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Black Lake Shoreline Vegetation Survey July 1, 2015

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Background:

Black Lake, located within North Oaks, MN and within the Vadnais Lake Area Watershed Management Organization (VLAWMO) (Figure 1), is surrounded by a Northern Mixed Cattail Marsh (MRn83) as defined by the Minnesota Department of Natural Resources Ecological Land Classification Program (MN DNR ELC, 2005). Details characterizing the vegetation structure, composition, landscape and natural history of this plant community can be found within the appendix of this report.

The area of the wetland community, as determined using 2013 color infrared Farm Service Agency (FSA) aerial photography provided by the MnGeo Web Map Service (WMS), was found to be approximately 111,500 square meters and the lake area was measured at approximately 42,800 square meters (Figure 2).

Species previously reported as observed within this community include broadleaf arrowhead *(Sagittaria latifolia)*, jewelweed *(Impatiens sp.)*, sedge *(Carex sp.),* red osier dogwood *(Cornus sericea)*, and most notably wild rice *(Zizania palustris)*. Invasive species of concern previously observed within this community include purple loosestrife *(Lythrum salicaria)*, reed canary grass *(Phalaris arundinacea)*, and amur silver grass *(Miscanthus sacchariflorus)*.

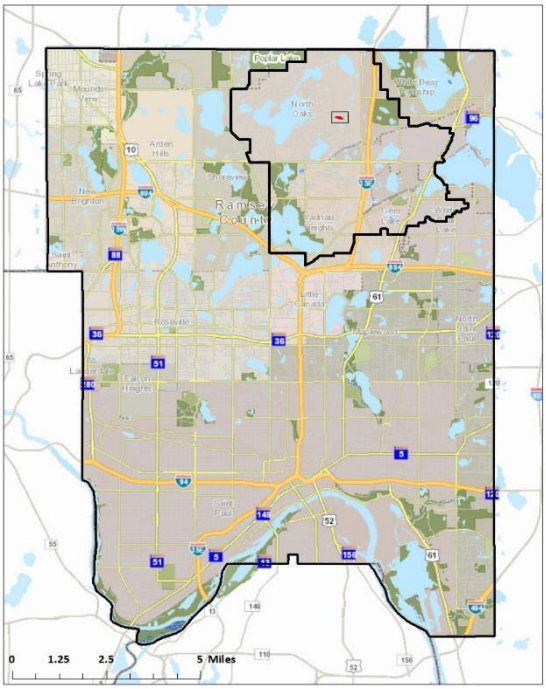

Figure 1. Location of Black Lake shown in red within VLAWMO and Ramsey County Boundaries.

Figure 2. Black Lake Shoreline vegetation community boundaries approximately 111,500 square meters in area.

Methods:

Transect-Quadrat Survey

In order to characterize the plant community within the wetland surrounding Black Lake, a quadrat-transect sampling method was utilized as first developed by Curtis and McIntosh (1950). Within this methodology, a transect is laid out along a vegetation gradient using a tape measure and quadrats are placed along various lengths of the transect in which percent cover and frequency of each species are recorded. Data is later equalized to account for bare ground. This technique allows for calculation of valuable statistics including cover, density and frequency of each species in addition to relative cover, relative density and relative frequency of each species, as shown in the equations below (Cox, 1990).

$$Relative\ Coverage = \frac{\%\ of\ individual\ species\ occuring\ in\ all\ quadrats}{\%\ cover\ of\ all\ species\ occuring\ in\ all\ quadrats}$$

$$Density = \frac{\#\ of\ individuals}{Total\ area\ sampled}$$

$$Relative\ Density = \frac{Species\ density}{Total\ density\ for\ all\ species} \times 100$$

$$Frequency = \frac{\#\ of\ quadrats\ species\ occurs\ in}{Total\ number\ of\ quadrats} \times 100$$

$$Relative\ Frequency = \frac{Species\ frequency}{Total\ frequency\ of\ all\ species} \times 100$$

For sites characterized mainly by herbaceous vegetation, most studies utilize a quadrat size of 0.1-1.0 square meters. To account for mainly herbaceous vegetation present within cattail marsh habitats, a one square meter quadrat was used within this survey (Goldsmith et al., 1986). Plots can be placed randomly or systematically based on survey objectives and needs. When a pattern in vegetation is being investigated, for example determining change in abundance of plant species across time or space, systematic sampling is most effective (Barbour et al., 1987; Cambridge, 2015). Within this survey, nine 20m transects were completed as shown in Figure 3. Five one square meter quadrats were placed and sampled along each transect at 0, 5, 10, 15 and 20 meters.

Figure 3. Black Lake Shoreline vegetation N=9 survey transect locations each containing N=5 one square meter quadrats.

