Hydrologic and Biological Findings

for the Conservation Master Plan

Bay Shore Blufflands State Natural Area

January 2015

Groundwater Flow Model Construction
September 2014, Kenneth R. Bradbury

Green Bay Water Testing Preliminary Report
2014, Dan Collins

Quantitative Macroinvertebrate Survey
June - July 2014, Kurtis Quamme

Odonate Survey
2014, Mary Standish

Pilot Herptile Assessment
2014, Gary S. Casper and Ryne D. Rutherford

Great Lakes Coastal Wetlands Monitoring Program
2014, Erin Giese et al

Breeding Bird Survey
June - July 2014, Paul Regnier

Migratory Bird Survey
2014, Michael Grimm

Small Mammal Survey & Recommendations
2014, Reis, Callaghan, Loedding and Vargo

Draft Plant Species List
2014, Dan Collins and Nancy Aten

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Groundwater Flow Model Construction

September 2014, Kenneth R. Bradbury

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

Groundwater Flow Model Construction for the Bay Shore Blufflands Project

Summary Report

September, 2014

Kenneth R. Bradbury

Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension

Objectives and Background

This report describes construction of a simple groundwater flow model for the Bay Shore Blufflands area in central Door County, Wisconsin. The Bay Shore Blufflands is a Wisconsin DNR Designated State Natural Area (SNA) of significant note for its grand scenery, unusual geology, rare plant and animal species. Containing more than seven miles of the Niagara Escarpment, the Bay Shore Blufflands is an ecologically complex site with a diversity of plant communities above and below the escarpment and a series of seeps, springs and wetlands at the base of the talus slopes which feed small streams that enter Green Bay (Wisconsin Coastal Management, 2013). Construction of a simple groundwater flow model for the Bay Shore Blufflands and surrounding area is part of a larger effort to inventory groundwater resources for the Bay Shore Blufflands project. The groundwater model simulates water table elevations, groundwater flow paths, flow rates and discharge zones. It is a tool that can be used to investigate hydrologic conditions in the Blufflands area.

Model Methods

The two-dimensional groundwater flow model used for this study uses the analytic element groundwater-flow modeling code GFLOW (Haitjema, 1995). Hunt (2006) gives a review of applications of the analytic element method, and Haitjema (1995) discusses the underlying concepts and mathematics of the method in detail. A complete description of analytic elements is beyond the scope of this report, but a brief description follows.

An infinite aquifer is assumed in analytic element modeling. Features important for controlling groundwater flow (for example, wells and surface-water features) are simulated as mathematical elements or strings of elements called sinks. Point sinks represent wells and line sinks represent surface-water features. The amount of detail specified for each feature depends on distance from the area of interest and the purpose of the model. Each model element is represented by one analytic solution to the groundwater flow equation. The effects of these individual solutions are superposed to form a solution for any location in the simulated groundwater flow system. Because the solution is not confined to a grid, heads and flows can be computed anywhere in the model domain without interpolating between grid cells. In the GFLOW model used here, the analytic elements are two-dimensional and are

used only to simulate steady-state conditions – that is, simulated water levels do not vary with time. The analytic element method and comparisons of analytic element to finite-difference numerical model techniques have been discussed by others (Haitjema, 1995; Hunt and others 1998; and Hunt and others, 2003).

Development of the Conceptual Model

Conceptualization of the hydrologic system forms the framework for mathematical model development and simplifies the groundwater system into important component parts. Steps in the development of the conceptual model include: 1) characterization of the aquifer(s); 2) identification of sources and sinks of water; and 3) identification and delineation of hydrologic boundaries in the area of interest.

The groundwater system in the vicinity of the Blufflands area consists of fractured dolomite of Silurian age. Previous studies (Sherrill, 1978; Bradbury and Muldoon, 1992; Muldoon and others, 2001; Rayne, Bradbury, and Muldoon, 2001; Bradbury and Cobb, 2008) have documented the properties of the dolomite aquifer. Over much of the area the dolomite lies is less than 5 feet beneath the surface.

The following description of Door County's hydrogeology is taken from Bradbury and Cobb (2008).

"Door County's principal aquifer is composed of fractured, solution-weathered Silurian age dolomite. Extensive research has been conducted on the hydrogeology of the aquifer (e.g., Sherrill, 1978; Bradbury, 1989; Bradbury and Muldoon, 1992; Muldoon and others, 2001). The dolomite strata dip gently to the east, thickening from just tens of feet in the extreme southwest on the Green Bay shore to as much as 500 ft along Lake Michigan in the northeast of the county. Soil cover over the dolomite is frequently very thin, particularly in upland areas, and rainfall and snowmelt can infiltrate rapidly. Soil thicknesses increase in occasional buried bedrock valleys, particularly along the Lake Michigan shoreline. North of Sturgeon Bay, springs, streams and wetlands are typically restricted to these depressions in the bedrock surface.

The dolomite is very permeable but has relatively little storage. Recharge is conducted rapidly into the aquifer by vertical joints. Groundwater moves laterally along bedding plane fractures, many of which have been enlarged by rock dissolution. Muldoon and others (2001) showed that discrete near-horizontal zones of high permeability may be continuous over distances of as much as 10 miles.

Groundwater discharge occurs in springs, wetlands and into Lake Michigan and Green Bay. The majority of springs in Door County occur as focused discharge though a loose cover of sediment into a spring pool or stream bed. The visible turbulence in the sand or peat is commonly called a boil. Door County's springs have not been studied in detail, though it is assumed that most occur where highly permeable bedding plane fractures or joints intersects the bedrock surface. In many of the Hine's emerald habitats, we infer that a bedding plane fracture opens to a buried depression in the bedrock surface. The nature

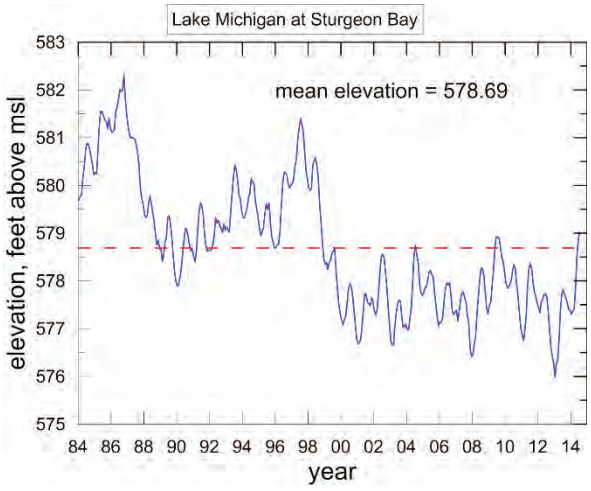
and volume of these springs suggests that they are not regional discharge points receiving far-field recharge transported as deeply circulating groundwater. We consider it more likely that most identified springs receive relatively local recharge conveyed in the shallower intervals of the dolomite aquifer."

Description of the GFLOW model

Model development included estimating the elevation of the base of the groundwater system, regional horizontal hydraulic conductivity, and areally averaged recharge rate. In two-dimensional areal models groundwater flow is simulated using the aquifer transmissivity of a single layer, where transmissivity represents hydraulic conductivity multiplied by saturated thickness. Although both base elevation and hydraulic conductivity affect transmissivity, parameter calibration efforts focused on horizontal hydraulic conductivity rather than base elevation due to more robust model stability during parameter estimation. The Blufflands model uses a model base elevation of 400 feet above sea level.

Surface-water features, such as streams, lakes, and wetlands, were simulated with various analytic elements in the model. The shores of Lake Michigan and Green Bay represent excellent model boundaries and were simulated as "far field" line sinks for which the groundwater elevation is fixed and there is no resistance between the groundwater and surface water. Because this formulation "pins" the water table to surface water stages, locations and elevations of far-field surface-water features control water levels at the model boundary. For this reason, the elevation selected to represent this boundary is quite important. The elevation of Lake Michigan and Green Bay has fluctuated significantly in recent years. Figure 1 shows that, over the past 30 years, the lake elevation has fluctuated over a range greater than six feet, from a high of about 582.5 feet in 1987 to a low of 576 feet in 2013. For model calibration the lake stage was set at the 30-year average value of 578.7 feet, but the stage was then varied between 577.3 and 580.1 feet (representing one standard deviation on each side of the 30-year mean) as described below to assess the effects of lake level variation on groundwater discharge along the bluff.

Streams, lakes, and wetlands in the model were simulated as routed near-field elements, or stream line sinks. Six significant wetland or stream features along the shore between the Escarpment and Green Bay were simulated as wetlands using the "drain" line sink type in GFLOW. These features were selected as wetlands mapped on the USGS 1:24000 quadrangle maps, and are arbitrarily named, from south to north, as the south wetland, the middle wetland, the bluff base wetland, the north wetland, and Murphy Creek (see figure 2). The "drain" line sink in GFLOW allows these features to be sinks, but not sources, of groundwater. In other words, if the simulated adjacent groundwater head exceeds the elevation of the line sink then groundwater will discharge to these features, but if the groundwater head drops below the



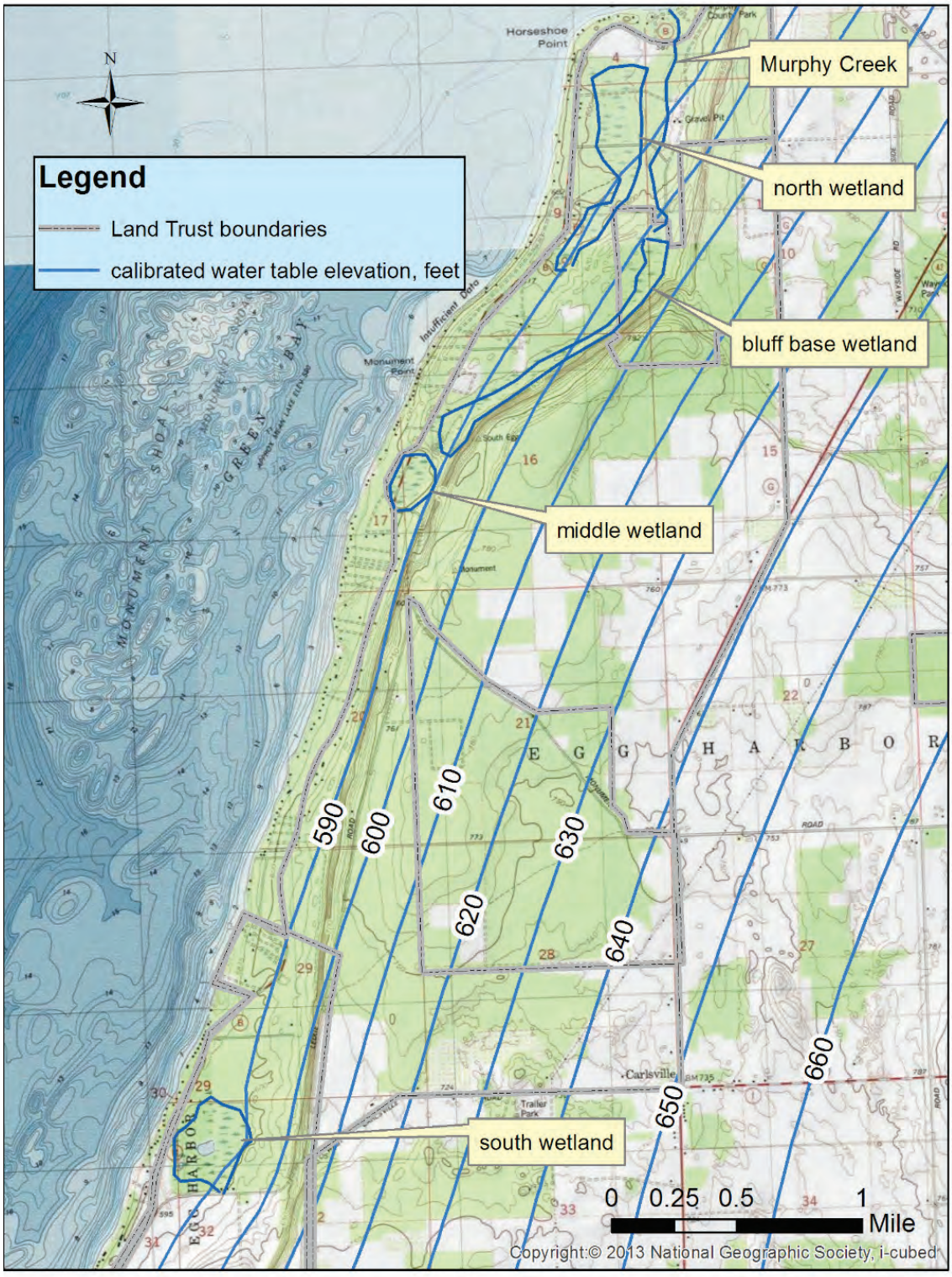
line sink elevation then the feature will be dry. This conceptualization appears appropriate for these wetlands, which are observed to hold water during wet seasons but be completely dry at other times of the year. GFLOW can compute the simulated groundwater discharge to each of these features.

Groundwater withdrawal from high-capacity wells in the model domain was simulated, using steady-state pumping rates obtained from the Wisconsin DNR for 2013. Pumping from private residential wells was not simulated in the model because withdrawal rates tend to be low and much of the withdrawal is returned to the aquifer through septic infiltration.

