

A VASCULAR FLORA OF THE NORWEGIAN BAY WETLANDS ON GREEN LAKE, GREEN LAKE COUNTY, WISCONSIN

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ABSTRACT

The Norwegian Bay Wetlands (NBW) are located along the western shore of Norwegian Bay on Green Lake, in Green Lake County, Wisconsin. The property, which is held in trust by the Green Lake Sanitary District, encompasses 20.5 acres, including nearly 700 feet of lake frontage.

During this study, 248 vascular plants were collected and identified from the NBW, of which 71 families and 157 genera are represented. All voucher specimens were deposited at OSH. The number of documented species represents 26% of the total county flora, including seven species that are recognized as county records (Eddy 1996, 1999).

Additionally, three species from the NBW are cited in Wisconsin's threatened and endangered species list: *Tofieldia glutinosa* is a state threatened species, while *Calamagrostis stricta* and *Gentianopsis procera* are listed as special concern (WDNR 1999).

Based on knowledge of the present-day NBW flora, a review of the original land survey records, and anecdotal information collected from personal interviews, an overview of past land uses and changes in vegetation is presented.

INTRODUCTION

The Norwegian Bay Wetlands (NBW) comprise part of the largest area of undeveloped shoreland along the western shore of Norwegian Bay on Green Lake, in Green Lake County, Wisconsin (Fig. 1). The bay varies in depth from 3 to 175 feet and is located on the northwest side of Wisconsin's deepest inland lake at 236 feet. Historically, the westernmost rim of the bay was a shallow sand and muck-filled flat, stippled with extensive beds of hardstem bulrush, *Scirpus acutus*, and aquatic submergents (*Potamogeton*, *Elodea*, *Vallisneria*, *Zosterella*, *Zannichellia*).

In 1845, when the first dam was built near the head of Green Lake's main outlet, the raised lake levels resulted in flooding of the original shoreline and contributed to a decline in the littoral zone. The natural shoreland buffer was further diminished by the dredging of a boat canal off the southwest corner of Norwegian Bay and the subsequent development of lakeshore properties. Piers and heavy boat traffic have since become the norm.

In 1998, to offset shoreland development, improve and maintain lake water quality, and protect an environmentally sensitive area, the Green Lake Conservancy Foundation, Inc. (GLCF) and the Green Lake Sanitary District (GLSD), with the support of a state grant, acquired the NBW property to preserve it in perpetuity. The acronym "NBW" is used to describe the property held in trust by the Green Lake Sanitary District and constitutes the study area in this report. The

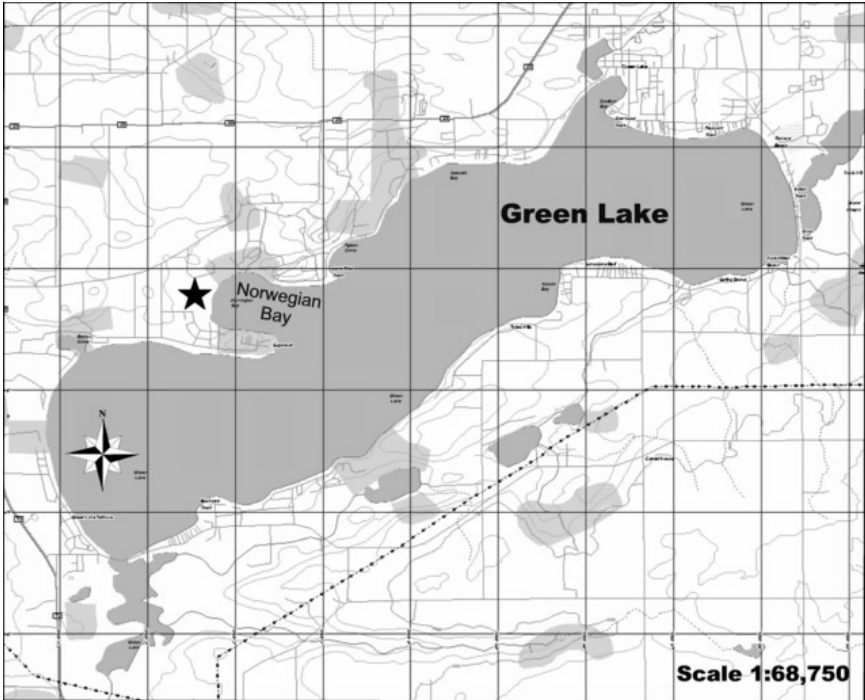


FIGURE 1. Norwegian Bay Wetlands (star) (DeLorme 19999)

NBW encompasses 20.5 acres, including nearly 700 feet of lake frontage. Additional wetlands are contiguous north and south of the property.

Adding to its high-quality natural communities and ecological significance, the NBW is vital because it constitutes the largest wetlands remnant bordering Green Lake and it serves as a Wisconsin Department of Natural Resources (WDNR) "reference site." According to the WDNR, identification and inventory of native shorelands are essential for subsequent shoreland restoration efforts that include plantings of species known to be part of the local native flora. To date, about 60 such restoration projects have occurred on Green Lake shores as part of the Green Lake Association's (GLA) Revitalization of Shoreland Vegetation Project (Lisa Reas, personal communication, 27 August 2001).

LOCATION, GEOLOGY, SOILS, WATER

The NBW is located in Wisconsin's Central Plain region at $N43^{\circ}48.6'$ latitude and $W89^{\circ}2.5'$ longitude in the $NW\frac{1}{4}$ $SW\frac{1}{4}$ section 35, T16N, R12E of Brooklyn Township. Cambrian sandstone is the upper bedrock unit throughout Green Lake Valley, while the surrounding uplands are capped with Ordovician

TABLE 1: Average water quality measurements of spring stream at NBW

Temperature	12.7°Celsius
pH	7.8
Conductivity	250.9 mg/L
Turbidity	34.7 NTU (nephelometric turbidity units)
Flow Rate	0.084 m/sec
Dissolved O ₂	7.0 mg/L
Ammonium (NH ₄ ⁺)	7.1 mg/L
Nitrate (NO ₃ ⁻)	10.7 mg/L
Calcium (Ca ⁺²)	3.1 mg/L
Chloride (Cl ⁻¹)	11.7 mg/L

units of St. Peter sandstone and Prairie du Chien dolomite, respectively (Martin 1965).