Wild Rice Observation

As wild rice *(Zizania palustris)* grows within shallow lake areas rather than on the shoreline, a separate methodology was used to document presence and abundance of wild rice within Black Lake. This methodology entailed mapping areas of emerging wild rice growth utilizing GoogleMap software and satellite imagery and ground-truthing this data during the July 1, 2015 survey through field observation and photography from the shoreline where accessible.

Results:

Transect-Quadrat Surveys

Tables 1 through 5 displayed below contain species, coverage, density and frequency data as observed within N=45 one square meters quadrats taken along nine 20m long transects (Figure 3). A total of thirty species were observed, with hybrid cattail *(Typha x glauca)*, Northern marsh fern *(Thelypteris palustris)*, lake sedge *(Carex lacustris)*, jewelweed *(Impatiens sp.)*, willow *(Salix sp.)* and reed canary grass *(Phalaris arundinacea)* among the most common species. The native broadleaf cattail *(Typha latifolia)* and invasive narrowleaf cattail *(Typha angustifolia)* were also observed, but in low abundance compared to hybrid cattail, a hybrid between broadleaf cattail and invasive narrow-leaf cattail *(Typha angustifolia)*.

Reed canary grass, an invasive species that reproduces through horizontal underground stems is a threat to natural wetlands as it out-competes most native species. Within the survey completed on July 1, 2015, this species was found to have approximately three percent coverage, three percent density and three percent frequency relative to other species surrounding the shoreline (Table 3, Table 4 and Table 5). Within this habitat, reed canary grass has not yet begun to form large monotypic stands aside from a few further from the shoreline, but should be monitored in future years for potential management needs. A guide for reed canary grass monitoring and treatment can be found within the reference section of this document (Reinhardt, 2000).

As stated within the habitat description in the appendix of this document, invasion and dominance of marshes by non-native cattail species, such as hybrid cattail *(Typha x glauca)*, is likely related to alterations in wetland hydrology, commonly from drain tiling, ditching, and impoundments in addition to high levels of nutrient-rich runoff and runoff from roads. Marshes dominated by non-native cattail species are considered to be low-quality or disturbed habitats. For further information on the ecology and management of this species visit the following: http://dnr.wi.gov/topic/invasives/fact/cattailhybrid.html.

Other notable species include five varieties of native sedge *(Carex sp.)* and purple loosestrife *(Lythrum salicaria)*. Purple loosestrife, an invasive emergent aquatic species of concern, was found to have approximately one percent coverage and density and approximately four percent frequency relative to other species, indicating that this species is present and more abundant than most forbs, but not completely invading and overrunning natives. This species should be monitored in future years for increased dominance. Management will be required as plants begin to form large monotypic stands. Loosestrife ecology and control information is available at the following: www.dnr.state.mn.us/invasives/aquaticplants/purpleloosestrife/program.

Species present but not observed within quadrat surveys are displayed in Table 2. Of these species, phragmites *(Phragmites australis)*, brome grass *(Bromus inermus)* and buckthorn *(Rhamnus cathartica)* are other potential invasive species of concern to monitor. Raw data from individual transects can be found within the appendix of this document.

Figure 4. Black Lake invasive species including monotypic stand of hybrid cattail (left), purple loosestrife (top right) and reed canary grass (bottom right).

Figure 5. Black Lake native species including diverse sedge species (right), bulrush (middle) and ferns (left)

Table 1

Black Lake Shoreline Vegetation Survey Species List

Scientific Name	Common Name
Apocynum cannabinum	American hemp
Calamagrostis canadensis	Bluejoint
Carex aquatilis	Aquatic sedge
Carex comosa	Bristly sedge
Carex diandra	Lesser panicled sedge
Carex hystericina	Porcupine sedge
Carex lacustris	Lake sedge
Carex stricta	Tussock sedge
Cornus sericea	Red-osier dogwood
Equisetum palustre	Marsh horsetail
Eutrochium maculatum	Spotted Joe pye weed
Galium trifidum	Three-cleft bedstraw
Glyceria grandis	Tall manna grass
Impatiens sp.	Jewelweed
Lycopus uniflorus	Northern bugleweed
Lysimachia thyrsiflora	Tufted loosestrife
Lythrum salicaria	***Purple loosestrife***
Onoclea sensibilis	Sensitive fern
Phalaris arundinacea	***Reed canary grass***
Pilea pumila	Clearweed
Sagittaria latifolia	Broad-leaved arrowhead
Salix sp.	Willow
Scirpus validus	Soft stem bulrush
Scutellaria galericulata	Marsh skullcap
Solidago canadensis	Canada goldenrod
Thelypteris palustris	Northern marsh fern
Typha x glauca	***Hybrid cattail***
Unknown 1	N/A
Unknown 2	N/A
Unknown sapling	N/A

Note. Invasive species identified in bold and italics.