Model Calibration

Model calibration is the process of adjusting model parameters until the model satisfactorily reproduces field measurements consisting of water levels in wells and stream discharge. In this study, the GFLOW model was coupled with the parameter estimation code PEST (Doherty, 2011). Initial hydraulic conductivity and recharge values were taken from Bradbury and Cobb, 2008.

Groundwater level targets for the model consisted of historical measurements from 26 private wells or research wells in the WGNHS database and 4 measurements of streamflow. Calibration of a steady state model in Door County is problematic because the system is rarely, if ever, at steady state, and large (10's to 100's of feet) seasonal fluctuations in water levels occur in individual wells (Bradbury and Muldoon, 1992). Likewise surface streams have significant flow during some seasons and are completely dry during others. The model calibration for this study is intended to be meaningful for average low-flow groundwater conditions. The calibrated areal recharge is 4.8 inches/year, and the calibrated regional hydraulic conductivity is 10 feet/day. For comparison, Bradbury and Cobb (2008) used dry-period



recharge of 8.5 in/yr and hydraulic conductivity of 10-60 ft/day for similar models in the eastern part of Door County. Effective porosity, needed for particle tracking, was set at 0.005, which is far lower than the values of 0.1 to 0.15 typical of porous media but realistic for the fractured rock of Door County (Rayne and others 2001).

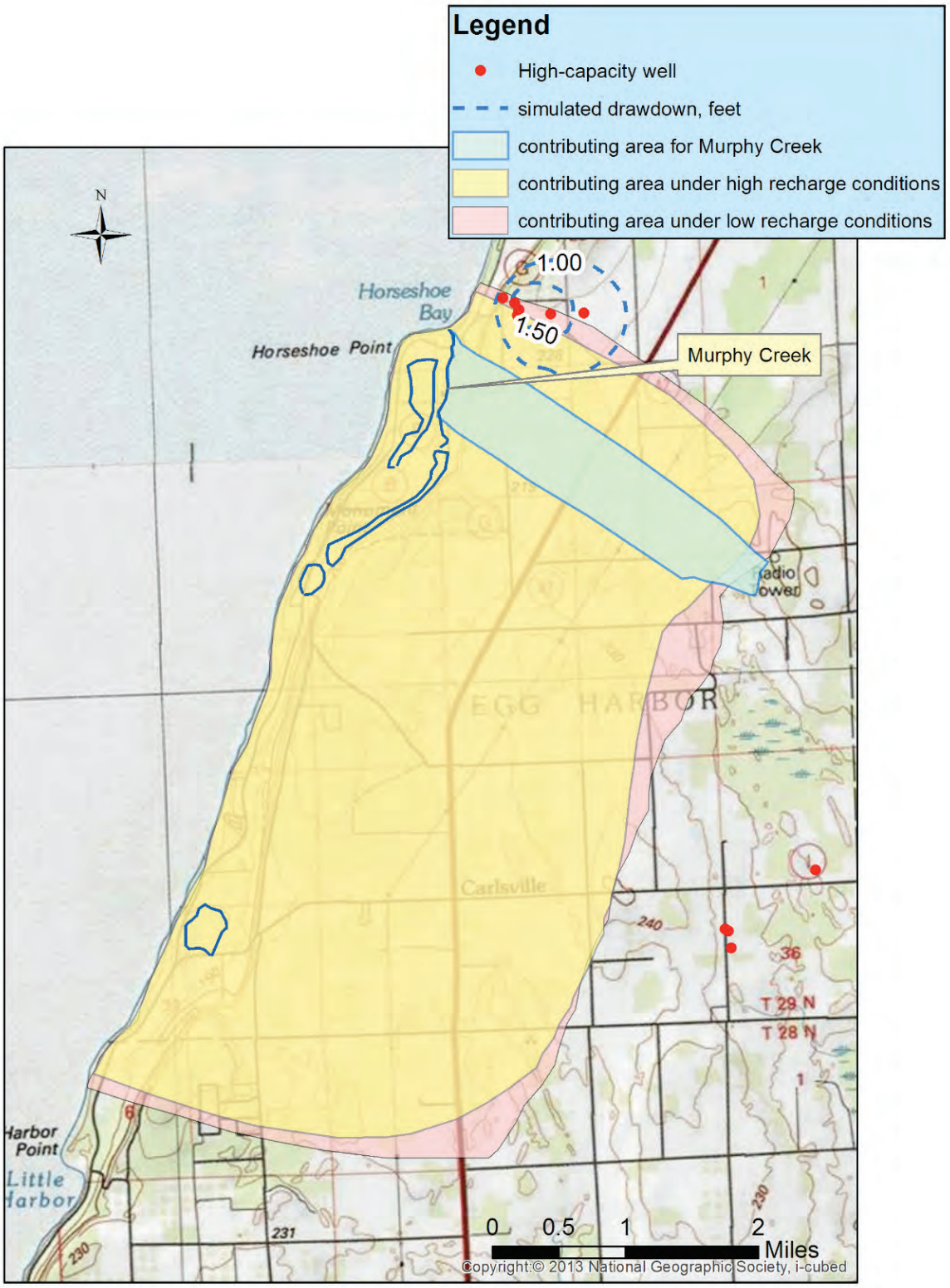
Application of the model

The model simulates the water table for low-flow-conditions (figure 2). This simulated water table is very smooth because the model uses single values of hydraulic conductivity and recharge. In reality the true water table is certainly less smooth, but the overall configuration, with a slope from a high of about 660 feet above sea level near the middle of the peninsula to about 580 feet at the lake shore is quite reasonable.

One of the primary uses of the model is to determine the contributing area, or zone of contribution for the Blufflands area. The contributing area represents the land surface area over which recharging groundwater can reach the feature of interest in a given time period. Figure 3 shows contributing areas for the average recharge case (4.4 in/yr) and also for a high recharge case (15 in/yr), both for a period of 5 years. The high recharge case is probably more representative of spring or wet-season conditions. Under the high recharge case the contributing area shrinks slightly.

Figure 3 also shown the low-flow contributing area for Murphy Creek, again for 5 years, and figure 4 shows a more detailed view of the Murphy Creek contributing area, showing individual mathematical particle paths simulated using the model. Similar figures can be constructed for other hydrologic features in the model.

Drawdown from high-capacity wells is very minor in the Blufflands area. Figure 3 shows that several high-capacity wells near Horseshoe Bay, the largest water users near the Blufflands, cause drawdown of less than one foot about a mile distant from the wells and drawdown of about 1.5 feet within about a half-mile of the wells. These small drawdowns are probably imperceptible along the bluff shoreline.


Legend
High-capacity well
simulated drawdown, feet
contributing area for Murphy Creek
contributing area under high recharge conditions
contributing area under low recharge conditions
N
1:00
1:50
Murphy Creek
Horseshoe Bay
Horseshoe Point
EGG HARBOR
Carlsville
240
36
T 29 N
T 28 N
1
231
230
Harbor Point
Little Harbor
0 0.5 1 2
Miles
Copyright:© 2013 National Geographic Society, i-cubed

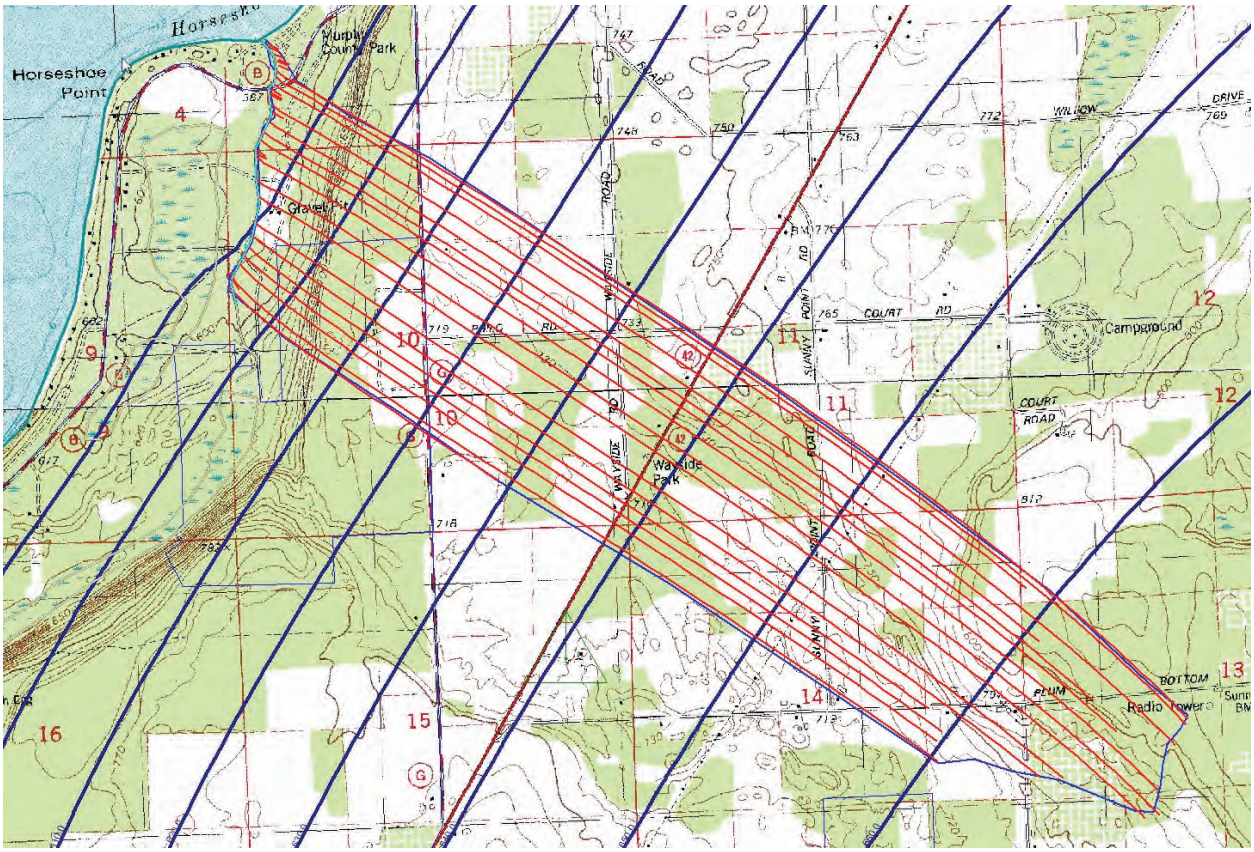


Figure 4. Steady-state contributing area for Murphy Creek, using a travel time of 1 year. Red lines represent simulated particle paths. Dark blue lines are contours of the water table.

One of the interesting uses of the model is to quantify groundwater discharge to the surface water features along the bluff. Table 1 shows simulated discharges, in cubic feet per day (cfd) and cubic feet per second (cfs) to the five significant hydrologic features shown on figure 2. Under the low-flow calibrated condition only Murphy Creek and the south wetland receive direct groundwater discharge. But under high recharge conditions all the features receive direct groundwater discharge. The table also quantifies the effect of changing levels in Lake Michigan and Green Bay. Variations in lake stage have some impact on Murphy Creek and the south wetland, but no effect on the other features.

A comparison of model predictions to a tracer experiment shows that the Blufflands model gives reasonable results for particle tracking. In 2007 a septic contamination incident at a large restaurant located along Highway 42 sickened over 200 restaurant patrons and employees (Borchardt and others, 2011). Part of the ensuing investigation include a tracer experiment in which dye was added to the restaurant septic system and leach field. This dye was detected 151 days later at a spring at the base of

the Niagara Escarpment in the Blufflands area, showing that groundwater from beneath the restaurant can travel to the Escarpment in under 150 days. Adding mathematical particles to the GFLOW model in the vicinity of the restaurant and tracking them forward in time predicts that they reach the areas below the spring in under 270 days under the wet-season high-recharge scenario. Given reasonable uncertainty in hydraulic conductivity and effective porosity this is considered good agreement for a model of this type.

Table 1. Simulated groundwater discharge to selected hydrologic features under three different scenarios. Calibrated scenario represents low-flow calibrated condition. High recharge represents high-flow condition. High and low lake levels represent the effects of changing Lake Michigan levels to historic high and low stages.

hydrologic feature	calibrated discharge		high recharge discharge		high lake level discharge		low lake level discharge	
	cfd	cfs	cfd	cfs	cfd	cfs	cfd	cfs
Murphy's Creek	53600	0.62	106400	1.23	62500	0.72	44700	0.52
North wetlands	dry	dry	23700	0.27	dry	dry	dry	dry
Bluff base wetlands	dry	dry	71100	0.82	dry	dry	dry	dry
Middle wetland	dry	dry	12100	0.14	dry	dry	dry	dry
south wetland	45870	0.53	156900	1.82	53000	0.61	38700	0.45

Summary

A simple steady-state, two-dimensional groundwater flow model for the Bay Shore Blufflands area produces reasonable results for groundwater elevation, flow directions, and discharge to surface water. The model can be used to delineate the areas contributing groundwater to the Blufflands as a whole and to individual hydrologic features in the Bluffland area. The model also quantifies simulated groundwater discharge to specific features, such as streams and wetlands under different recharge and lake level scenarios.

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Muldoon, M.A., J.A. Simo, and K.R. Bradbury. 2001. Correlation of hydraulic conductivity with stratigraphy in a fractured-dolomite aquifer, northeastern Wisconsin, USA. Hydrogeology Journal., V. 9, no 6., p. 570-583.

