonally Flooded Basin	Central Cordgrass Wet Prairie	CEGL002224
		Midwest Ephemeral Pond	CEGL002430
Calcareous Fen	Calcareous Fen	Bog Birch / Leatherleaf Rich Fen	CEGL002494
		Prairie Transition Peat Rich Fen	CEGL002383
		Upright (Tussock) Sedge Fen	CEGL005241
		Dogwood - Willow - Poison-sumac Shrub Fen	CEGL005087
		Shrubby-cinquefoil / Dioecious Sedge Prairie Fen	CEGL005139
Open Bog	Open Bog	Open Graminoid / Sphagnum Bog	CEGL005256
		Leatherleaf Bog	CEGL005278
Boreal Rich Fen		Boreal Sedge Rich Fen	CEGL002500
Central Poor Fen		Midwestern Graminoid Poor Fen	CEGL005279
Muskeg		Tamarack Scrub Poor Fen	CEGL005226
		Black Spruce / Leatherleaf Semi-treed Bog	CEGL005218

NHI Natural community	Eggers and Reed (2015)	National Vegetation Classification	NVC CODE
Alder Thicket	Alder Thicket	Gray (Tag) Alder Shrub Swamp	CEGL002381
Shrub-Carr	Shrub-Carr	Red-osier Dogwood - Willow Shrub Swamp Dogwood - Willow - Poison-sumac Shrub Fen Dogwood - Willow - Blueberry Fen Sandbar Willow Wet Shrubland	CEGL002186 CEGL005087 CEGL005083 CEGL008562
Black Spruce Swamp	Coniferous Bog	Black Spruce - Tamarack / Labrador-tea Poor Swamp Forest	CEGL005271
		Black Spruce / Alder Intermediate Swamp	CEGL002452
Northern Tamarack Swamp		Northern Tamarack Swamp Forest	CEGL002472
		Northern Tamarack Rich Swamp Forest	CEGL002471
Southern Tamarack Swamp	Coniferous Swamp	Southern Tamarack - Red Maple Rich Swamp Forest	CEGL005232
Northern Wet-Mesic Forest (Cedar Swamp)		Midwest Northern White-cedar Swamp Forest	CEGL002455
		Northern White-cedar - Black Ash Swamp Forest	CEGL005165
White Pine-Red Maple Swamp	N/A	White Pine - Red Maple Swamp Forest	CEGL002482
Floodplain Forest	Floodplain Forest	Midwestern Silver Maple - Elm Floodplain Forest Midwestern Cottonwood - Black Willow - Silver Maple Floodplain Forest Bur Oak - Swamp White Oak Mixed Bottomland Forest	CEGL002586 CEGL002018 CEGL002098
Northern Hardwood Swamp	Hardwood Swamp	Red Maple - Ash - Birch Swamp Forest	CEGL002071
		Black Ash - Mixed Hardwoods Swamp	CEGL002105
Southern Hardwood Swamp		Maple - Ash - Elm Swamp Forest	CEGL005038
N/A (Disturbance Community)	Fresh (Wet) Meadow (disturbed subtype)	Eastern Ruderal Reed Canarygrass Marsh (Dominated by <i>Phalaris arundinacea</i>)	CEGL006044
	Deep and Shallow Water Marsh	Eastern North America Temperate Ruderal Common Reed Marsh (Dominated by <i>Phragmites australis ssp. australis</i>)	CEGL004141
	Shallow Open Water Communities	Eastern NA Ruderal Aquatic Vegetation Group (Dominated by <i>Myriophyllum spicatum</i> or other floating-leaved or submersed aquatic; Natives < 20-25%)	G595
	Shrub-Carr	Common Buckthorn Ruderal Shrubland (Wetlands dominated by <i>Rhamnus cathartica</i>).	CEGL005461
	Hardwood Swamp	Red Maple - Green Ash - Box-elder Ruderal Flooded & Swamp Forest Group (Dominants = <i>Acer rubrum</i> , <i>Fraxinus pennsylvanica</i> , or <i>Acer negundo</i> . Shrub and herb layer dominated by >80% exotics).	G552

¹ Additional wetland community types, e.g., patterned peatland, interdunal wetland, etc., may be surveyed. For a detailed description of each Natural Community, please refer to "Wisconsin's Natural Communities" on the WDNR [NHI website](#).

Table 2. Abundance Classification

Symbol	Abundance Code	Description
A	Abundant	The dominant plants throughout the site
C	Common	Locally abundant or frequently encountered
O	Occasional	Occasionally encountered, or locally common but absent or infrequent across much of site
U	Uncommon	Infrequently encountered
R	Rare	Very few plants seen

Attachment 1: WDNR Timed-Meander Survey Data Sheet, next page

WDNR Timed-Meander Survey Data Sheet

Observers _____ Date _____

Site Name _____ Landowner/Property _____

Access Route _____ County _____

Community Type _____ EOID (if existing EO) _____

Start point (Dec Deg) _____ End point (Dec Deg) _____ Track Taken? Y N

Start Meander Time _____ Total Meander Time _____ (mins) Soils & pH _____

Time	Species	%	AC	Notes	Time	Species	%	AC	Notes
0-5	1					29			
	2					30			
	3					31			
	4					32			
	5					33			
	6					34			
	7					35			
	8					36			
	9					37			
	10					38			
	11					39			
	12					40			
	13					41			
	14					42			
	15					43			
	16					44			
	17					45			
	18					46			
	19					47			
	20					48			
	21					49			
	22					50			
	23					51			
	24					52			
	25					53			
	26					54			
	27					55			
	28					56			

Notes:

Estimate % areal cover and abundance code for each species *AC: Abundance codes: A (abundant), C (common), O (occasional), U (uncommon), R (rare)*

WDNR Timed-Meander Survey Data Sheet

Time	Species	%	AC	Notes	Time	Species	%	AC	Notes
57					89				
58					90				
59					91				
60					92				
61					93				
62					94				
63					95				
64					96				
65					97				
66					98				
67					99				
68					100				
69					101				
70					102				
71					103				
72					104				
73					105				
74					106				
75					107				
76					108				
77					109				
78					110				
79					111				
80					112				
81					113				
82					114				
83					115				
84					116				
85					117				
86					118				
87					119				
88					120				

Notes:

Estimate % areal cover and abundance code for each species
Abundance codes: A (abundant), C (common), O (occasional), U (uncommon), R (rare)