Table 2

Species Observed Outside of Survey Transects

Scientific Name	Common Name
Typha latifolia	Broad-leaved cattail
Sium suave	Water parsnip
Potentilla palustris	Marsh cinquefoil
Urtica dioica	***Stinging nettle***
Rumex orbiculatus	Great water dock
Bromus inermis	***Smooth brome***
Rhamnus cathartica	***Common buckthorn***
Solanum dulcamara	***Bittersweet nightshade***
Lotus corniculatus	***Bird's-foot trefoil***
Phragmites	***Phragmites australis***
Iris versicolor	Northern blue flag

Note. Invasive species identified in bold and italics.

Table 3

Coverage of Species Present within N=45 One Square Meter Quadrats

Scientific Name	Common Name	Total Coverage	Relative Coverage (%)
Typha x glauca	***Hybrid cattail***	1722	38.66
Thelypteris palustris	Northern marsh fern	918	20.60
Carex lacustris	Lake sedge	908	20.38
Impatiens sp.	Jewelweed	154	3.46
Salix sp.	Willow	151	3.38
Phalaris arundinacea	***Reed canary grass***	135	3.03
Carex hystericina	Porcupine sedge	83	1.86
Carex diandra	Lesser panicled sedge	74	1.67
Lythrum salicaria	***Purple loosestrife***	62	1.39
Glyceria grandis	Tall manna grass	38	0.86
Sagittaria latifolia	Broad-leaved arrowhead	28	0.62
Scutellaria galericulata	Marsh skullcap	21	0.48
Unknown 2	N/A	21	0.47
Carex comosa	Bristly sedge	20	0.45
Carex aquatilis	Aquatic sedge	16	0.35
Galium trifidum	Three-cleft bedstraw	14	0.30
Cornus sericea	Red-osier dogwood	13	0.30
Calamagrostis canadensis	Bluejoint	10	0.23
Unknown 1	N/A	10	0.23
Apocynum cannabinum	American hemp	10	0.23
Solidago canadensis	Canada goldenrod	10	0.23
Equisetum palustre	Marsh horsetail	8	0.18
Onoclea sensibilis	Sensitive fern	6	0.13
Lysimachia thyrsiflora	Tufted loosestrife	6	0.13
Unknown sapling	N/A	5	0.11
Eutrochium purpureum	Spotted Joe pye weed	4	0.10
Pilea pumila	Clearweed	4	0.09
Lycopus uniflorus	Northern bugleweed	1	0.03
Carex stricta	Tussock sedge	1	0.02
Scirpus validus	Soft stem bulrush	1	0.02
	Total	4455	100

Note. Invasive species identified in bold and italics.

Table 4

Density of Species Present within N=45 Square Meter Quadrats

Scientific Name	Common Name	Plants/m2	Relative Density (%)
Typha x glauca	***Hybrid cattail***	22.20	35.78
Carex lacustris	Lake sedge	14.84	23.92
Thelypteris palustris	Northern marsh fern	9.74	15.70
Impatiens sp.	Jewelweed	2.55	4.11
Carex hystericina	Porcupine sedge	2.36	3.80
Phalaris arundinacea	***Reed canary grass***	2.07	3.33
Carex diandra	Lesser panicled sedge	1.80	2.90
Lythrum salicaria	***Purple loosestrife***	0.78	1.25
Carex aquatilis	Aquatic sedge	0.69	1.11
Salix sp.	Willow	0.60	0.97
Scutellaria galericulata	Marsh skullcap	0.56	0.90
Glyceria grandis	Tall manna grass	0.49	0.79
Galium trifidum	Three-cleft bedstraw	0.47	0.75
Unknown 2	N/A	0.45	0.73
Carex comosa	Bristly sedge	0.44	0.72
Sagittaria latifolia	Broad-leaved arrowhead	0.38	0.61
Equisetum palustre	Marsh horsetail	0.27	0.43
Unknown 1	N/A	0.24	0.39
Cornus sericea	Red-osier dogwood	0.21	0.33
Solidago canadensis	Canada goldenrod	0.18	0.29
Apocynum cannabinum	American hemp	0.13	0.21
Lysimachia thyrsiflora	Tufted loosestrife	0.13	0.21
Calamagrostis canadensis	Bluejoint	0.11	0.18
Pilea pumila	Clearweed	0.11	0.18
Eutrochium purpureum	Spotted Joe pye weed	0.09	0.14
Onoclea sensibilis	Sensitive fern	0.09	0.14
Carex stricta	Tussock sedge	0.02	0.04
Lycopus uniflorus	Northern bugleweed	0.02	0.04
Scirpus validus	Soft stem bulrush	0.02	0.04
Unknown sapling	N/A	0.02	0.04
	Total	62.04	100

Note. Invasive species identified in bold and italics.