Green Lake formed in an ancient preglacial river valley that became dammed by recessional moraines deposited during the Woodfordian stage, 12,000–23,000 years before present (B. P.). The Woodfordian drift, in turn, is covered by glacio-lacustrine sediments deposited by Glacial Lake Oshkosh during the Valdres stage, 6,000–12,000 years B. P. (Paull & Paull 1977). The NBW are situated on the extinct lakebed, below the eastern edge of the recessional moraines.

Soils of the NBW include mostly Houghton muck, with smaller areas of loamy sands and gravels also present. The nearly level and often saturated Houghton muck is derived from lacustrine deposits and oxidized plant material. Besides functioning as a natural buffer that filters, absorbs and stores surface runoff, the organic soils are invaluable for supporting a rich wetlands biota.

An unnamed spring-fed stream, which does not appear on the Princeton East quadrangle map, flows from the northwest property boundary and drains east into a shallow inlet. The thread-like rivulet meanders from west to east through buckthorn thickets, a rich fen assemblage and calcareous meadows. Average water quality measurements near the mouth of the flowage, collected with a CBL (calculator-based laboratory) system in May and August 2001, indicate the stream is of average to above average water quality (Table 1).

ORIGINAL LAND SURVEY RECORDS

The earliest known reports that contain references of specific plants from the NBW area are from the field notes of the original land surveys (General Land Office, 1834 and 1835). The survey records for Township 15 North and Range 12 East were begun on December 26, 1834 and finished January 3, 1835, while surveys for Township 16 North and Range 12 East were begun January 6, 1835 and completed January 15, 1835. A resurvey of the south boundary of T16N was certified on January 3, 1891.

The present-day vegetation patterns for the NBW and adjoining sections correspond closely to the specific names of “witness” trees cited in the original land survey records. Oak forest and savanna were prevalent communities that sur-

rounded the wetlands on Norwegian Bay and were sustained by periodic fires. Trees of the forest and savanna that are frequently reported along town and range lines in the field notes include black, white and bur oak, *Quercus velutina*, *Q. alba* and *Q. macrocarpa*, respectively. Since the records do not consistently cite distances between trees, it is possible that areas mapped oak forest may have actually been oak opening (Finley 1976).

Off the southwest corner of the bay, along the north shore of Sugar Loaf (Sections 1, 2, 3 T15N R12E), the oak forests and openings gathered along the Norwegian Bay shore: "North Between sections 35 & 36 Green Lake Blk Oak on margin of Lake By trigonometry bay of lake 39.88 [chains] wide [equivalent to 0.4985 miles]." Near the quarter section post between sections 35 and 36 the field notes explain: "fell in line north of Lake [at 42.26 chains] Blk Oak 7 [7 inches diameter] on margin of Lake North side." Continuing north on this section line, "W Oak 12" and at the post corner sections, white oak and bur oak are cited as bearing trees and the "Land rolling second rate Blk W & Bur Oak."

North between sections 34 and 35, white and black oak are named at the quarter section post, and at the corner posts of sections 26, 27, 34 and 35 the land is again described as ". . . rolling second rate Blk W and Bur Oak." Then, north between sections 26 and 35, white oak is a bearing tree at the quarter section post: "W Oak 18 [18 inches diameter] Do 12 [ditto, 12 inches diameter]", while 6.67 chains further west, "Bur Oak 17" is reported. In contrast to the presence of oak forest and savanna contiguous with the NBW on the north and west, bearing trees reported in the field notes indicate a subtle transition to mesic forest to the south, i.e. Sugar Loaf. Between sections 1 and 2 of T15N R12E, from the town line between sections 35 and 36 of T16N R12E: "W Oak 16 Iron wood [ironwood, *Ostrya virginiana*]." Then, 13.85 chains further south between the same sections, a post is set on Green Lake, with red cedar (*Juniperus virginiana*) noted and the "Land rolling second rate Oak Lynn [basswood, *Tilia americana*] Iron wood Cedars."

Similarly, south between sections 2 and 3, T15N R12E, "From post on Town line comes sections 34 & 35 T16N R12E," white oak and black oak are present. Five chains and 3 links further south, "Lynn 8 [*Tilia americana*, 8 inches diameter] on margin of Green Lake between sections 2 & 3." The presence of *Tilia* and *Ostrya* as bearing trees is understandable, given the fact that the range lines immediately south of sections 35 and 36 of T16N R12E mark the north face slope of Sugar Loaf, a prominent dolomitic-capped peninsula that borders the southern shore of Norwegian Bay.

Ironically, nowhere do the original field notes refer to wetlands within the NBW study area. The omission may be attributed to the fact that the study area is not located along the range and township section lines.

PLANT COMMUNITIES

According to the county wetlands GIS polygon, the entire wetlands area of Norwegian Bay is 67.03 acres, or 53%, of the total wetlands on Green Lake (126



FIGURE 2. GIS aerial map depicting wetlands at Norwegian Bay (lightened area) (Wisconsin Department of Natural Resources 1998). The entire area is classified as S3K wetlands (scrub/shrub, broad-leaved deciduous, wet soil, palustrine), based on the WDNR's classification system for wetlands inventory (WDNR 1992).

acres) (WDNR 1998). Of this, the study site comprises 20.5 acres, or 30.5% of the Norwegian Bay wetlands (Fig. 2). The land is classed as S3K wetlands (scrub/shrub, broad-leaved deciduous, wet soil, palustrine), based on the WDNR's classification system for wetlands inventory (WDNR 1992). By comparison, the second-largest wetlands remnant on Green Lake, 18.25 acres, is located on Blackbird Point, east of Dodge County Park on the southwest shore of the main body of Green Lake.

Among the plant communities to occur at the NBW are marsh, shrub-carr, sedge meadow, low prairie, and fen (Fig. 3). Additionally, a low wood on the southwest boundary off Bay Road contains *Populus tremuloides*, *P. deltoides*, and *Juniperus virginiana*. Unfortunately, crowded thickets of *Rhamnus cathartica* and *R. frangula* flourish beneath the canopy. West from here, a small oak wood at higher elevation contains a scattering of *Prunus serotina*, *Quercus alba* and *Q. velutina*.