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Wisconsin Coastal Management Program, 2013. Conservation master plan for Bay Shore Blufflands state natural area. Project proposal. 19 p.

Explanations for maps developed in support of the Bayshore Blufflands State Natural Area project, Door County, Wisconsin, 2014.

October, 2014

The maps and datasets described below were compiled to support the Bayshore Blufflands State Natural Area project Conservation Master Plan for Bay Shore Blufflands State Natural Area conducted by the Door County Land Trust in 2013 and 2014 and supported by the Wisconsin Coastal Management Program.

The maps described here were developed by the Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension. The GIS compilations were carried out by Sam Tedford of the WGNHS staff, assisted by Peter Schoephoester. Kenneth Bradbury provided project oversight.

Each plate was developed in ArcMap GIS at a scale of 1:100,000, and exported to PDF format for printing and viewing. The underlying data sets are available for plotting and analyses at other scales.

Plate 1: Groundwater contributing area

Plate 1 shows the Bay Shore Blufflands study area with the groundwater contributing area indicated. The groundwater contributing area is the general land surface area from which recharging groundwater might eventually discharge either along the base of the Niagara Escarpment or along the shore of Green Bay adjacent to the Blufflands State Natural Area (SNA). The eastern boundary of this contributing area fluctuates seasonally in response to changes in groundwater levels. The area shown here is probably the greatest extent.

Plate 2: Land surface elevation

Plate 2 shows the general elevation of the land surface, in feet above sea level. The background is a LIDAR hillshade image of the study area.

Plates 3A and 3B: Surface watersheds

Plate 3A shows surface watersheds delineated in the US National Hydrography HUC-12 data set. These watersheds correspond to the major surface water features occurring in the SNA and adjacent areas. This data set is available for viewing and download from the US Geological Survey at http://nhd.usgs.gov/.

Plate 3B shows surface subwatersheds delineated using 10-foot digital elevation data based on bare-earth LIDAR information.

Plate 4: Closed Depressions

Plate 4 shows closed depressions and surface-water contributing areas on the landscape. These areas are likely internally drained. Each contributing area contains one closed depression, which is the lowest elevation within the area. Such features may be sinks or sinkholes in the vicinity of the Bay Shore Blufflands, but were not field checked. Some of these features are very small and might not be visible at the 1:100,000 scale. Closed depressions were delineated using a roadless DEM filled to a 3-ft fill level derived from USGS Bare Earth LiDAR data. Although these features have had preliminary review, no extensive ground-truthing has been conducted.

Plate 5: Karst features

Plate 5 shows the locations of mapped karst features such as caves, crevices, sinkholes, and springs. The plate also show mapped fracture traces. Data provided by the Door County Land Information Office based on an inventory conducted in the early 1990s.

Plate 6: water wells

The plate shows the locations of private low-capacity water-supply wells (wells producing less than 70 gallons per minute) and high-capacity wells (well producing more than 70 gallons per minute) based on Wisconsin DNR records available in 2014. The private well inventory is based on available well construction reports (WCRs) on file at the DNR and/or WGNHS.

Plate 7: Aquifer thickness

This map shows the approximate saturated thickness of the Silurian dolomite aquifer in the study area. Aquifer thickness generally increases from west to east. Most wells in the area derive water from this bedrock aquifer.

Plate 8: Surface hydrologic features

Locations of important streams, lakes, and wetlands in the study area, based on WDNR and USGS mapping.

Plate 9: Surficial geology

Distribution of geologic materials at the land surface, based on Quaternary mapping by Carson and others (2014). This dataset is derived from a digital version of the map titled "Quaternary Geology of Door County, Wisconsin." This map is published as Bulletin 109, Plate 1 by Eric C. Carson, Scott R. Brown, David M. Mickelson, and Allan F. Schneider and is available from the Wisconsin Geological and Natural History Survey (WGNHS).This dataset provides a spatial assessment of the unconsolidated surface sediment across the entire county including—in some cases—interpretation of underlying sediments.

Plate 10: Water table elevation

This map shows the approximate elevation, in feet above sea level, of the water table in the study area. The water table fluctuates seasonally, and this map is an approximate snapshot of the water table during the dry (summer) season. Data were digitized from a water table map of Door County, Wisconsin entitled Water Table of the Silurian Dolomite Aquifer System published in October 1971 by the United States Geological Survey. These water table contour lines were digitized by WGNHS from a digital image of the original map at 1:125,000-scale.

Plate 11: Groundwater recharge

This map shows estimated recharge to the groundwater system based on a soil-water-balance (SWB) model. This model estimates recharge as deep infiltration using a simple Thornthwaite mass balance of soil water at individual cells across the landscape. The model includes precipitation, temperature, soil characteristics, land cover, and slope in the water balance calculations and routes excess water across the landscape. The data for Door County are based on unpublished work at the WGNHS. The modeling technique is described in Westenbroek, S.M., Kelson, V.A., Dripps, W.R., Hunt, R.J., and Bradbury, K.R., 2010, SWB—A modified Thornthwaite-Mather Soil-Water-Balance code for estimating groundwater recharge: U.S. Geological Survey Techniques and Methods 6–A31, 60 p. The report can be viewed here: http://pubs.usgs.gov/tm/tm6-a31/

Plates 12A, 12B: Shallow bedrock and shallow water

Plate 12A: shallow bedrock.

This map shows areas where bedrock is within 5 feet of the surface based on soils mapping by the Natural Resource Conservation Service (NRCS).

Plate 12B: wet soil or shallow groundwater

This map shows areas of perennially wet soil or shallow groundwater as delineated on NRCS soils maps. Note that these areas may or may not coincide with the regional water table.

Plates 13A, 13B, 13C: Groundwater Quality

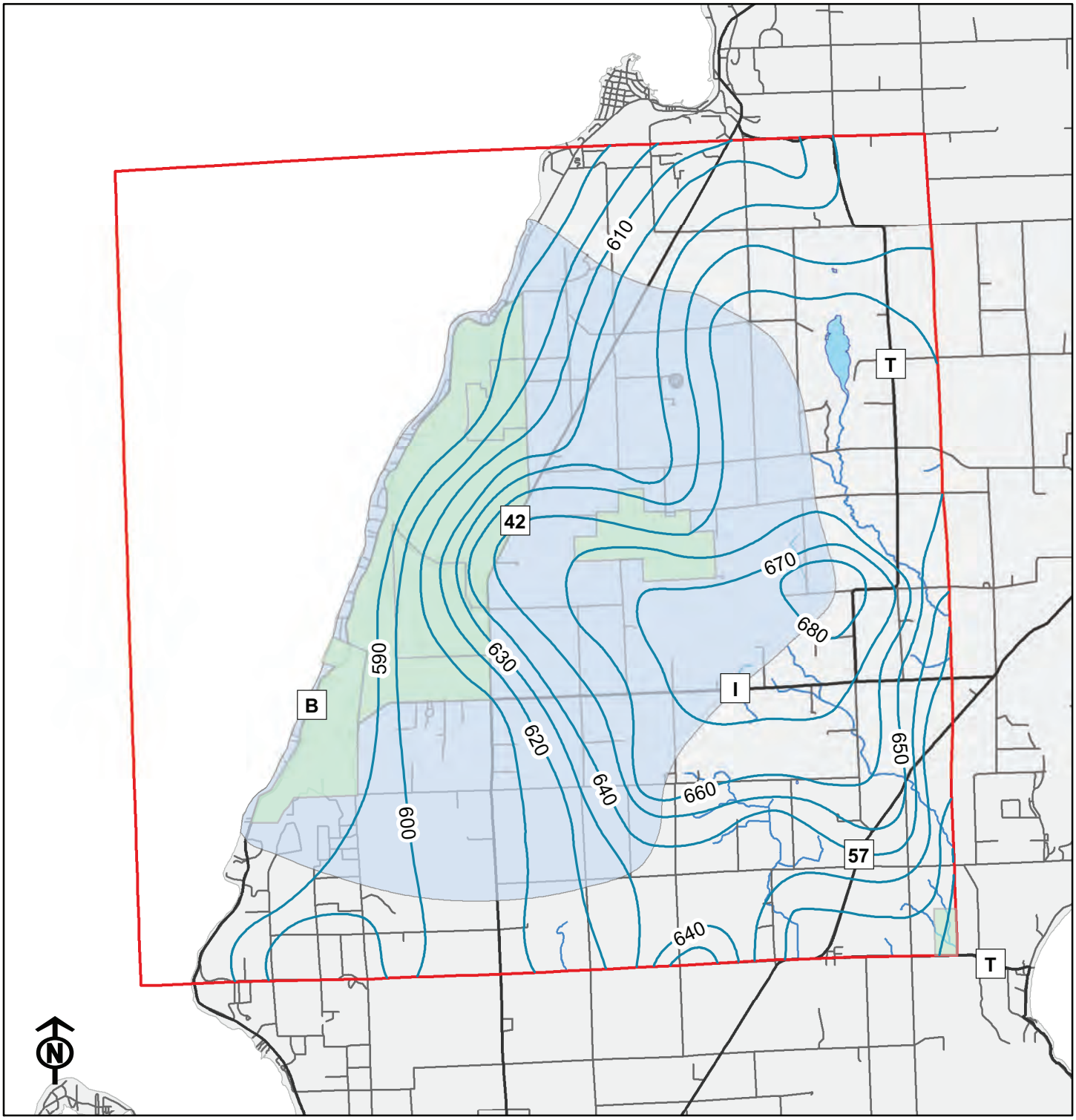
These three maps show major groundwater quality indicators (nitrate, chloride, and coliform) aggregated by section across the study area. The data come from private well samples analyzed by the Water and Environmental Sciences Laboratory at the Center for Watershed Science and Education at the University of Wisconsin-Stevens Point. On all three maps the sections are color-coded to indicate relative concentrations. Numbers in the section indicate the maximum concentrations (nitrate, chloride) or number of positive samples (total coliform). Un-colored sections did not have enough samples to display a value. The nitrate (NO3-N) map (13A) shows that the average values in several sections exceed the NO3-N drinking water standard of 10 mg/l. However, nitrate values in other places are generally low. Nitrate contamination is commonly associated with agricultural fertilizers and manure disposal, but can also come from septic tanks and other sources. Elevated chloride values (13B) occur in several sections. Chloride is most commonly associated with road salting but can also come from septic tanks and agricultural sources. Coliform bacteria (13C) indicate well contamination from surface sources and can be related to well construction and to rapid flow through fractures or karst features.

Plate 14: Groundwater contamination

This map shows locations where point-source groundwater or soil contamination has occurred. Typical contamination sources include leaking underground tanks, surface spills, or industrial mixing or loading sites. The data represented was obtained via download from the DNR through The Bureau for Remediation and Redevelopment Tracking System (BRRTS, http://dnr.wi.gov/topic/Brownfields/botw.html).