Table 5

Frequency of Species Present within N=45 Square Meter Quadrats

Scientific Name	Common Name	Frequency (%)	Relative Frequency (%)
Thelypteris palustris	Northern marsh fern	87	17
Typha x glauca	***Hybrid cattail***	80	16
Carex lacustris	Lake sedge	60	12
Impatiens sp.	Jewelweed	42	8
Scutellaria galericulata	Marsh skullcap	22	4
Carex diandra	Lesser panicled sedge	20	4
Sagittaria latifolia	Broad-leaved arrowhead	20	4
Lythrum salicaria	***Purple loosestrife***	18	4
Phalaris arundinacea	***Reed canary grass***	18	4
Salix sp.	Willow	13	3
Carex hystericina	Porcupine sedge	11	2
Galium trifidum	Three-cleft bedstraw	11	2
Lysimachia thyrsiflora	Tufted loosestrife	11	2
Unknown 2	N/A	11	2
Cornus sericea	Red-osier dogwood	9	2
Solidago canadensis	Canada goldenrod	9	2
Apocynum cannabinum	American hemp	7	1
Calamagrostis canadensis	Bluejoint	7	1
Eutrochium purpureum	Spotted Joe pye weed	7	1
Glyceria grandis	Tall manna grass	7	1
Carex aquatilis	Aquatic sedge	4	1
Equisetum palustre	Marsh horsetail	4	1
Unknown 1	N/A	4	1
Carex comosa	Bristly sedge	2	0
Carex stricta	Tussock sedge	2	0
Lycopus uniflorus	Northern bugleweed	2	0
Onoclea sensibilis	Sensitive fern	2	0
Pilea pumila	Clearweed	2	0
Scirpus validus	Soft stem bulrush	2	0
Unknown sapling	N/A	2	0
	Total	498	100

Note. Invasive species identified in bold and italics.

Wild Rice Observation

Plant Ecology:

Wild rice *(Zizania palustris)* is an annual plant growing in lakes, marshes and streams in water six inches to three feet deep. This species grows above the water surface and prefers soft, mucky sediment. Leaves are ribbon-like and tapered, floating on the surface during late spring and early summer with stocks growing three to ten feet tall by early July. The grains are yellow or red and appear at the tip of the stalk in August. Stems are hollow except at the nodes where leaves, tillers, roots and flowers appear. Wild rice has a shallow root system with a spread of eight to twelve inches.

Seeds disperse the plant in early August or September and remain dormant in the mud until warm water of approximately 45 degrees Fahrenheit and low oxygen conditions develop in the spring that stimulate germination. Some seeds may germinate the following year and some may remain dormant for five or more years. The plant begins to develop aerial shoots by the end of June which continue to grow into August, reaching a height of 2-8 feet above the water; shoots are most common where water is shallow and plant density is low. By late July, flowering begins and both male and female panicles, or flowers, develop on the same stalk allowing for cross-pollination. Wild rice *(Zizania palustris)* matures in approximately 110 days.

This species will thrive only in flooded soils and is most successful at a constant water depth of at least six inches. Variations in water depth during the growing season can damage plants in addition to water deeper than fourteen inches. Wild rice is usually produced on low, wet land and thrives in shallow peat or mucky soils with impervious subsoil such as clay to prevent seepage during the growing season (Oelke et al, 2015).

Results:

On July 1, 2015 wild rice *(Zizania palustris)* was observed to have begun emerging as shown in Figures 4 and 5. The emerging shoots which were observed around the entire lake shore were approximately two to three feet above the water surface. Shoots were moderately dense with approximately twenty shoots per square meter. Wild rice was emerging, but not yet flowering or seeding on the date of the survey as wild rice flowers in early August (Figure 5).

Satellite imagery was utilized to estimate areas of wild rice *(Zizania palustris)* emergence using Google Earth Technology which was then ground-truthed to field observations. As shown in Figure 4, the area of wild rice growth *(Zizania palustris)* was found to be approximately 16,725 square meters or forty percent of the lake surface. Wild rice emergence occurred no deeper than an approximate water depth of 1.25m (4ft) based on contours sampled on May 29, 2015 (Figure 4).

Figure 6. Black Lake wild rice emergent areas displayed with April 29, 2015 contours.

Figure 7. Black Lake wild rice emergent areas field observation, July 1, 2015.

Survey Limitation and Future Survey Needs

Site conditions and survey methods within the cattail marsh proved more difficult and time consuming than predicted during survey development. Some areas of the marsh, where transects had previously been mapped for survey in ArcGIS were inaccessible due to deep levels of muck and water nearly topping surveyor chest-waders at times. Due to safety concerns related to this, transects were randomly placed in areas with higher stability and accessibility. Within these conditions, three surveyors completed nine transects within an eight hour day as opposed to the previously proposed sixteen transects which would likely take approximately one and a half to two field days. Based on this knowledge and field experience, future vegetation survey development should take these conditions into account when developing methodology, as each 20 meter transect took approximately forty five minutes for three surveyors to complete.