Pockets of emergent marsh, especially near the lakeshore, are occupied by dense colonies of *Typha angustifolia* and *T. latifolia*, with lesser amounts of *Spartanium eurycarpum* present. *Phalaris arundinacea*, is common, as is *Phrag-*

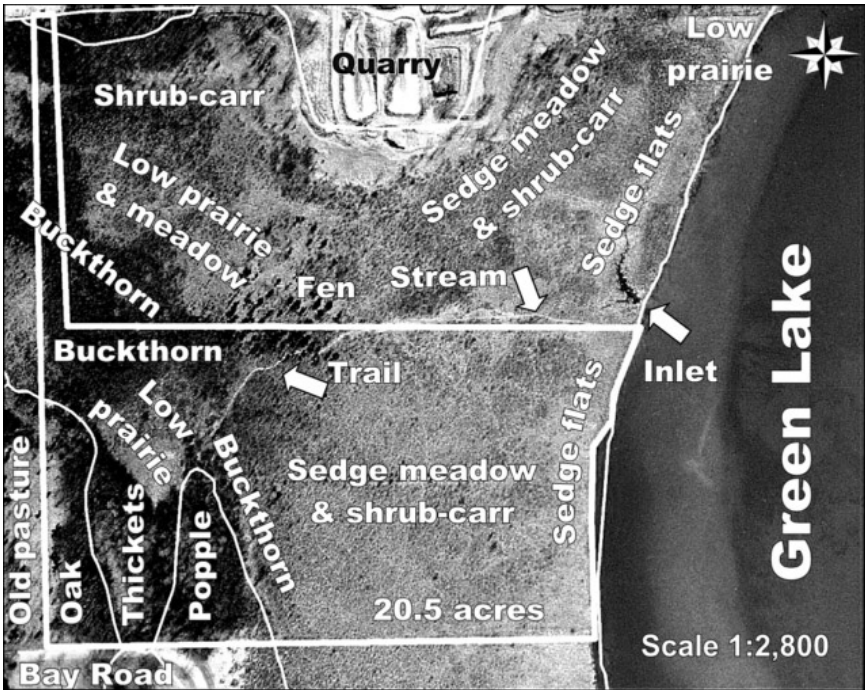


FIGURE 3. GIS aerial map depicting general vegetation patterns for Norwegian Bay Wetlands (20.5 acres) and bordering lands (Wisconsin Department of Natural Resources 1998). Thin lines are soil type contours, while property boundaries are denoted by thick lines. Note the original shoreline, which appears as a lightened area offshore, on the right side of the photograph.

mites australis, which forms a monotypic stand beside a man-made trail near the northeast boundary. Other common emergent aquatic species present include *Equisetum fluviatile*, *Sagittaria cuneata* and *S. latifolia*, *Cicuta bulbifera*, *Aster puniceus*, *Polygonum amphibium*, *Bohemeria cylindrica*, *Cyperus strigosus*, *Eleocharis palustris*, and *Scirpus atrovirens*.

Calcareous sedge meadow occupies the greatest area of the NBW. *Carex stricta* is prevalent, while *C. hystericina*, *C. lacustris* and *C. lasiocarpa* are among the common carices. Characteristic forbs include *Cicuta maculata*, *Oxypolis rigidior*, *Sium suave*, *Bidens* species, *Cirsium muticum*, *Erigeron philadelphicus*, *Eupatorium maculatum*, *Solidago uliginosa*, *Campanula aparinoides*, *Scutellaria galericulata*, *Lysimachia quadriflora* and *L. thyrsoiflora*, *Geum alep-picum*, *Agalinis purpurea*, *Pedicularis lanceolata*, and *Verbena hastata*.

Liparis loeselii, one of two orchids known from the NBW, is rare among sedge tussocks, while *Spiranthes cernua* is locally common. *Viola nephrophylla*, an early flowering violet of wet, cold soils, is likewise very local, as is *Apios americana*, which vines along portions of the lakeshore.

Sedge flats along the shoreline are less hummocky and form bog-like mats.

Distinctive *Carex* on these quaking shoreland flats, but not restricted to them, include *C. buxbaumii*, *C. leptalea*, *C. limosa* and *C. vesicaria*. Other sedges include *Eriophorum polystachion* and *Eleocharis acicularis*. The grasses *Leersia oryzoides* and *Muhlenbergia racemosa* are interspersed among the sedges.

Two other species that grow on the sedge flats are *Cyperus diandrus*, an uncommon shoreland plant, and *Menyanthes trifoliata*, a circumboreal plant of sphagnum bogs and wet coniferous forests. Even though *M. trifoliata* is present, characteristic bog ericads were not observed. Prior to this study, the occurrence of *M. trifoliata* in Green Lake County was known only from a University of Wisconsin-Madison (WIS) voucher that was collected near White River Marsh in 1956, while *Cyperus diandrus* was collected in "Drying mud, shore of L. Marion" [Lake Maria, Manchester Township] in 1931 (Theodore C. Cochrane, personal communications, 4 September & 23 October 2001).

Fire suppression accounts for the sustained invasion and ongoing succession of meadow to shrub-carr. *Cornus sericea* and *Salix* spp. are most prevalent throughout, while *Larix laricina*, *Toxicodendron vernix*, and *Betula glandulosa* are more local. *Rhamnus frangula* is spreading, and except for an occasional deer trail, is impenetrable along sections of the trail and spring stream where past disturbances occurred. Indeed, a "buckthorn swamp" surrounds the spring stream along the western boundary. Like *R. frangula*, *Lythrum salicaria* is spreading throughout the NBW, but it is most prominent beside the trail nearest the lakeshore.

Sedge meadow blends into low prairie where grasses are dominant. Prairie along the northwest property boundary is represented by *Calamagrostis canadensis* and *C. stricta*, *Muhlenbergia* spp., *Glyceria striata*, and *Andropogon gerardii*. *Hierochloa odorata* grows intermittently, while *Spartina pectinatus* is typical in wet prairie areas.