Bay Shore Blufflands
Door County, Wisconsin

Plate 1
Water table and groundwater contributing area



water table elevation, feet above msl

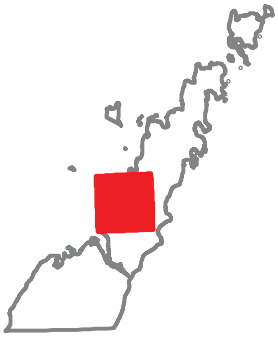
groundwater contributing area

State Natural Areas

Study Area Boundary

Scale 1:100,000

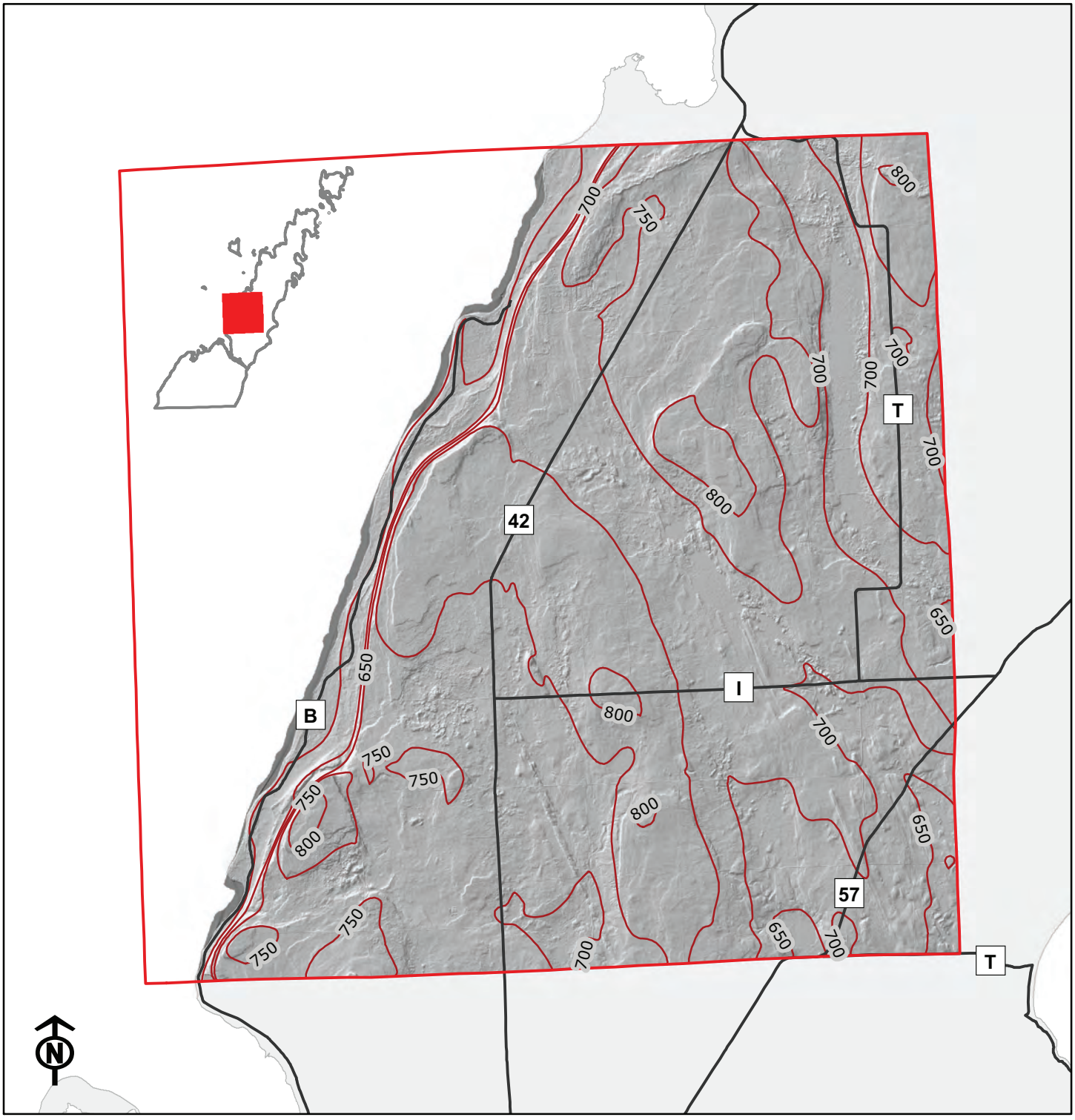
0 1 2
Miles



Wisconsin Geological and Natural History Survey
June 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 2
Elevation of the land surface (LIO, 2014)
LiDAR 10 Meters



Study Area Boundary

Elevation Contour, feet above msl

Door County

Scale 1:100,000

0 1 2

Miles

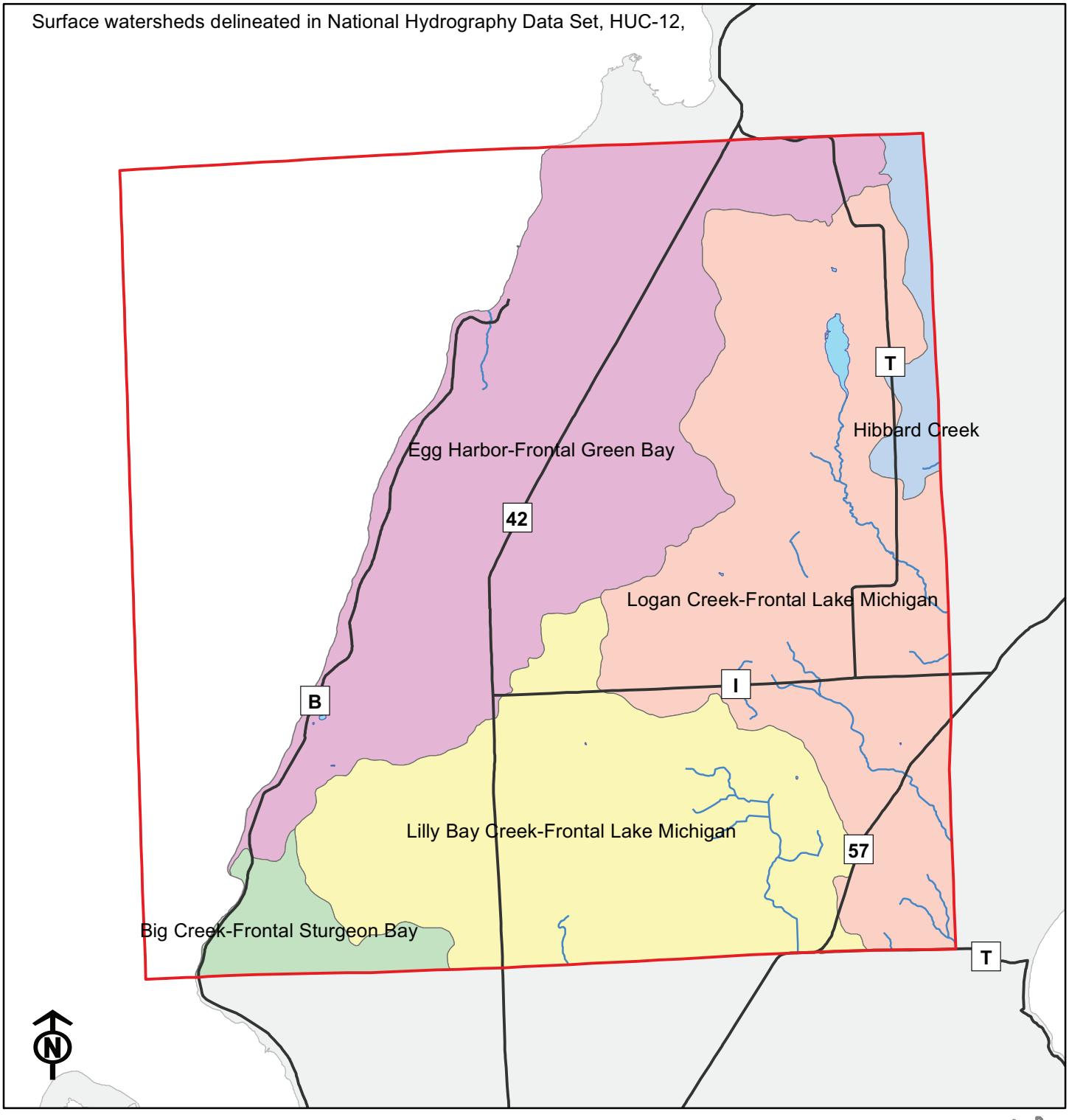
Wisconsin Geological and Natural History Survey

June 2014

Plate 3A

Bay Shore Blufflands
Door County, Wisconsin

Surface Watersheds (USGS, 2011)
NHD 1:24,000-scale



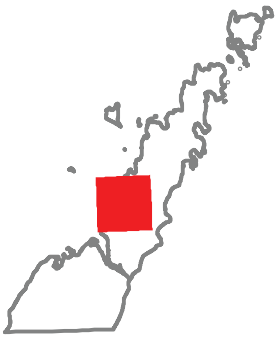
Study Area Boundary

Door County

Scale 1:100,000

0 1 2

Miles



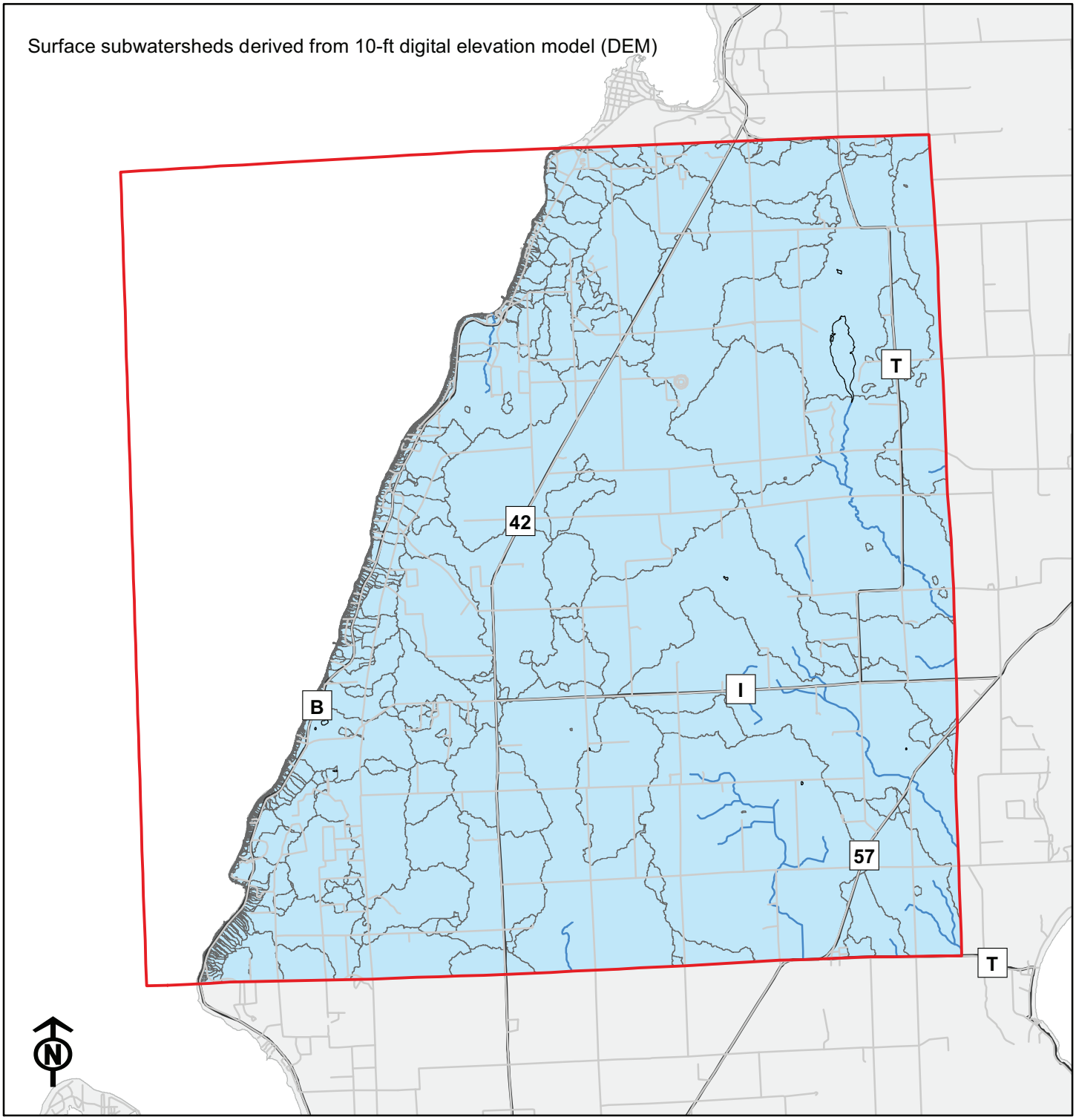
Wisconsin Geological and Natural History Survey

June 2014

Plate 3B

Bay Shore Blufflands
Door County, Wisconsin

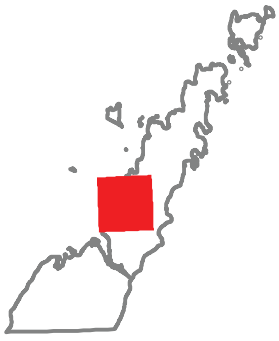
Surface Subwatersheds
Derived From 10-foot DEM (USGS, 2008)