Inventory of wild rice *(Zizania palustris)* should be completed separately from shoreline vegetation surveys to fully document presence of the species beyond visual inspection as was completed along with July 1, 2015 transect survey. This inventory would most successfully be performed by utilizing a canoe and Garmin/GPS technology to accurately map wild rice location and abundance. Ideally this survey would be completed in early to mid-August when flowers are fully developed, although multiple sampling dates throughout the growing season would most accurately represent wild rice growth stages and development. In-field surveys could also be coupled with aerial photography analysis across various growth stages and over several growing seasons to document change in wild rice abundance across time and space.

In order to track and document the spread of invasive species present within the marsh, targeted invasive species mapping should be included in future surveys and monitoring. Aside from random transects and quadrats placed to capture a general picture of the plant community, species specific surveys would prove beneficial in the form of large subjective plots documenting areas and abundance of invasive species of concern. This data would aid in determining and developing future management needs.

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Appendix:

Raw Transect Data

Transect 1	Species:	Aquatic Sedge	Lesser Panicled Sedge	Lake Sedge	Three-cleft Bedstraw	Jewelweed	Northern Bugleweed	Broad-Leaved Arrowhead	Willow	Marsh Skullcap	Northern Marsh Fern	Hybrid Cattail
Quadrat	% Cover:	0	0	10	0	0	0	5	0	0	5	80
0m	Frequency:	0	0	10	0	0	0	3	0	0	3	50
Quadrat	% Cover:	1	10	0	1	0	0	1	0	1	10	77
5m	Frequency:	1	7	0	1	0	0	2	0	5	3	60
Quadrat	% Cover:	0	12	35	3	0	0	0	0	3	35	12
10m	Frequency:	0	30	60	3	0	0	0	0	5	10	5
Quadrat	% Cover:	0	29	17	0	0	1	0	0	6	29	17
15m	Frequency:	0	20	10	0	0	1	0	0	4	10	10
Quadrat	% Cover:	0	15	59	0	3	0	1	15	0	7	0
20m	Frequency:	0	15	30	0	2	0	2	4	0	4	0

Transect 2	Species:	Lake Sedge	Jewelweed	Tufted Loosestrife	Reed Canary Grass	Marsh Skullcap	Northern Marsh Fern	Hybrid Cattail	Unknown 1
Quadrat	% Cover:	10	1	0	10	0	0	79	0
0m	Frequency:	15	1	0	12	0	0	50	0
Quadrat	% Cover:	35	0	1	0	1	0	62	1
5m	Frequency:	20	0	2	0	1	5	30	1
Quadrat	% Cover:	15	5	0	0	0	10	70	0
10m	Frequency:	10	4	0	0	0	6	45	0
Quadrat	% Cover:	0	9	0	0	2	18	71	0
15m	Frequency:	0	4	0	0	2	5	20	0
Quadrat	% Cover:	0	0	1	1	0	0	98	0
20m	Frequency:	0	0	1	1	0	0	80	0

Transect 3	Species:	Bluejoint	Lesser Panicled Sedge	Lake Sedge	Tall Manna Grass	Jewelweed	Tufted Loosestrife	Reed Canary Grass	Broad-Leaved Arrowhead	Marsh Skullcap	Northern Marsh Fern	Hybrid Cattail
Quadrat	% Cover:	8	0	16	0	8	2	24	2	0	8	32
0m	Frequency:	3	0	3	0	2	1	10	1	0	2	10
Quadrat	% Cover:	1	0	7	0	1	1	20	1	0	68	0
5m	Frequency:	1	0	3	0	1	1	10	1	0	22	0
Quadrat	% Cover:	0	0	32	32	16	0	0	0	3	0	16
10m	Frequency:	0	0	10	15	4	0	0	0	1	6	5
Quadrat	% Cover:	0	2	28	0	0	0	4	9	2	0	56
15m	Frequency:	0	1	10	0	0	0	2	2	1	0	15
Quadrat	% Cover:	1	1	11	0	0	0	63	0	0	21	3
20m	Frequency:	1	1	5	0	0	0	50	0	0	10	1

Transect 4	Species:	Lake Sedge	Red-Osier Dogwood	Jewelweed	Purple Loosestrife	Soft Stem Bulrush	Northern Marsh Fern	Hybrid Cattail	Unknown 1
Quadrat	% Cover:	0	0	47	0	0	6	47	0
0m	Frequency:	0	0	30	0	0	3	25	0
Quadrat	% Cover:	0	0	0	0	1	10	89	0
5m	Frequency:	0	0	0	0	1	5	25	0
Quadrat	% Cover:	0	2	0	0	0	33	66	0
10m	Frequency:	0	1	0	0	0	10	30	0
Quadrat	% Cover:	0	0	4	2	0	9	75	9
15m	Frequency:	0	0	2	1	0	5	30	10
Quadrat	% Cover:	5	0	5	0	0	0	65	0
20m	Frequency:	7	0	7	0	0	0	87	0