Springy, calcareous soils are characteristic of fen, a tie-in between low prairie and sedge meadow. Fen-indicator species occur in calcareous meadows, but their greatest frequencies occur in a fen that lies parallel to the trail and borders the spring stream that flows east. Among the calciphiles known from this assemblage are *Aster umbellatus*, *Gentianopsis procera*, *Lobelia kalmii*, *Parnassia glauca*, *Potentialla fruticosa*, *Solidago riddellii* and *Spiranthes cernua*. A state threatened lily, *Tofieldia glutinosa*, is a rare spring-flowering calciphile that was also documented from this fen.

Wave action and shoreline erosion aid seed dispersal and germination of *Echinochloa walteri* and *Polygonum lapathifolium*, common annual natives that grow on muddy shoreland soils. *Lysimachia vulgaris*, a county record during this study, is an escaped garden perennial that is established near the mouth of the spring stream. The plant was likely introduced as seed, transported by water from a nearby lakeshore property.

Offshore, efforts by the GLSD have been undertaken to protect and propagate a relict stand of *Scirpus acutus*. In the same area, submergents include *Potamogeton* spp., *Vallisneria americana*, *Zosterella dubia*, *Elodea canadensis*, and *Zannichellia palustris*.

LAND USE AND CHANGES IN VEGETATION

Five factors, based in part on anecdotal information, have contributed to changes in the NBW vegetation since the time of European settlement, circa 1835: 1) dam construction, 2) fire suppression, 3) the use of wetlands for pasturage, 4) shoreland development, and 5) the introduction of invasive weeds.

Anson Dart and Smith Fowler constructed the earliest dam in 1845 by impounding the Puchyan River, Green Lake's main outlet (Heiple & Heiple 1976). Initially the raised water levels were used to power a sawmill, then later a gristmill. Eventually, regulation of lake water levels accommodated lakeshore property owners by improving access to piers and recreational boating. The artificially elevated water levels flooded shorelines and adversely impacted shoreland vegetation. Historically, lake levels fluctuated between seasonal drawdowns and flooding, thus allowing for effective seed dispersal and germination. However, after the dam was built, seed reproduction by *Scirpus acutus* and other littoral emergents was diminished.

In the early 1960s, duck hunters anchored a camouflaged houseboat amid the bulrush (Danny Stoneberg, personal communication, 16 September 2001). At that time there were three main stands of hardstem bulrush that covered a larger area and were considerably denser than the present-day stand (Fig. 4). During the 1970s the bulrush beds were sufficiently dense to easily conceal one, maybe



FIGURE 4. Norwegian Bay Wetlands. Note the narrow line of hardstem bulrush, *Scirpus acutus*, in the background. Sugar Loaf, a prominent dolomitic-capped peninsula that borders the southern shore of Norwegian Bay, appears on the right in the background. Photo by the author, 2 September 2000.

two pontoon boats (Steve Lewis, personal communication, 27 August 2001). Presently, about one-quarter of the original bulrush area survives (Kenny Berger, personal communication, 16 September 2001).

Before European settlement, recurring drought and fire were natural features of the oak savanna landscape. However, since the late 1940s, and probably much earlier, fire has been suppressed at the NBW (Chuck Dahlke, personal communication, 27 August 2001). Marsh, sedge meadow, low prairie, and fen are fire-dependent communities that require periodic burning to recycle nutrients and stimulate growth, arrest invasive weeds, and check woody succession. Land use and development surrounding the NBW area by the mid-1900s was more than enough to discourage a managed burn during a dry year—Chuck Dahlke (personal communication, 27 August 2001) recalls a dry year in the early 1950s. While leading cattle from the NBW back to the family farm, he was able to walk down to the lakeshore without getting his feet wet.

The use of the NBW for pasture had a profound impact on the character of the vegetation over time. Soils on the better-drained portions of the property became compacted by grazing herds and the disturbance created ideal conditions for weeds to become established. Aside from helping prune back woody growth where forage was accessible, the continuous grazing probably favored some species over others, and eventually may even have extirpated certain native plants on the property. From 1952 to 1955, Holstein heifers grazed the NBW, but the wetlands served as pasturage for many years even prior to Dahlke ownership (Chuck Dahlke & Anita Dahlke, personal communications, 27 & 28 August 2001).

To create greater access to pasture, a drainage ditch was hand-dug along the southern boundary to partially drain the wetlands (Steve Lewis, personal communication, 2 September 2001). After 1955, the property was no longer used as grazing land and the disturbed areas became overgrown with brush soon after. The property has since been used as recreational land, notably for whitetail deer and duck hunting.

Shoreland development accelerated in Norwegian Bay in the late 1950s. By the mid-1960s, wetlands dredging in the southwest corner of the bay produced a boat canal and generated further interest in development of shoreland properties. The wakes created by increased boating activity continue to contribute to shoreland erosion, and propeller turbulence in shallow areas can cause littoral plants to become uprooted.

In the early 1950s, a sewage treatment plant was constructed northeast of the NBW on the grounds of the American Baptist Assembly. The treated effluent may have benefited wild celery, *Vallisneria americana* (Danny Stoneberg, personal communication, 16 September 2001). Stoneberg noted dense colonies of flowering *Vallisneria* growing near the mouth of the discharge stream, which he suggested was due partly to the increased nutrients from the treated effluent.

When the property was acquired from the Dahlke family in 1992, the land was “very brushy” and in 1994, a trail was established that leads northeasterly off Bay Road to a permanent duck blind on the lakeshore (Steve Lewis, personal communication, 27 August 2001). A major invasion of glossy buckthorn, *Rhamnus frangula*, is evident, but the densest thickets border the trail and the spring stream on the western half of the property. Near the trailhead off Bay Road, *R.*

frangula is joined by European buckthorn, *R. cathartica*, and Bella honeysuckle, *Lonicera xbella*, two more non-native invasive shrubs. On the opposite end of the trail, large patches of purple loosestrife, *Lythrum salicaria*, are established on both sides of the wooden walkway.