Study Area Boundary
Watershed
Door County

Scale 1:100,000

0 1 2
Miles

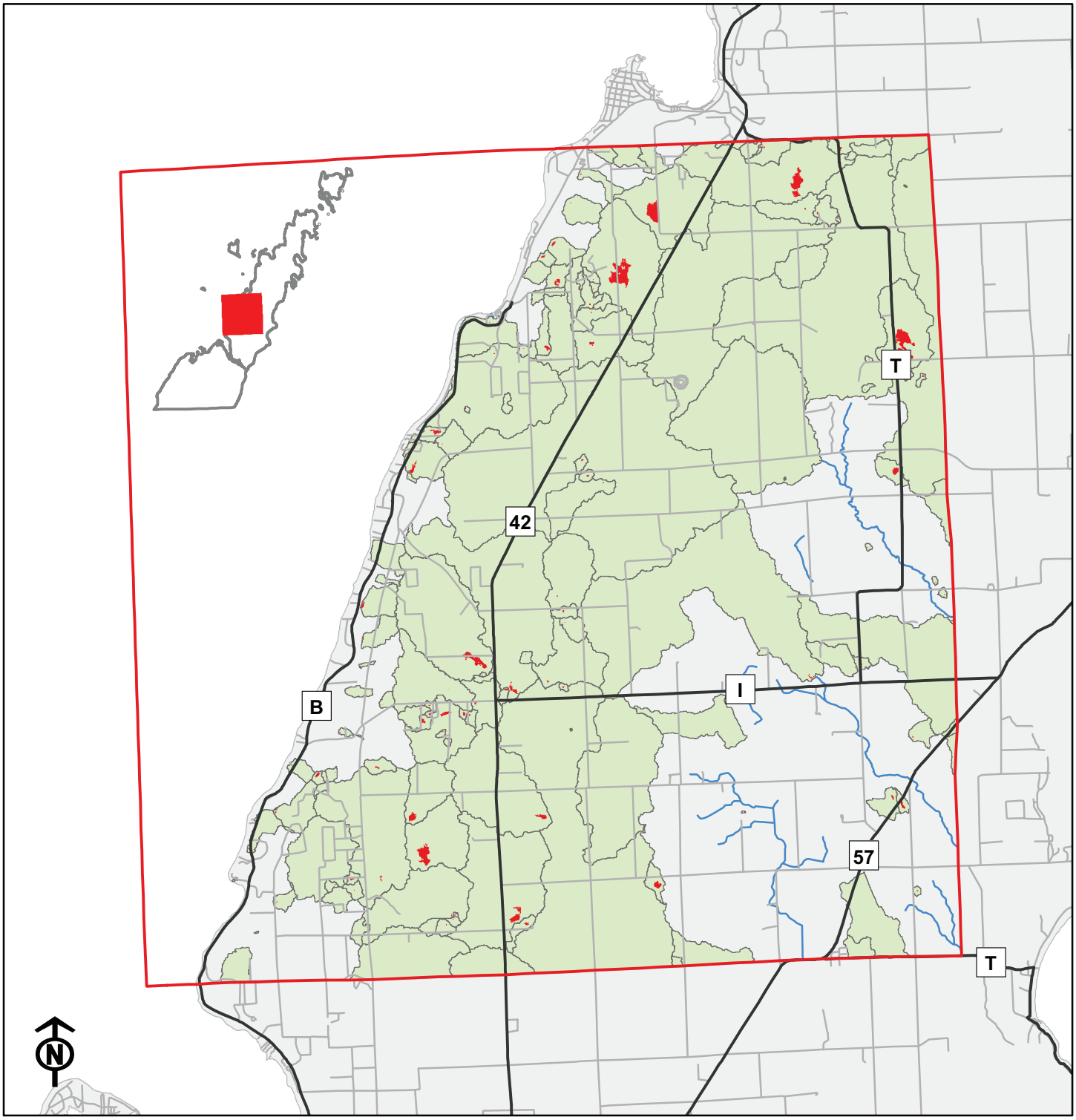


UW Extension
Wisconsin Geological and Natural History Survey
June 2014

Plate 4

Bay Shore Blufflands
Door County, Wisconsin

Modeled Closed Depression (WGNHS, 2014)
Derived From 10-foot DEM



Study Area Boundary

Door County

Scale 1:100,000

0 1 2
Miles

Closed Depressions

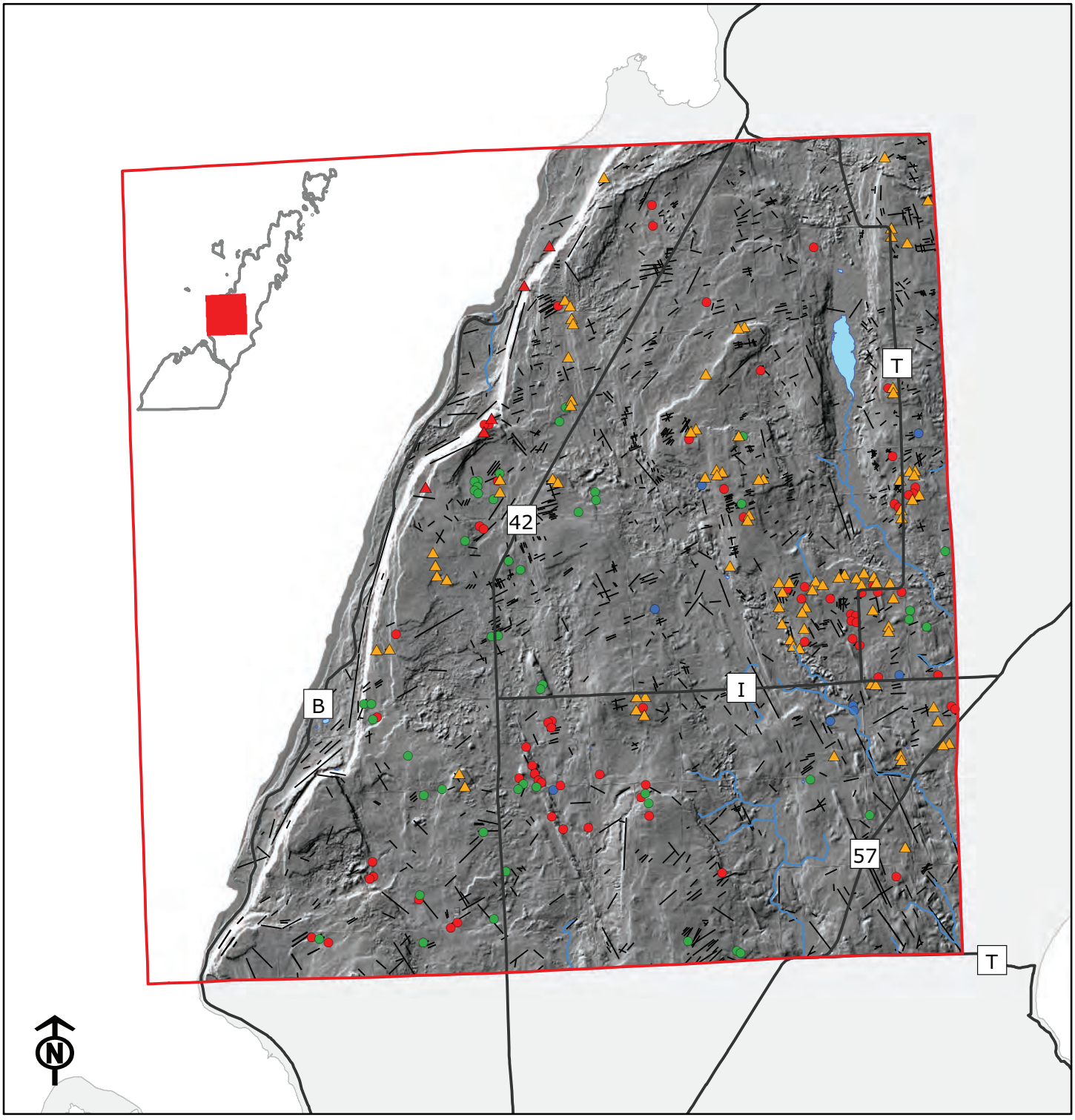
Contributing Areas

Wisconsin Geological and Natural History Survey

June 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 5
Karst Features (DNR, 1990)



Study Area Boundary

Fractures

Door County

Scale 1:100,000

0 1 2

Miles

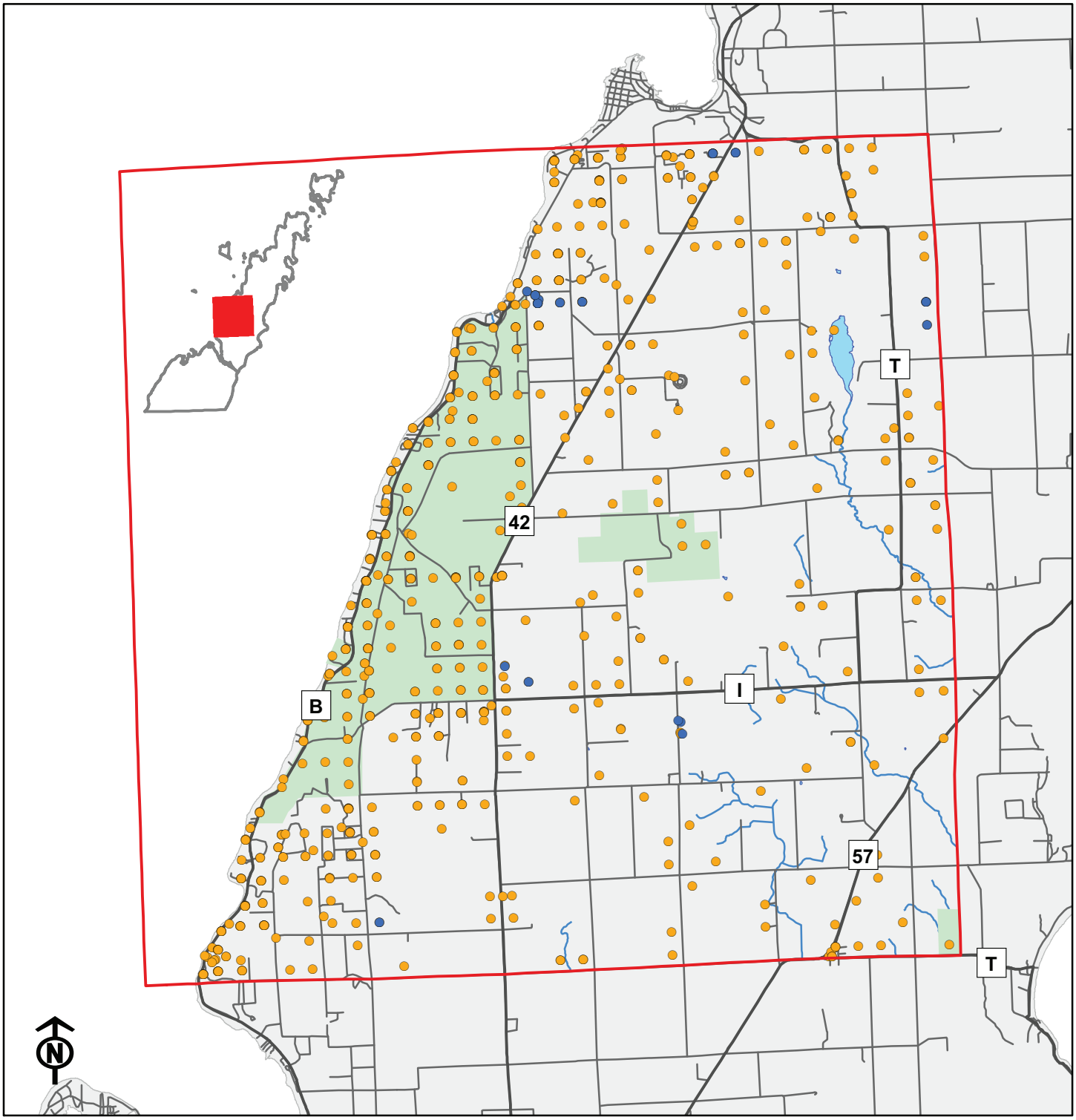
Karst Features

- Cave
- Crevice
- Sinkhole - Filled
- Sinkhole - Open
- Spring

UW Extension
Wisconsin Geological and Natural History Survey
October 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 6
Water Wells



Study Area Boundary
State Natural Areas
Door County

Scale 1:100,000

0 1 2
Miles

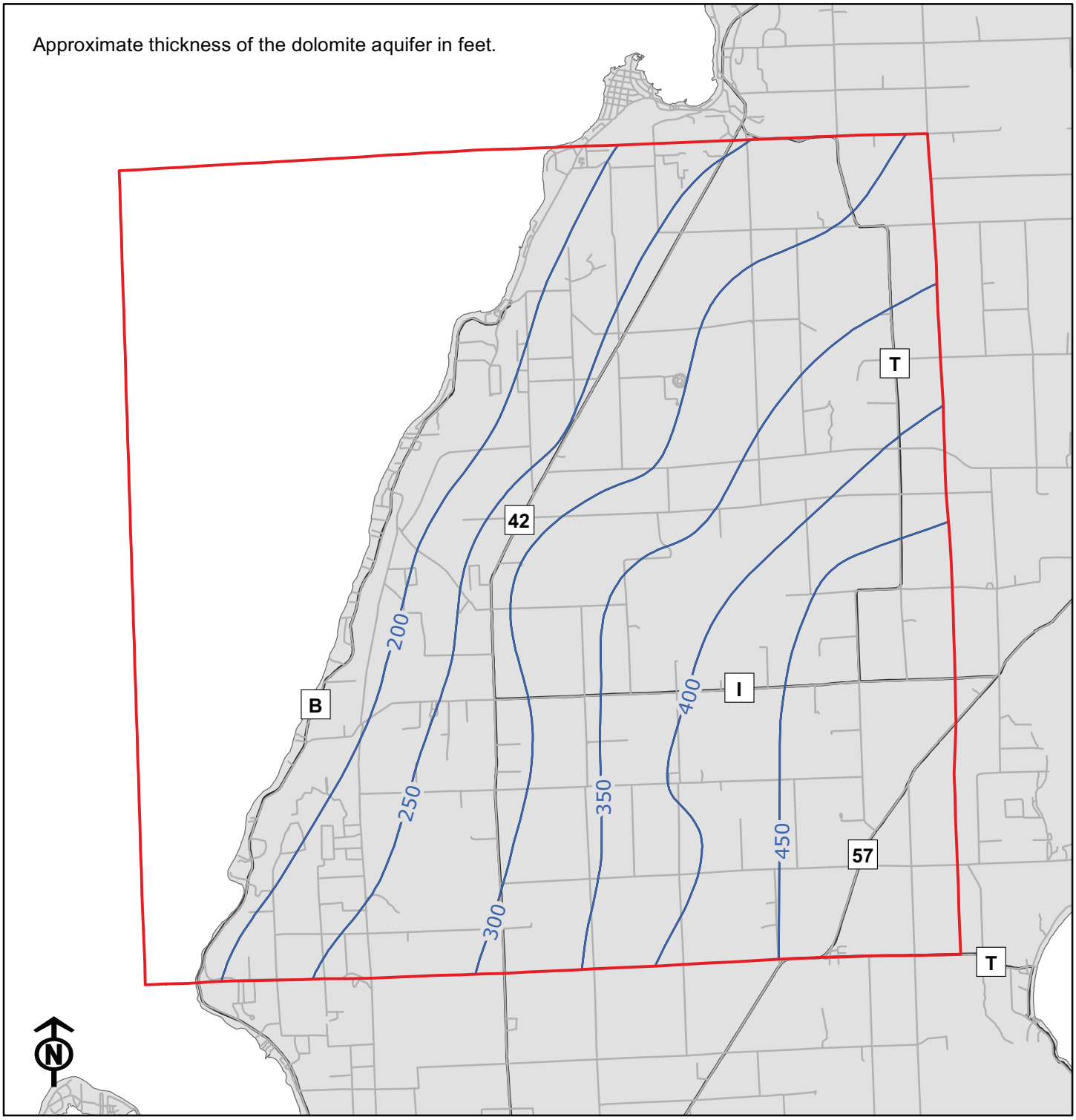
Well Type
High Capacity Wells (DNR, 2014)
Private Wells (WCRs)