Transect 5	Species:	American Hemp	Lesser Panicled Sedge	Porcupine Sedge	Lake Sedge	Red-Osier Dogwood	Spooted Joe Pye Weed	Jewel-weed	Sensitive Fern	Clear-weed	Willow	Northern Marsh Fern	Hybrid Cattail	Un-known 2
Quadrat	% Cover:	1	0	4	0	0	0	9	0	4	0	34	43	4
0m	Frequency:	1	0	3	0	0	0	10	0	5	0	20	20	5
Quadrat	% Cover:	0	1	0	23	0	0	1	6	0	0	1	68	0
5m	Frequency:	0	1	0	10	0	0	1	4	0	0	1	30	0
Quadrat	% Cover:	0	0	0	11	1	1	2	0	0	2	76	5	1
10m	Frequency:	0	0	0	20	1	1	5	0	0	2	20	4	1
Quadrat	% Cover:	0	0	0	31	0	0	0	0	0	46	15	8	0
15m	Frequency:	0	0	0	20	0	0	0	0	0	10	10	5	0
Quadrat	% Cover:	0	0	0	40	5	0	0	0	0	0	25	5	5
20m	Frequency:	0	0	0	50	6	0	0	0	0	0	31	6	6

Transect 6	Species:	Amer-ican Hemp	Aqua-tic Sedge	Bristly Sedge	Por-cupine Sedge	Tus-sock Sedge	Red-Osier Dog-wood	Spotted Joe Pye Weed	Marsh Horse-tail	Tall Manna Grass	Jewel-weed	Tufted Loose-strife	Purple Loose-strife	Nor-thern Marsh Fern	Hybrid Cattail	Un-known sapling	Un-known 2
Quadrat	% Cover:	3	0	0	0	0	0	0	0	0	15	0	7	15	60	0	0
0m	Frequency:	2	0	0	0	0	0	0	0	0	10	0	3	5	20	0	0
Quadrat	% Cover:	0	15	0	0	0	0	0	0	5	5	1	15	10	45	5	0
5m	Frequency:	0	30	0	0	0	0	0	0	5	5	1	10	4	20	1	0
Quadrat	% Cover:	0	0	0	33	0	6	2	2	0	0	0	1	50	0	0	6
10m	Frequency:	0	0	0	50	0	1	1	2	0	0	0	1	20	0	0	3
Quadrat	% Cover:	0	0	20	20	1	0	0	0	0	0	0	5	50	0	0	5
15m	Frequency:	0	0	20	20	1	0	0	0	0	0	0	3	20	0	0	5
Quadrat	% Cover:	0	0	0	22	0	0	0	6	0	0	0	6	67	0	0	0
20m	Frequency:	0	0	0	30	0	0	0	10	0	0	0	5	40	0	0	0

Transect 7	Species:	American Hemp	Lesser Panicled Sedge	Lake Sedge	Three-Cleft Bedstraw	Jewelweed	Broad-Leaved Arrowhead	Willow	Marsh Skullcap	Canada Goldenrod	Northern Marsh Fern	Hybrid Cattail
Quadrat	% Cover:	6	0	51	6	6	1	0	1	3	25	0
0m	Frequency:	3	0	25	15	5	1	0	1	2	15	0
Quadrat	% Cover:	0	5	82	0	0	0	0	0	5	9	0
5m	Frequency:	0	5	50	0	0	0	0	0	3	5	0
Quadrat	% Cover:	0	0	84	0	0	0	0	0	2	14	0
10m	Frequency:	0	0	60	0	0	0	0	0	2	6	0
Quadrat	% Cover:	0	0	80	0	0	0	0	1	1	11	6
15m	Frequency:	0	0	50	0	0	0	0	2	1	4	5
Quadrat	% Cover:	0	0	77	0	1	0	11	0	0	0	11
20m	Frequency:	0	0	60	0	2	0	2	0	0	0	10