The GLSD and GLCF recognize the need to control the spread of these invasive exotics. The organizations are committed to a management plan that provides the resources and manpower to safely eradicate these ubiquitous weeds, while at the same time protecting and fostering the native vegetation cover.

METHODOLOGY AND CATALOG DESIGN

The catalog of species is based upon plant collections obtained during the 2000 and 2001 growing seasons. Most of the plants listed in the catalog are native, but non-native "naturalized" species are included, as well as cultivars that may have escaped and reproduce spontaneously. In addition to wetlands, roadside collections off Bay Road include upland prairie species and common roadside weeds. Voucher specimens and duplicates were identified and deposited in the University of Wisconsin-Oshkosh Herbarium (OSH). Plant families in the catalog are alphabetized within the major plant groups, as are the genera and species within a family. Nomenclature follows Gleason & Cronquist (1991). The treatment of narrowly defined species and most infraspecific taxa is avoided, as is the listing of synonyms.

Collection numbers that are cited are my own, except for 13 specimens vouchered by my students, and are deposited at OSH. Plants collected and identified during this study that are not included in the published county flora (Eddy 1996) are reported as county records.

One state threatened species, *Tofieldia glutinosa*, was found to occur at the NBW. The threatened status of this rare lily is based on the WDNR's threatened and endangered species list, which was last revised in June 1998 (WDNR 1999). Two additional species, *Calamagrostis stricta* and *Gentianopsis procera*, are listed as special concern, because statewide they show "some problems of abundance or distribution . . ." (WDNR 1999).

COUNTY RECORDS AND SUMMARY OF TAXA

The majority of species compiled for the NBW flora are included as part of the Green Lake County vascular flora (Eddy 1996, 1999). Nonetheless, seven species previously unreported for the county until collected for this study are: *Utricularia intermedia*, *Lysimachia vulgaris*, *Potentilla intermedia*, *Viola nephrophylla*, *V. selkirkii*, *Carex vesicaria*, and *Poa glauca*.

At present, the number of documented vascular plants at the NBW is 248 species (Table 2). This represents 26% of the total county flora (958 species) (Eddy 1996, 1999). A summary of the number of families, genera, and species

TABLE 2. Summaries of Major Plant Taxa at NBW

PLANT GROUP	Families	Genera	Species
Pteridophytes	4	5	8
Gymnosperms	2	2	2
Dicotyledons	50	105	152
Monocotyledons	15	45	86
TOTALS	71	157	248

TABLE 3. A Comparison of the Three Largest Dicot¹ and Monocot Families

DICOTS	Genera	Species	% of total NBW flora
Asteraceae	19	31	12.5%
Rosaceae	7	10	4%
Lamiaceae	7	8	3.2%
MONOCOTS			
Cyperaceae	6	32	12.9%
Poaceae	21	28	11.3%
Potamogetonaceae	1	6	2.4%
TOTALS	61	115	46.3%

¹The Lamiaceae and Polygonaceae are each represented by eight species.

for the three largest dicot and three largest monocot families is compiled in Table 3.

A single family, the Asteraceae, represents about one-fifth or 20.4% of the total number of dicots, while the Poaceae and Cyperaceae together account for 69.8% of the total number of monocots. The combined number of species of the three largest dicot and monocot families comprises 46.3% of the total NBW flora (Table 3).

CATALOG OF SPECIES

PTERIDOPHYTES

EQUISETACEAE

- Equisetum arvense* L. (Eddy 4872; Eddy & Ellis 4752)
E. fluviatile L. (Eddy 4818, 4872; Eddy & Ellis 4741, 4756)

ASPLENIACEAE

- Dryopteris cristata* (L.) A. Gray (Eddy 4871, 4882, 4978)
D. intermedia (Muhl.) A. Gray (Eddy 4976)
Thelypteris palustris Schott var. *pubescens* (Lawson) Fern. (Eddy & Ellis 4772)

ONOCLEACEAE

- Onoclea sensibilis* L. (Eddy & Ellis 4803)

OSMUNDACEAE

- Osmunda cinnamomea* L. (Eddy 4833)

O. regalis L. var. *spectabilis* (Willd.) A. Gray (Eddy & Ellis 4714, 4715)

GYMNOSPERMS

CUPRESSACEAE

Juniperus virginiana L. (Eddy 4824, 4895; Eddy & Ellis 4737)

PINACEAE

Larix laricina (Du Roi) K. Koch (Eddy & Ellis 4774, 4939)

DICOTYLEDONS

ACERACEAE

Acer negundo L. (Eddy 4878; Eddy & Ellis 4958)

AMARANTHACEAE

Amaranthus tuberculatus (Moq.) Sauer (Eddy & Harriman 5049)

ANACARDIACEAE

Toxicodendron vernix (L.) Kuntze (Eddy & Ellis 4964)

APIACEAE

Angelica atropurpurea L. (Eddy 4849)

Cicuta bulbifera L. (Eddy 5005; Eddy & Ellis 4810)

C. maculata L. (Eddy 4993)

Pastinaca sativa L. (Eddy 4910)

Sium suave Walter (Eddy 5017; Eddy & Ellis 4782)

Zizia aurea (L.) Koch (Eddy 4816; K. Valasek 027)

APOCYNACEAE

Apocynum sibiricum Jacq. (Eddy & Neil 4921)

ASCLEPIADACEAE

Asclepias incarnata L. (Eddy & Ellis 4730, 4944)

A. syriaca L. (Eddy & Ellis 4957)

A. tuberosa L. (Eddy 4994)

ASTERACEAE

Achillea millefolium L. (Eddy 4906)

Ambrosia artemisiifolia L. (Eddy 5020)

Aster borealis Prov. (Eddy & Ellis 4723, 4780, 4807)

A. lateriflorus (L.) Britton (Eddy & Ellis 4765, 4785)

A. novae-angliae L. (Eddy 5072)

A. puniceus L. (Eddy & Ellis 4802)

A. umbellatus Miller (Eddy 5014; Eddy & Ellis 4728, 4784)

Bidens cernua L. (Eddy 5062)

B. coronata (L.) Britton (Eddy 5028; Eddy & Ellis 4790)

B. frondosa L. (Eddy 5040; Eddy & Ellis 4755)

Chrysanthemum leucanthemum L. (N. Ellis 011)