UW Extension
Wisconsin Geological and Natural History Survey

June 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 7
Aquifer Thickness (WGNHS, 2014)



Study Area Boundary

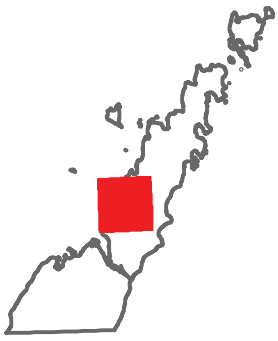
Aquifer Thickness in Feet

Door County

Scale 1:100,000

0 1 2

Miles

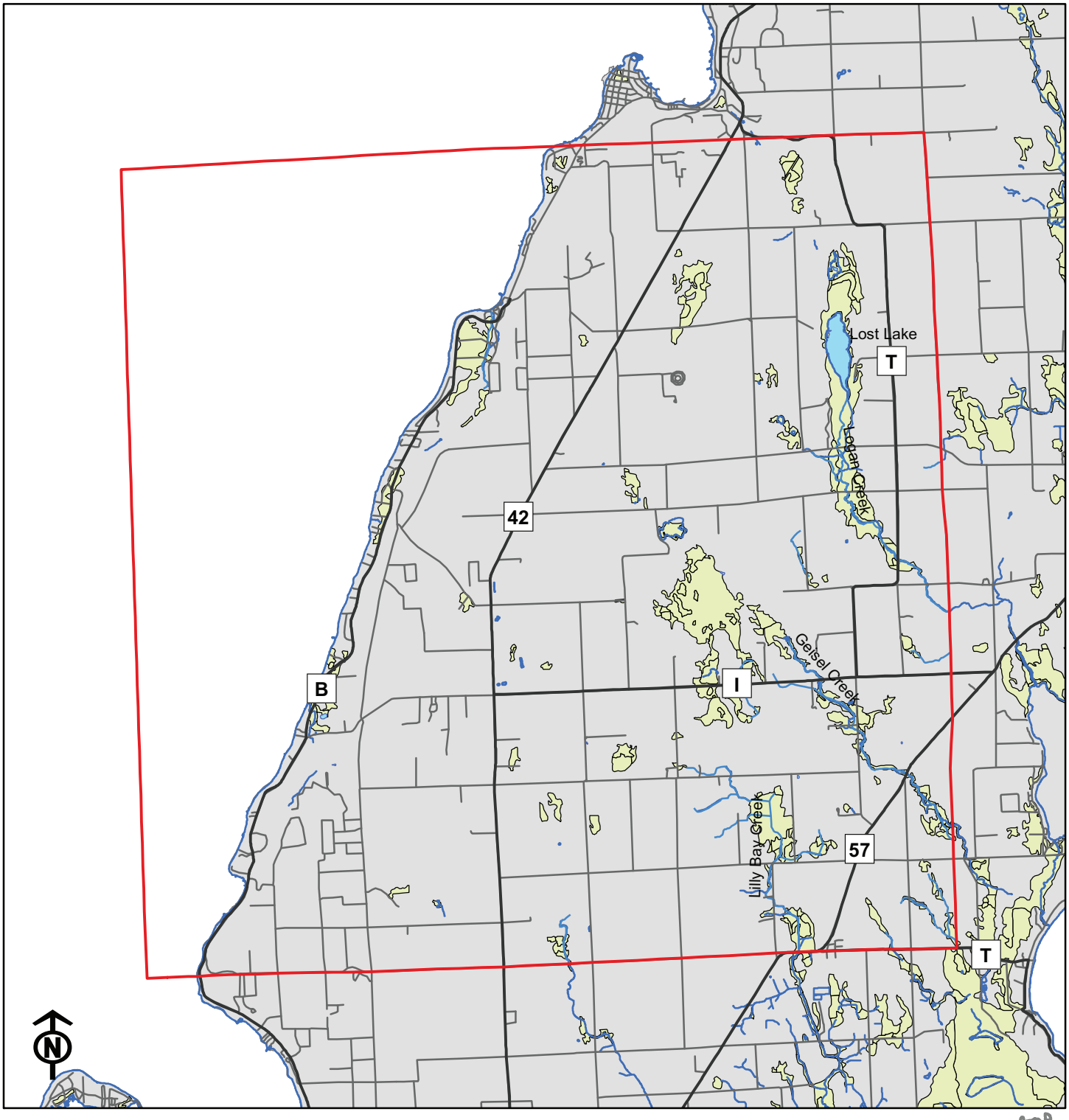


Wisconsin Geological and Natural History Survey

June 2014

Bay Shore Blufflands
Door County, Wisconsin

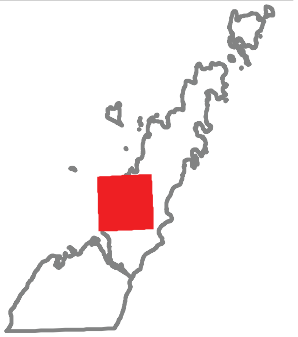
Plate 8
Surface Hydrologic Features (USGS)



Study Area Boundary
Stream
Lake
Wetlands

Scale 1:100,000

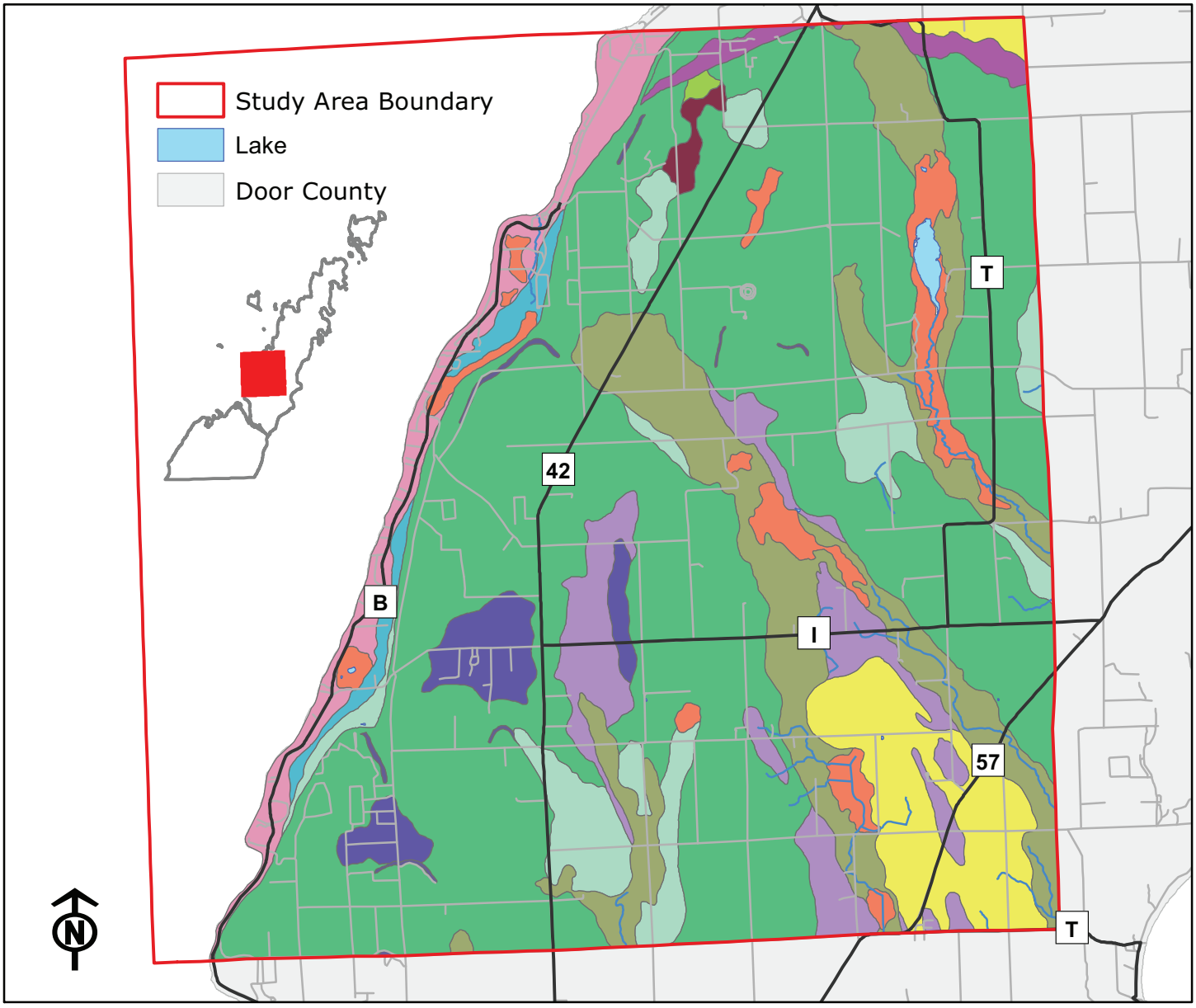
0 1 2
Miles



UW Extension
Wisconsin Geological and Natural History Survey
June 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 9
Surficial Geology (WGNHS, 2014)



Unit Description

- Beach and nearshore sediment
- End moraine at maximum advance
- Gravel and sand
- Postglacial organic sediment
- Rock
- Sand, gravel, and till
- Silty clay
- Submerged beach and nearshore sediment
- Thin till cover on rolling topo w/ low relief
- Thin till cover on streamlined topo
- Till in areas of hummocky topo
- Till in areas of rolling topo
- Till in areas of streamlined topo

Source:
Carson, E.C., S.R. Brown, D.M. Mickelson, and A.F. Schneider, 2014. Quaternary geology of Door County, Wisconsin. Bulletin 109, Wisconsin Geological and Natural History Survey, Plate 1.

Scale 1:100,000

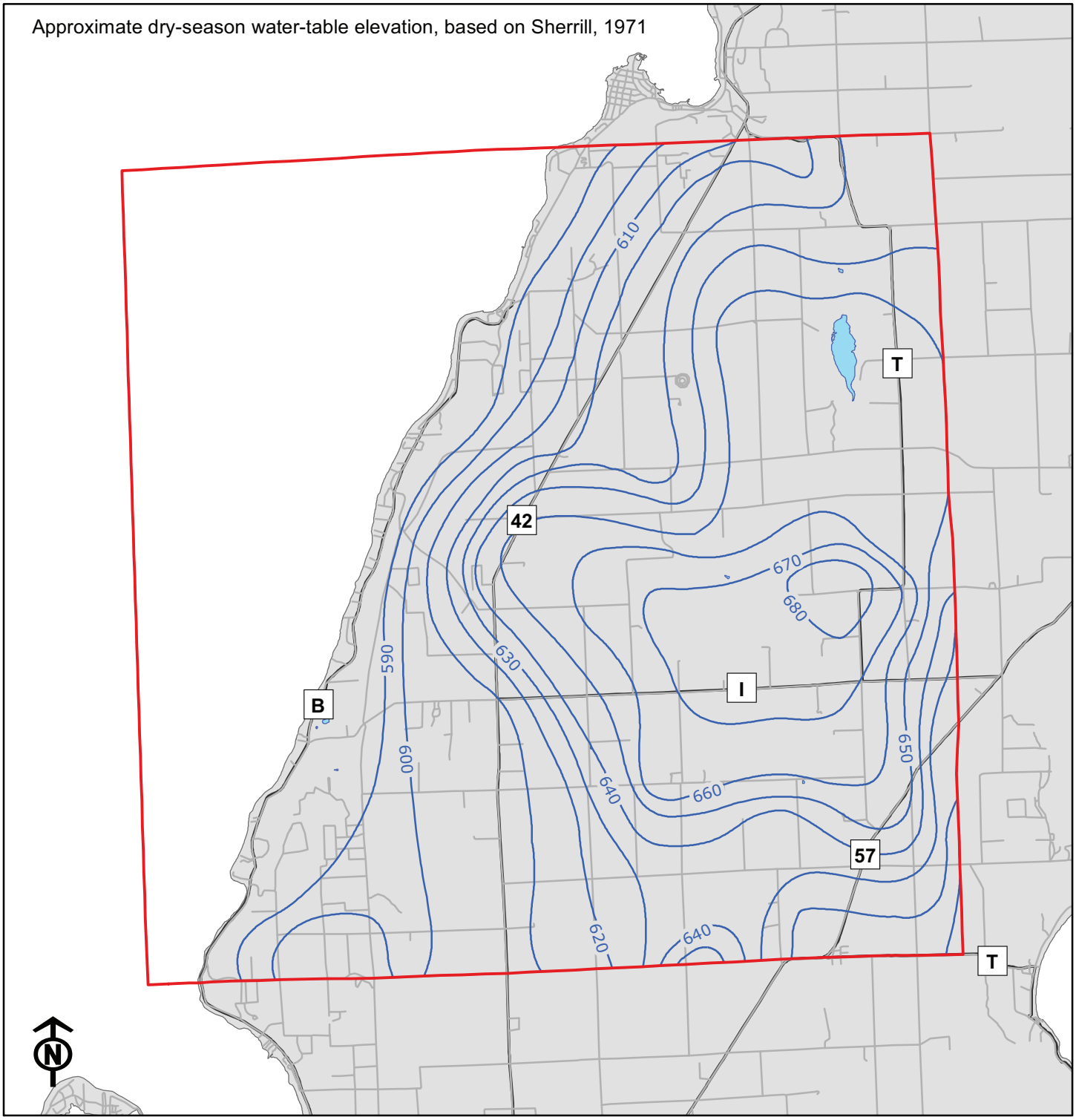
0 1 2
Miles

UW Extension
Wisconsin Geological and Natural History Survey

October 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 10
Water Table Elevation
Water Table Contour (USGS, 1971)