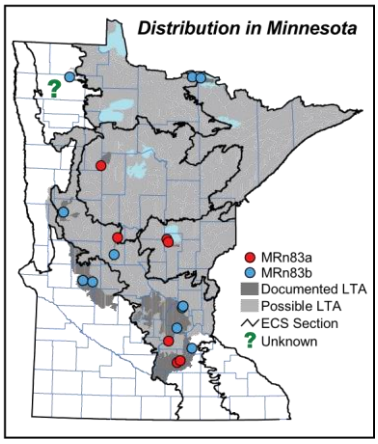
Transect 8	Species:	Lesser Panicled Sedge	Lake Sedge	Spotted Joe Pye Weed	Three-Cleft Bedstraw	Jewelweed	Reed Canary Grass	Willow	Broad-Leaved Arrowhead	Marsh Skullcap	Northern Marsh Fern	Hybrid Cattail
Quadrat	% Cover:	0	5	0	1	5	0	0	5	1	77	5
0m	Frequency:	0	5	0	1	10	0	0	4	3	45	2
Quadrat	% Cover:	0	23	1	0	0	0	0	0	0	70	6
5m	Frequency:	0	35	2	0	0	0	0	0	0	30	5
Quadrat	% Cover:	0	52	0	2	0	9	34	2	0	2	0
10m	Frequency:	0	40	0	1	0	3	4	1	0	1	0
Quadrat	% Cover:	1	17	0	0	0	4	42	0	0	34	3
15m	Frequency:	1	20	0	0	0	5	5	0	0	20	2
Quadrat	% Cover:	0	53	0	0	0	0	0	0	0	42	5
20m	Frequency:	0	30	0	0	0	0	0	0	0	20	2

Transect 9	Species:	Porcupine Sedge	Tall Manna Grass	Jewelweed	Purple Loosestrife	Northern Marsh Fern	Hybrid Cattail
Quadrat	% Cover:	0	1	10	21	5	63
0m	Frequency:	0	2	10	9	5	70
Quadrat	% Cover:	3	0	0	5	5	86
5m	Frequency:	3	0	0	3	2	45
Quadrat	% Cover:	0	0	0	0	10	90
10m	Frequency:	0	0	0	0	4	55
Quadrat	% Cover:	0	0	0	0	0	100
15m	Frequency:	0	0	0	0	0	60
Quadrat	% Cover:	0	0	0	0	1	99
20m	Frequency:	0	0	0	0	1	60

MRn83 Northern Mixed Cattail Marsh

Northern Mixed Cattail Marsh
Emergent marsh communities, typically dominated by cattails. Present on floating mats along shorelines in lakes, ponds, and river backwaters or rooted in mineral soil in shallow wetland basins.

Vegetation Structure & Composition
Description is based on summary of field survey records and vascular plant data from 22 plots (relevés).



-Floating-leaved and **submergent aquatic plant** cover is sparse, with species such as duckweed *(Lemna* spp.) and greater duckweed *(Spirodela polyrhiza)* frequent, and common bladderwort *(Utricularia vulgaris)* and common coontail *(Ceratophyllum demersum)* occasionally present. Seasonally prolific, floating clones of the liverworts *Riccia fluitans* and *Ricciocarpos natans* may be present, becoming stranded during watertable drawdown.
-Graminoid cover is variable, with lake sedge *(Carex lacustris)* and bristly sedge *(C. comosa)* commonly present.
-Forb cover is strongly dominated by cattails *(Typha* spp.), usually with > 50% cover. Other common forbs include emergent species such as broad-leaved arrowhead *(Sagittaria latifolia)*, marsh skullcap *(Scutellaria galericulata)*, small or three-cleft bedstraw *(Galium tinctorium* or *G. trifidum)*, and bur marigold and beggarticks *(Bidens* spp.).
-Shrubs are absent or very sparse.

Notes: Vegetation is often composed of dense stands of cattails interspersed with pools of open water. Associated species are highly variable. MRn83 and other shallowwater wetlands throughout much of the state (particularly the agricultural region) have been invaded by dense stands of the non-native species narrow-leaved cattail *(Typha angustifolia)* and hybrid cattail *(T.* x *glauca)*. Invasion and dominance of marshes by non-native cattail species is likely related to alterations in wetland hydrology, commonly from drain tiling, ditching, and impoundments; high levels of nutrient-rich runoff from agricultural fields; and salt-containing runoff from roads. Marshes dominated by non-native cattail species are considered to be low-quality or disturbed

examples of MRn83. Marshes dominated by the native species broad-leaved cattail *(T. latifolia)* are considered higher-quality examples of MRn83 and are increasingly rare in Minnesota.

Landscape Setting & Soils

MRn83 occurs in shallow basins and depressions and along the shores of lakes, ponds, and river backwaters. Substrates range from muck or shallow, well-decomposed peat to floating peaty mats. Substrate surface is usually covered with plant litter, especially dead cattail stalks. MRn83 is often transitional between shallow aquatic communities and wet meadows.

Natural History

MRn83 develops in areas where standing water is present most of the year, providing conditions favorable for hydrophytic plants. Occurrences of the community with plants rooted in muck or peat substrates may succeed to shallow aquatic communities if the water table rises for prolonged periods, or to wet meadows if the water table drops or if silt or sedimentary peat accumulation causes the substrate surface to become elevated above the water surface. Floating mats, which rise and fall with changes in water level, are presumably successionally stable but may be fragmented by strong winds or beaver activity. Variation in species composition observed in the class is likely due to differences in water depth, the permanence of standing water, and variation in substrate. Fires during severe droughts can remove accumulated peat in fens or wet meadows, effectively lowering the growing surface and creating the wetter conditions that favor marsh over fen or wet meadow vegetation.