Cirsium muticum Michx. (Eddy & Ellis 4758 uncommon white form; Eddy & Ellis 4773 typical pink form)

Erechtites hieracifolia (L.) Raf. (Eddy 5037)

Erigeron philadelphicus L. (Eddy 4831; Eddy & Ellis 4713; N. Ellis 011)

Eupatorium maculatum L. (Eddy 4989; Eddy & Ellis 4770)

E. perfoliatum L. (Eddy 4980; Eddy & Ellis 4776)

E. rugosum Houttuyn (Eddy 5071)

Helianthus giganteus L. (Eddy 5012, 5073)

H. hirsutus Raf. (Eddy & Ellis 4930)

Heliopsis helianthoides (L.) Sweet (Eddy 5013)

Hieracium caespitosum Dumort. (Eddy 4905)
Krigia biflora (Walter) S. F. Blake (Eddy 4889; Eddy & Ellis 4719)
Matricaria matricarioides (Less.) Porter (Eddy 4912)
Rudbeckia hirta L. (Eddy & Ellis 4761, 4963)
Solidago canadensis L. var. *canadensis* (Eddy 4979; Eddy & Ellis 4740)
S. riddellii Frank. (Eddy & Ellis 4783)
S. rigida L. var. *rigida* (Eddy 5031)
S. uliginosa Nutt. (Eddy 5030; Eddy & Ellis 4781)
Sonchus oleraceus L. (Eddy & Harriman 5050)
Taraxacum officinale Weber (Eddy 5019)
Tragopogon pratensis L. (Eddy 5018)

BALSAMINACEAE

Impatiens capensis Meerb. (Eddy & Ellis 4771, 4973)

BERBERIDACEAE

Berberis thunbergii DC. (Eddy 4870)
Podophyllum peltatum L. (Eddy 4868)

BETULACEAE

Betula glandulosa Michx. (Eddy & Ellis 4775; Eddy & Harriman 5059)
B. papyrifera Marshall (Eddy & Ellis 4736, 4762)

BORAGINACEAE

Myosotis scorpioides L. (Eddy & Neil 4919)

BRASSICACEAE

Cardamine rhomboidea (Pers.) DC. (C. Carroll 021; Eddy 4856)
Lepidium densiflorum Schrader (Eddy 4913)

CAMPANULACEAE

Campanula aparinoidea Pursh (Eddy & Ellis 4727)
Lobelia kalmii L. (Eddy & Ellis 4764)
L. siphilitica L. (Eddy 5070)
L. spicata Lam. var. *spicata* (Eddy 4996; Eddy & Ellis 4968)

CAPRIFOLIACEAE

Lonicera xbella Zabel (Eddy 4832; N. Ellis 010)

CAROPHYLLACEAE

Saponaria officinalis L. (Eddy & Ellis 4949)

CERATOPHYLLACEAE

Ceratophyllum demersum L. (Eddy & Neil 4920)

CLUSIACEAE

Hypericum perforatum Lam. (Eddy & Ellis 4948)

CONVOLVULACEAE

Convolvulus arvensis L. (Eddy 4886)

CORNACEAE

Cornus sericea L. (Eddy 4814; Eddy & Ellis 4796)

EUPHORBIACEAE

Acalypha rhomboidea Raf. (Eddy 5036)

FABACEAE

Apios americana Medikus (Eddy & Ellis 4749; Eddy & Harriman 5060)
Lathyrus palustris L. (Eddy 4843; Eddy & Ellis 4689, 4961)

- Medicago lupulina* L. (Eddy 4902; Eddy & Ellis 4908)
Melilotus alba Medikus (Eddy & Ellis 4950)
M. officinalis (L.) Pallas (Eddy 4909)
Trifolium pratense L. (Eddy 4995)
T. repens L. (Eddy 4911)

FAGACEAE

- Quercus alba* L. (Eddy 4877)
Q. velutina Lam. (Eddy 4879)

GENTIANACEAE

- Gentiana andrewsii* Griseb. (Eddy 5025; Eddy & Ellis 4805)
Gentianopsis procera (Holm.) Ma STATE SPECIAL CONCERN (Eddy & Ellis 4778)

GERANIACEAE

- Geranium maculatum* L. (Eddy 4875)

LAMIACEAE

- Lycopus americanus* Muhl. (Eddy 5003; Eddy & Ellis 4724, 4950)
L. uniflorus Michx. (Eddy 5043)
Mentha arvensis L. var. *canadensis* Kuntze (Eddy 5068)
Monarda fistulosa L. (Eddy & Ellis 4956)
Prunella vulgaris L. (Eddy & Ellis 4955)
Pycnanthemum virginianum (L.) Durand & B. D. Jackson (Eddy 4839, 4983; Eddy & Ellis 4766)
Scutellaria galericulata L. (Eddy 4982, 5001; Eddy & Ellis 4742, 4936, 4947)
Teucrium canadense L. var. *occidentale* (A. Gray) McClintock & Epling (Eddy 5011; Eddy & Ellis 4811)

LENTIBULARIACEAE

- Utricularia intermedia* Hayne (Eddy & Neil 4928) COUNTY RECORD
U. vulgaris L. (Eddy 4838; Eddy & Ellis 4800)

LYTHRACEAE

- Lythrum alatum* Pursh (Eddy & Ellis 4945)
L. salicaria L. (Eddy & Ellis 4738)

MENYANTHACEAE

- Menyanthes trifoliata* L. (Eddy 4846; Eddy & Ellis 4793)

MONOTROPACEAE

- Monotropa uniflora* L. (Eddy 5000)

NYMPHAEACEAE

- Nuphar variegata* Durand (Eddy 5064)

ONAGRACEAE

- Circaea lutetiana* L. (Eddy & Ellis 4967)
Epilobium ciliatum L. (Eddy 5039; Eddy & Ellis 4760)

OXALIDACEAE

- Oxalis stricta* L. (Eddy 5035)

PLANTAGINACEAE

- Plantago rugelii* Decne. (Eddy 4914, 4997)

POLEMONIACEAE

- Phlox pilosa* L. (Eddy 4823; Eddy & Ellis 4690)