Study Area Boundary

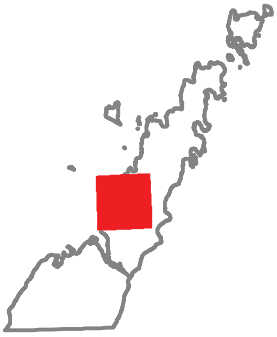
Water table elevation, feet above msl

Door County

Scale 1:100,000

0 1 2

Miles



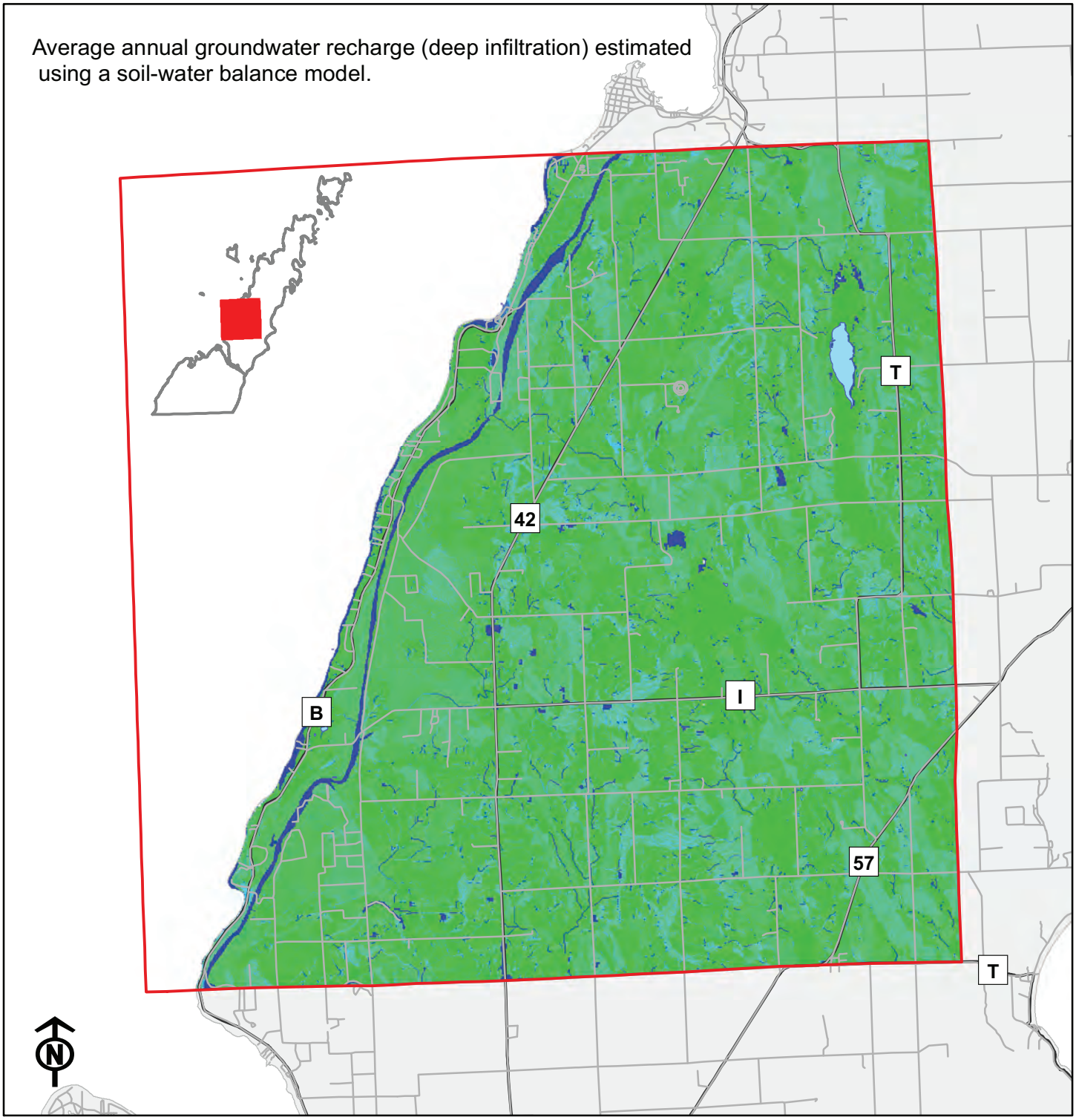
UW Extension

Wisconsin Geological and Natural History Survey

June 2014

Bay Shore Blufflands
Door County, Wisconsin

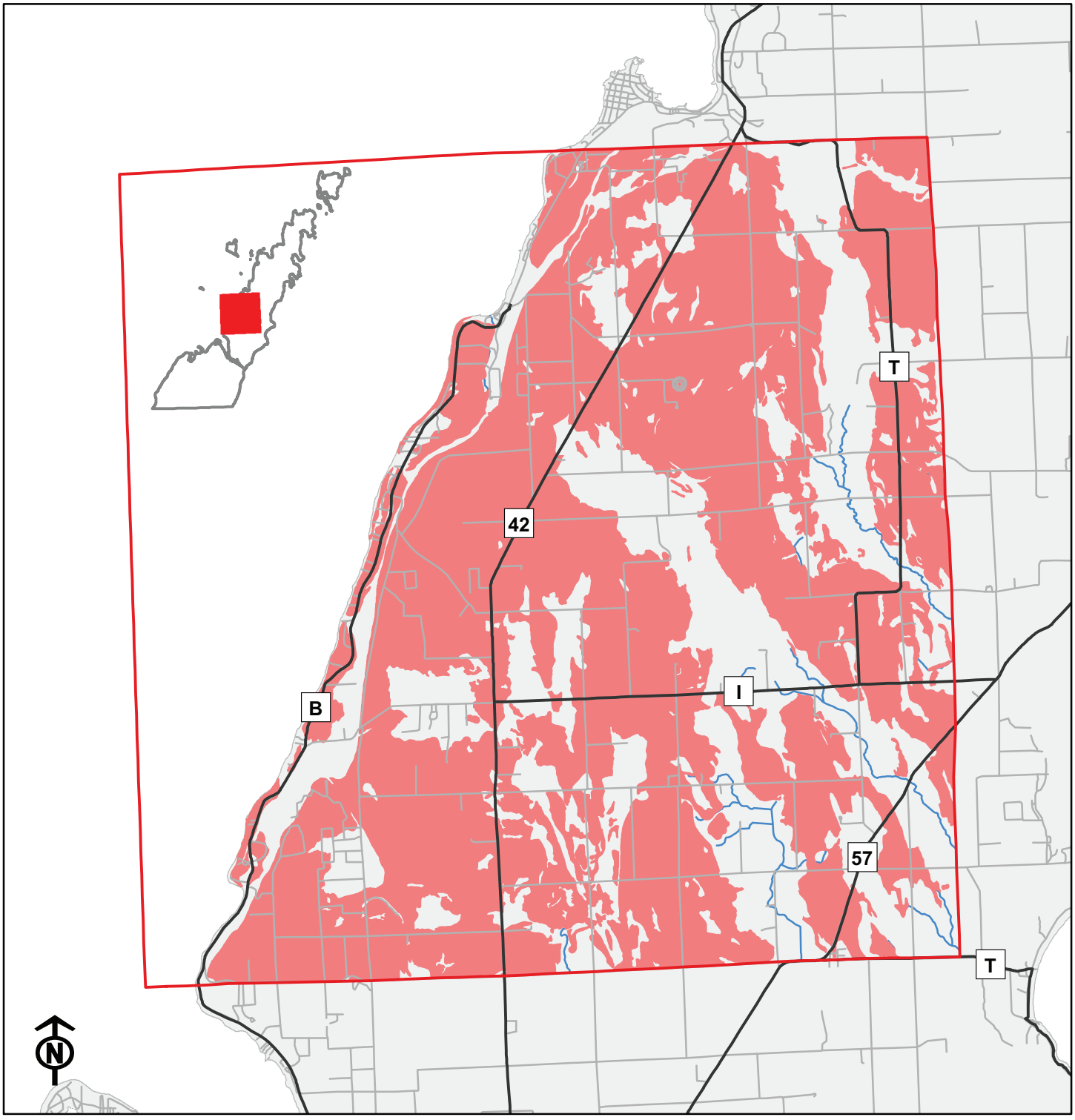
Plate 11
Groundwater Recharge (WGNHS, 2008)



Wisconsin Geological and Natural History Survey
June 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 12A
Shallow Bedrock (NRCS, 2014)



Study Area Boundary

Door County

Scale 1:100,000

0 1 2

Miles

Shallow Bedrock

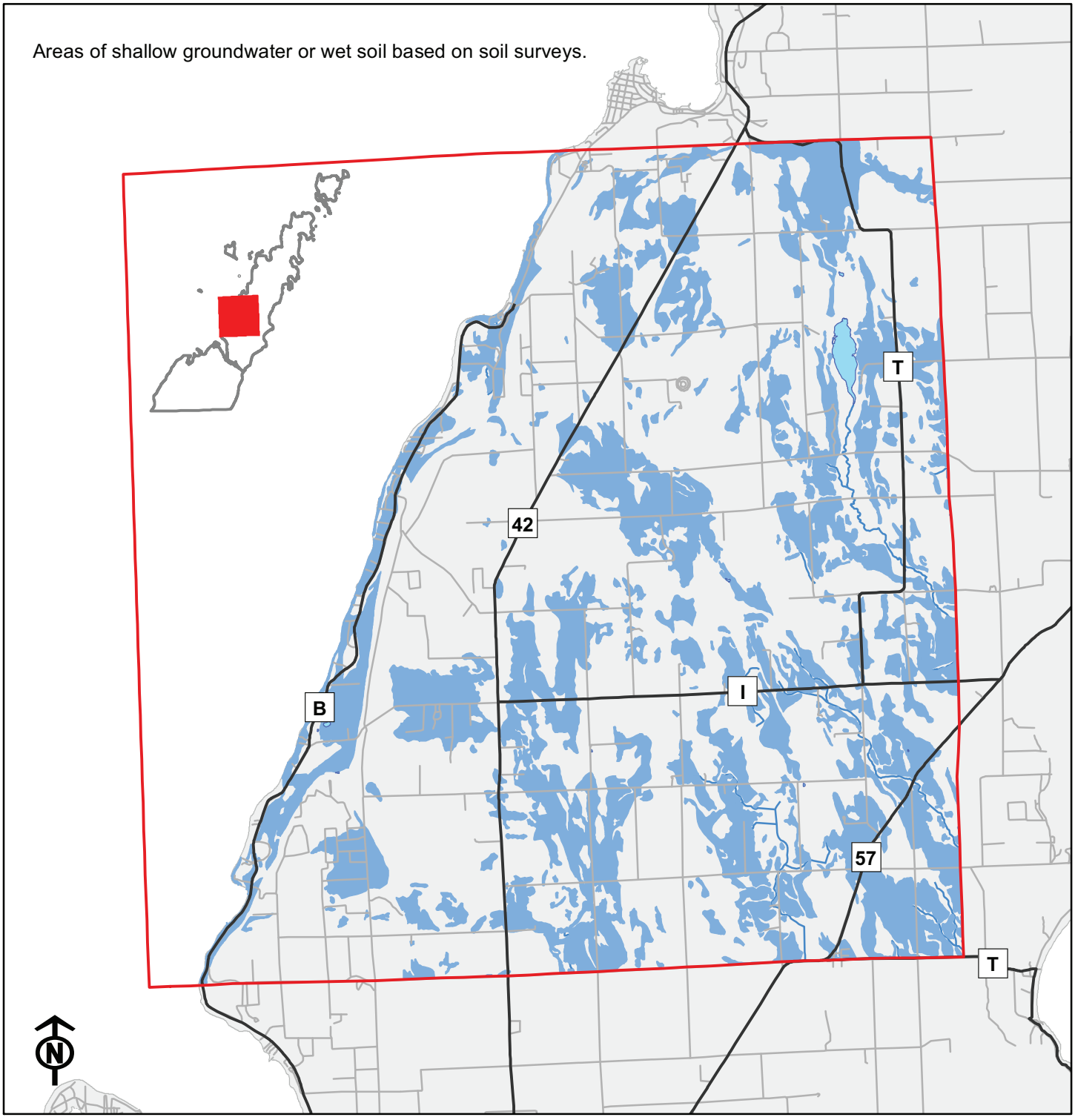
< 5 Feet

Wisconsin Geological and Natural History Survey

June 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 12B
Areas of wet soil or shallow groundwater (NRCS, 2014)