MRn83 Northern Mixed Cattail Marsh — Species Frequency & Cover

	freq%	cover
Grasses & Sedges		
Lake sedge *(Carex lacustris)*	45	●●●
Bristly sedge *(Carex comosa)*	41	●●
Red-stalked spikerush *(Eleocharis palustris)*	32	●
Bluejoint *(Calamagrostis canadensis)*	27	●●●
Rice cut grass *(Leersia oryzoides)*	23	●
Tall manna grass *(Glyceria grandis)*	23	●
Soft stem bulrush *(Scirpus validus)*	18	●●
Fen wiregrass sedge *(Carex lasiocarpa)*	14	●
Wild rice *(Zizania palustris)*	14	●●
Common reed grass *(Phragmites australis)*	14	●
Tussock sedge *(Carex stricta)*	14	●
Cyperus sedge *(Carex pseudocyperus)*	14	●●
River bulrush *(Scirpus fluviatilis)*	14	●●
Beaked sedge *(Carex utriculata)*	14	●●
Ovoid spikerush *(Eleocharis ovata)*	9	●
Lesser-panicled sedge *(Carex diandra)*	9	●
Aquatic sedge *(Carex aquatilis)*	9	●●
Fragrant cyperus *(Cyperus odoratus)*	9	●
Porcupine sedge *(Carex hystericina)*	9	●●
Woolgrass *(Scirpus cyperinus)*	9	●
Floating-Leaved & Submergent Forbs		
Star-duckweed *(Lemna trisculata)*	64	●●
Lesser-duckweed *(Lemna minor)*	59	●●
Greater duckweed *(Spirodela polyrhiza)*	55	●
Common bladderwort *(Utricularia vulgaris)*	45	●●
Common coontail *(Ceratophyllum demersum)*	36	●●
Water smartweed *(Polygonum amphibium)*	32	●
Flat-stemmed pondweed *(Potamogeton zosteriformis)*	14	●
Common white water-lily *(Nymphaea odorata)*	14	●
Straight-leaved pondweed *(Potamogeton strictifolius)*	9	●
Intermediate bladderwort *(Utricularia intermedia)*	9	●
Yellow pond lily *(Nuphar variegata)*	9	●
Unbranched bur reed *(Sparganium emersum)*	9	●
Emergent Forbs		
Broad-leaved arrowhead *(Sagittaria latifolia)*	64	●
Marsh skullcap *(Scutellaria galericulata)*	64	●
Three-cleft or small bedstraw *(Galium trifidum* or *G. tinctorium)*	59	●
Bur marigold and Beggarticks *(Bidens* spp.)	50	●
Tufted loosestrife *(Lysimachia thyrsiflora)*	45	●
Bulb-bearing water hemlock *(Cicuta bulbifera)*	41	●●
Great water dock *(Rumex orbiculatus)*	41	●
Marsh bellflower *(Campanula aparinoides)*	41	●
Clearweed *(Pilea* spp.)	36	●
Northern bugleweed *(Lycopus uniflorus)*	32	●
Broad-leaved cattail *(Typha latifolia)*	32	●●●●
Touch-me-not *(Impatiens* spp.)	32	●
Giant bur reed *(Sparganium eurycarpum)*	27	●●●
Water parsnip *(Sium suave)*	27	●
Linear-leaved, Marsh, or Downy willow-herb*	23	●
Spotted water hemlock *(Cicuta maculata)*	23	●
Dotted smartweed *(Polygonum punctatum)*	18	●
Sweet flag *(Acorus calamus)*	18	●●●
Swamp milkweed *(Asclepias incarnata)*	18	●
Northern marsh fern *(Thelypteris palustris)*	18	●
Cut-leaved bugleweed *(Lycopus americanus)*	18	●
Marsh cinquefoil *(Potentilla palustris)*	14	●
Spotted Joe pye weed *(Eupatorium maculatum)*	14	●
Marsh horsetail *(Equisetum palustre)*	9	●
Common mint *(Mentha arvensis)*	9	●
Stinging nettle *(Urtica dioica)*	9	●
Nodding smartweed *(Polygonum lapathifolium)*	9	●
Lady's thumb *(Polygonum persicaria)*	9	●
Common water plantain *(Alisma triviale)*	5	●
Shrubs		
Red-osier dogwood *(Cornus sericea)*	9	●●

*Linear-leaved, Marsh, or Downy willow-herb *(Epilobium leptophyllum*, *E. palustre*, or *E. strictum)*