POLYGONACEAE

- Polygonum amphibium* L. (Eddy & Ellis 4744, 4750, 4941; Eddy & Harriman 5047; Eddy & Neil 4918)
P. aviculare L. (Eddy 4985)
P. lapathifolium L. (Eddy & Ellis 4745; Eddy & Harriman 5047)
P. persicaria L. (Eddy & Ellis 4763)
P. punctatum Elliott var. *punctatum* (Eddy 4990; Eddy & Ellis 4759)
Rumex acetosella L. (Eddy & Ellis 4720)
R. crispus L. (Eddy 4904)
R. orbiculatus A. Gray (Eddy 5006; Eddy & Ellis 4801)

PRIMULACEAE

- Lysimachia quadriflora* Sims. (Eddy & Ellis 4743; Eddy & Neil 4931)
L. thysiflora L. (Eddy 4842; Eddy & Ellis 4688)
L. vulgaris L. (Eddy & Neil 4929) COUNTY RECORD

RANUNCULACEAE

- Anemone canadensis* L. (Eddy & Neil 4934)
A. quinquefolia L. (K. Valasek 028)
Caltha palustris L. (C. Carroll 024)
Ranunculus longirostris Godron. (Eddy & Neil 4935)
R. pensylvanicus L. f. (Eddy 4975)
R. recurvatus Poirlet (Eddy 4821)

RHAMNACEAE

- Rhamnus cathartica* L. (Eddy 5038; Eddy & Ellis 4804)
R. frangula L. (Eddy & Ellis 4739)

ROSACEAE

- Fragaria virginiana* Duchesne (Eddy 4853)
Geum aleppicum Jacq. var. *strictum* (Aiton) Fern. (Eddy 4894; Eddy & Ellis 4946)
G. canadense Jacq. (Eddy 4971)
Potentilla fruticosa L. (Eddy & Ellis 4701, 4779)
P. intermedia L. (Eddy 4888) COUNTY RECORD
P. simplex Michx. (Eddy & Ellis 4712)
Prunus serotina Ehrh. (Eddy 4880)
Pyrus malus L. (Eddy 4881)
Rosa palustris Marshall (Eddy & Ellis 4953)
Spiraea tomentosa L. (Eddy 5004)

RUBIACEAE

- Galium boreale* L. (Eddy & Ellis 4704)
G. labradoricum (Wieg.) Wieg. (C. Carroll 025; Eddy 4857)

SALICACEAE

- Populus deltoides* Marshall (Eddy 4900; Eddy & Ellis 4951)
P. tremuloides Michx. (Eddy & Ellis 4970)
Salix bebbiana Sargent (Eddy 4865; Eddy & Ellis 4747)
S. candida Fluegge (Eddy 4866; Eddy & Ellis 4681, 4746)
S. exigua Nutt. (Eddy & Ellis 4952)
S. fragilis L. (Eddy 5063)
S. pedicellaris Pursh (Eddy 4817)

SAXIFRAGACEAE

- Parnassia glauca* Raf. (Eddy & Ellis 4729)

SCROPHULARIACEAE

- Agalinis purpurea* (L.) Pennell var. *parviflora* (Benth.) B. Boivin (Eddy & Ellis 4733, 4777)
Chelone glabra L. (Eddy 5024, 5056; Eddy & Ellis 4722)

- Pedicularis lanceolata* Michx. (Eddy 5015; Eddy & Ellis 4767; Eddy & Neil 4932)
Penthorum sedoides L. (Eddy 5008)
Verbascum thapsus L. (Eddy 4992)
Veronica officinalis L. (Eddy 4890; Eddy & Ellis 4716, 4717)

SOLANACEAE

- Solanum dulcamara* L. (Eddy & Ellis 4685)

TILIACEAE

- Tilia americana* L. (Eddy 5016)

ULMACEAE

- Ulmus americana* L. (Eddy 4841, 4901; Eddy & Ellis 4962)

URTICACEAE

- Bohemeria cylindrica* (L.) Swartz (Eddy & Ellis 4787, 4960)
Pilea pumila (L.) A. Gray (Eddy & Ellis 4757)
Urtica dioica L. var. *procera* (Muhl.) Wedd. (Eddy & Ellis 4795)

VERBENACEAE

- Verbena hastata* L. (Eddy & Ellis 4731, 4954)

VIOLACEAE

- Viola nephrophylla* Greene (Eddy 4854; Eddy & Ellis 4806) COUNTY RECORD
V. selkirkii Pursh (Eddy 4819) COUNTY RECORD
V. sororia Willd. (Eddy 4852)

VITACEAE

- Parthenocissus vitacea* (Knerr) A. Hitch. (Eddy 4876)
Vitis riparia Michx. (Eddy 4915, 5002)

MONOCOTYLEDONS

ALISMATACEAE

- Alisma subcordatum* Raf. (Eddy 4972)
Sagittaria cuneata Sheldon (Eddy 4977)
S. latifolia Willd. (Eddy 5042; Eddy & Harriman 5057)

COMMELINACEAE

- Tradescantia ohiensis* Raf. (Eddy 4903)

CYPERACEAE

- Carex alopecoidea* Tuckerman (C. Carroll 020)
C. buxbaumii Wahlenb. (Eddy 4827, 4862; Eddy & Ellis 4684)
C. bebbii (L. Bailey) Fern. (Eddy 4883, 4974; Eddy & Ellis 4677, 4959)
C. festucacea Schk. (Eddy 4999)
C. foenea Willd. (Eddy 4815, 4834, 4836)
C. hystericina Muhl. (Eddy 4840, 4850; Eddy & Ellis 4707, 4711, 4791)
C. interior L. Bailey (Eddy 4835, 4837, 4860)
C. lacustris Willd. (Eddy 4845; Eddy & Ellis 4683)
C. lasiocarpa Ehrh. (Eddy 4859)
C. leptalea Wahlenb. (Eddy 4812; Eddy & Ellis 4702, 4709, 4799)
C. limosa L. (Eddy 4820)
C. pseudocyperus L. (Eddy & Ellis 4792)
C. rosea Schk. (Eddy 4892; Eddy & Ellis 4675, 4676)
C. sartwellii Dewey. (Eddy & Ellis 4686)
C. stricta Lam. (C. Carroll 023; Eddy 4825, 4848, 4863; Eddy & Ellis 4692)
C. stipata Muhl. (Eddy 4822, 4847, 4867)
C. tetanica Schk. (Eddy 4813, 4828, 4864; Eddy & Ellis 4693, 4710, 4718)

- C. vesicaria* L. (Eddy 4885; Eddy & Ellis 4687) COUNTY RECORD
Cyperus bipartitus Torr. (Eddy & Ellis 4754)
C. diandrus Torr. (Eddy 5066; Eddy & Ellis 4942; Eddy & Harriman 5045)
C. odoratus L. (Eddy 5009)
C. strigosus L. (Eddy 5067)
Eleocharis acicularis (L.) Roemer & Schultes (Eddy 4897)
E. compressa Sullivant (Eddy 4896)
E. intermedia (Muhl.) Schultes (Eddy & Ellis 4678, 4943)
E. palustris L. (Eddy 4851)
Eriophorum polystachion L. (Eddy 4858; Eddy & Ellis 4703)
Rhynchospora capillacea Torr. (Eddy & Ellis 4966)
Scirpus atrovirens Willd. (Eddy 4899; Eddy & Ellis 4700, 4788; Eddy & Neil 4933)
S. cyperinus (L.) Kunth (Eddy 5026)
S. pungens Vahl. var. *longispicatus* (Britton) Cronq. (Eddy & Ellis 4705)
S. acutus Muhl. ex Bigelow (Eddy 4887; Eddy & Ellis 4808)

HYDROCHARITACEAE

- Elodea canadensis* Michx. (Eddy & Neil 4923)
Vallisneria americana L. (Eddy 5010; Eddy & Harriman 5049)

IRIDACEAE

- Iris versicolor* L. (Eddy 4867a; Eddy & Ellis 4682)

JUNCACEAE

- Juncus greenii* Oakes & Tuckerman (Eddy & Ellis 4697, 4937)
J. tenuis Willd. var. *dudleyi* (Wieg.) F. J. Herm. (Eddy 4830)
Luzula multiflora (Retz.) Lej. (Eddy 4891)

LEMNACEAE

- Lemna minor* L. (Eddy & Neil 4920)

LILIACEAE

- Hypoxis hirsuta* (L.) Cov. (Eddy & Ellis 4706; K. Valasek 029)
Tofieldia glutinosa (Michx.) Pers. (Eddy & Ellis 4748) STATE THREATENED

ORCHIDACEAE

- Liparis loeselii* (L.) Rich. (Eddy & Ellis 4725)
Spiranthes cernua (L.) Rich. (Eddy & Ellis 4726; Eddy & Harriman 5041)

POACEAE

- Andropogon gerardii* Vitman. (Eddy 49941; Eddy & Ellis 4769)
Bromus ciliatus L. (Eddy 4893; Eddy & Ellis 4735)
B. inermis Leysser (Eddy 4907)
Calamagrostis canadensis (Michx.) P. Beauv. (Eddy 4873; Eddy & Ellis 4969)
C. stricta (Timm) Koeler (Eddy 4884, 4988) STATE SPECIAL CONCERN
Digitaria ischaemum (Schreber) Muhl. (Eddy 5033)
Echinochloa walteri (Pursh) Heller (Eddy & Ellis 4809; Eddy & Harriman 5044)
Elymus trachycaulus (Link) Gould (Eddy & Ellis 4768)
Elytrigia repens (L.) Nevski. (Eddy 4986; Eddy & Ellis 4965)
Glyceria striata (Lam.) A. Hitch. (Eddy 4829, 4861, 4869; Eddy & Ellis 4691, 4696, 4698)
Hierochloa odorata (L.) P. Beauv. (C. Carroll 021; Eddy 4855; Eddy & Ellis 4680, 4699)
Leersia oryzoides (L.) Swartz (Eddy & Harriman 5048)
Muhlenbergia glomerata (Willd.) Trin. (Eddy & Ellis 4734)
M. mexicana (L.) Trin. (Eddy & Ellis 4721, 4751, 4798)
M. racemosa (Michx.) BSP. (Eddy 4984; Eddy & Ellis 4794)
Panicum capillare L. (Eddy 5046)
P. lanuginosum Elliott var. *septentrionale* Fern. (Eddy 4898, 4981; Eddy & Ellis 4753, 4938)
P. dichotomiflorum Michx. (Eddy 4998)
Phalaris arundinacea L. (Eddy & Ellis 4694; N. Ellis 012)

- Phleum pratense* L. (Eddy 5001)
Phragmites australis (Cav.) Trin. (Eddy 5027; Eddy & Ellis 4789)
Poa glauca Vahl (Eddy & Ellis 4695) COUNTY RECORD
P. pratensis L. (Eddy 4916)
Schizachyrium scoparium (Michx.) Nash var. *scoparium* (Eddy 5029)
Setaria viridis (L.) P. Beauv. (Eddy 4987)
Spartina pectinata Link (Eddy & Ellis 4797)
Sphenopholis obtusata (Michx.) Scribn. var. *major* K. S. Erman. (Eddy 4874)
Sporobolus neglectus Nash (Eddy 5034)

PONTEDERIACEAE

- Zosterella dubia* (Jacq.) Small (Eddy 5022)

POTAMOGETONACEAE

- Potamogeton crispus* L. (Eddy & Neil 4924)
P. filiformis Pers. (Eddy 5021, 5065)
P. friesii Rupr. (Eddy & Neil 4925)
P. gramineus L. (Eddy & Neil 4927)
P. pectinatus L. (Eddy 5069)
P. robbinsii Oakes. (Eddy & Harriman 5048)

SPARGANIACEAE

- Sparganium eurycarpum* Engelm. (Eddy & Neil 4917)

TYPHACEAE

- Typha angustifolia* L. (Eddy & Neil 4922)
T. latifolia L. (Eddy & Ellis 4940)

ZANNICHELLIACEAE

- Zannichellia palustris* L. (Eddy 5023)

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