Study Area Boundary

Door County

Scale 1:100,000

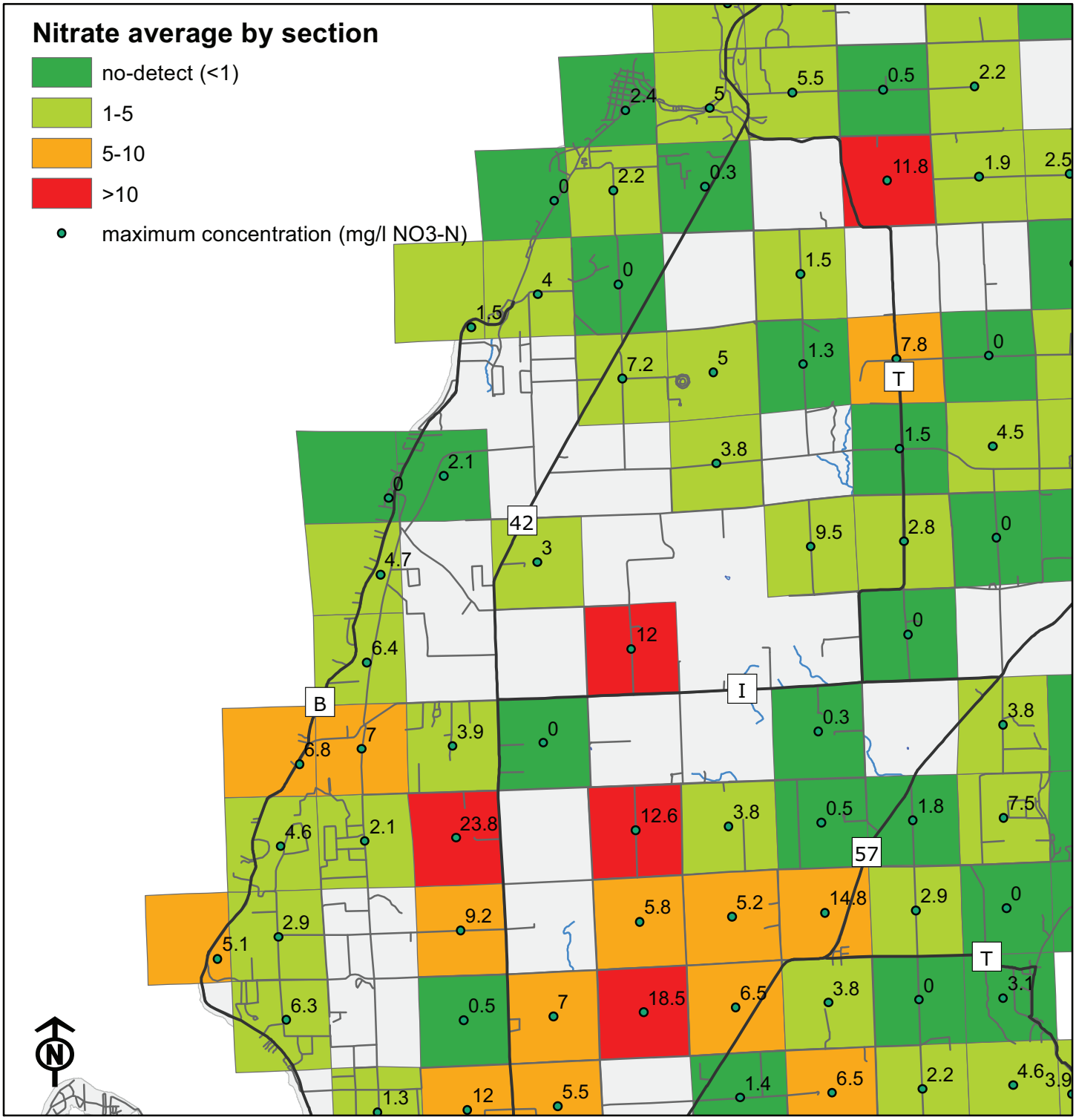
0 1 2
Miles

areas of wet soil

Wisconsin Geological and Natural History Survey
June 2014

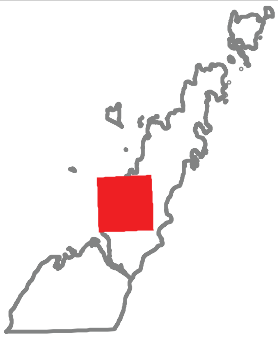
Bay Shore Blufflands
Door County, Wisconsin

Plate 13A
Groundwater Quality (UWSP, 2014)



Scale 1:100,000

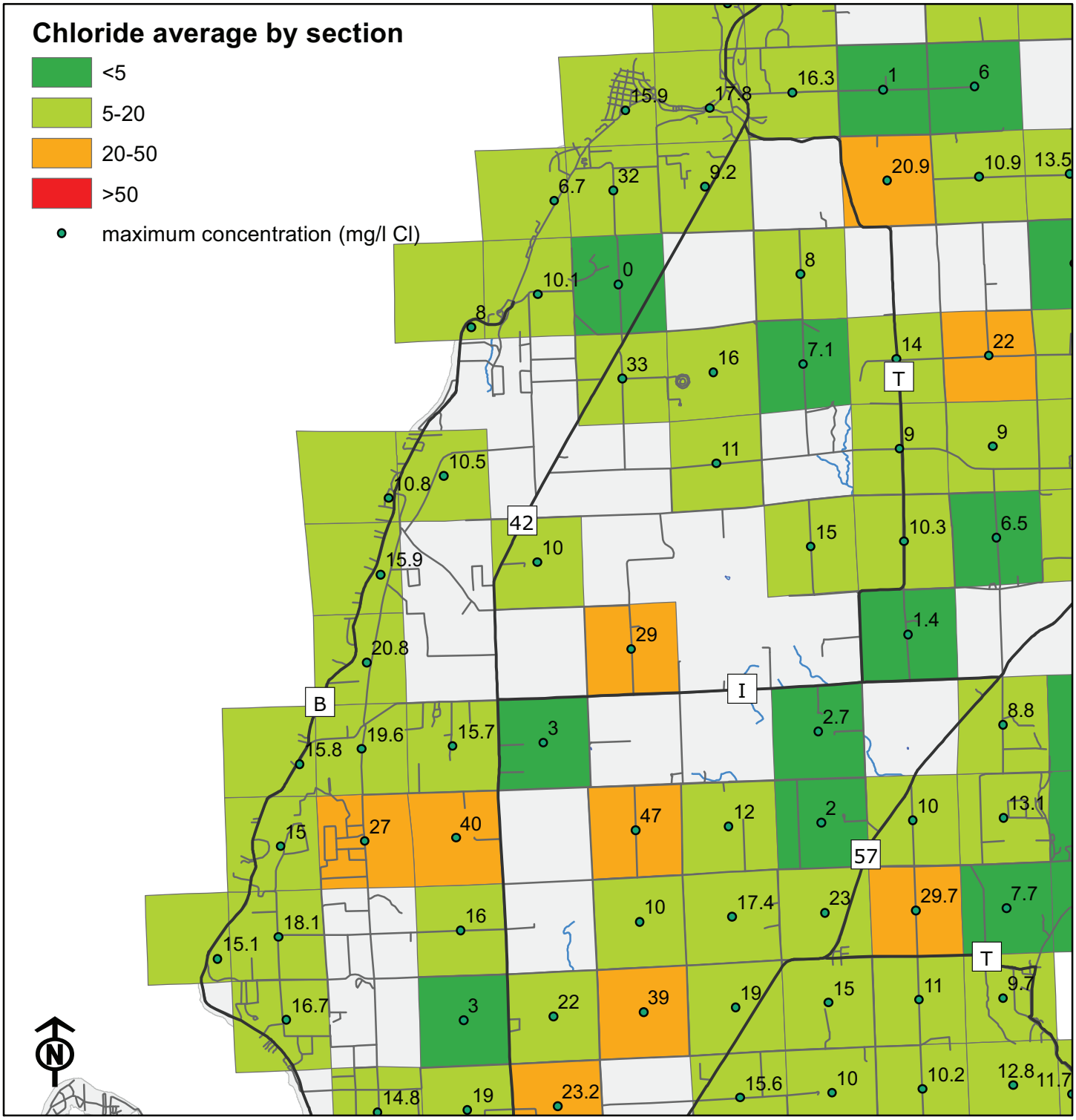
0 1 2
Miles



Wisconsin Geological and Natural History Survey
October 2014

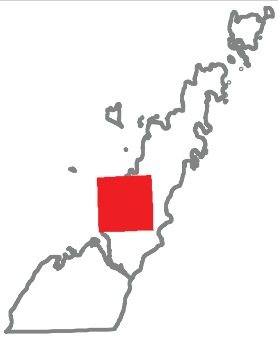
Bay Shore Blufflands
Door County, Wisconsin

Plate 13B
Groundwater Quality (UWSP, 2014)



Scale 1:100,000

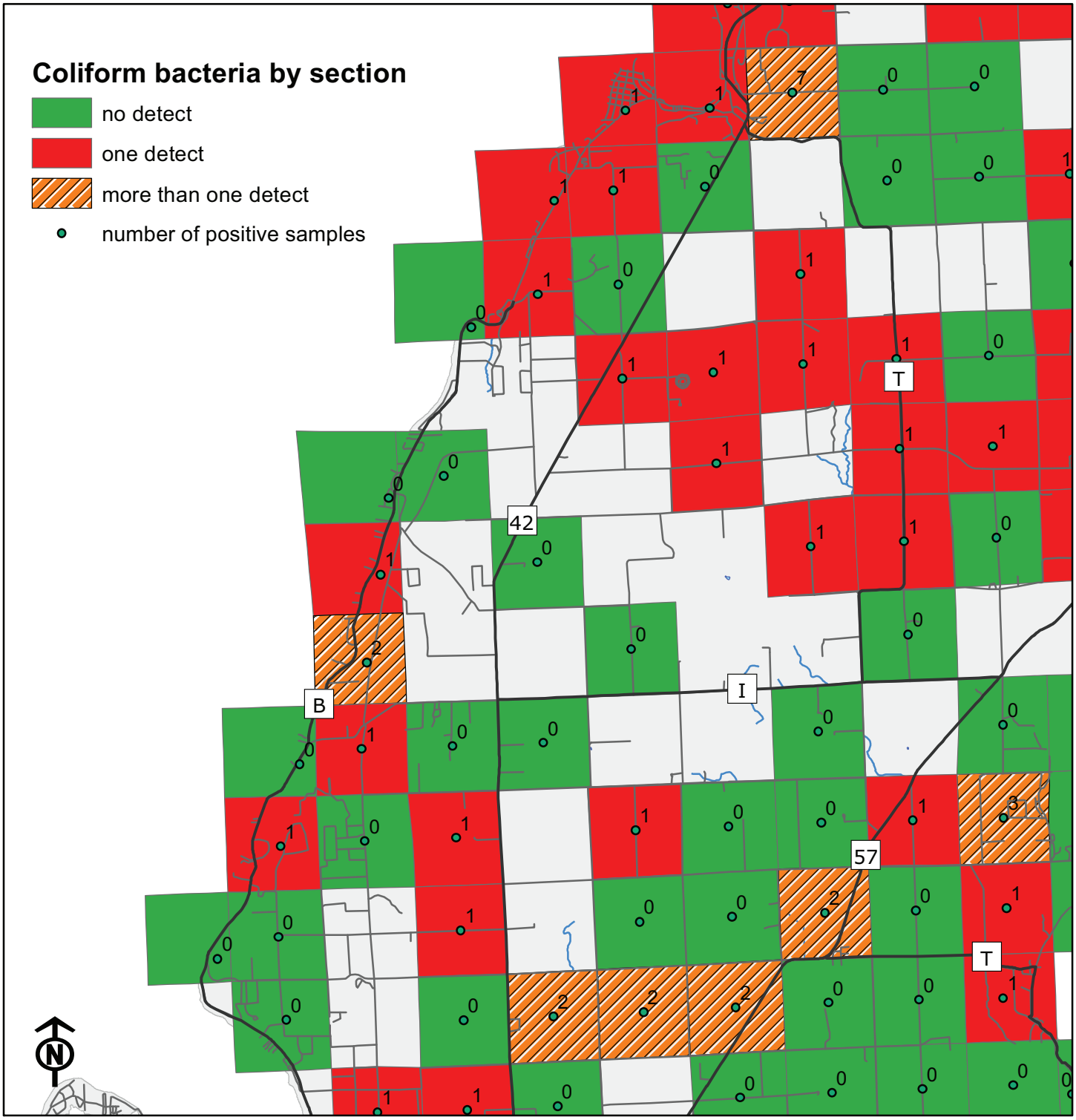
0 1 2
Miles



Wisconsin Geological and Natural History Survey
October 2014

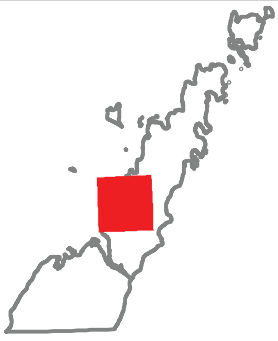
Bay Shore Blufflands
Door County, Wisconsin

Plate 13C
Groundwater Quality (UWSP, 2014)



Scale 1:100,000

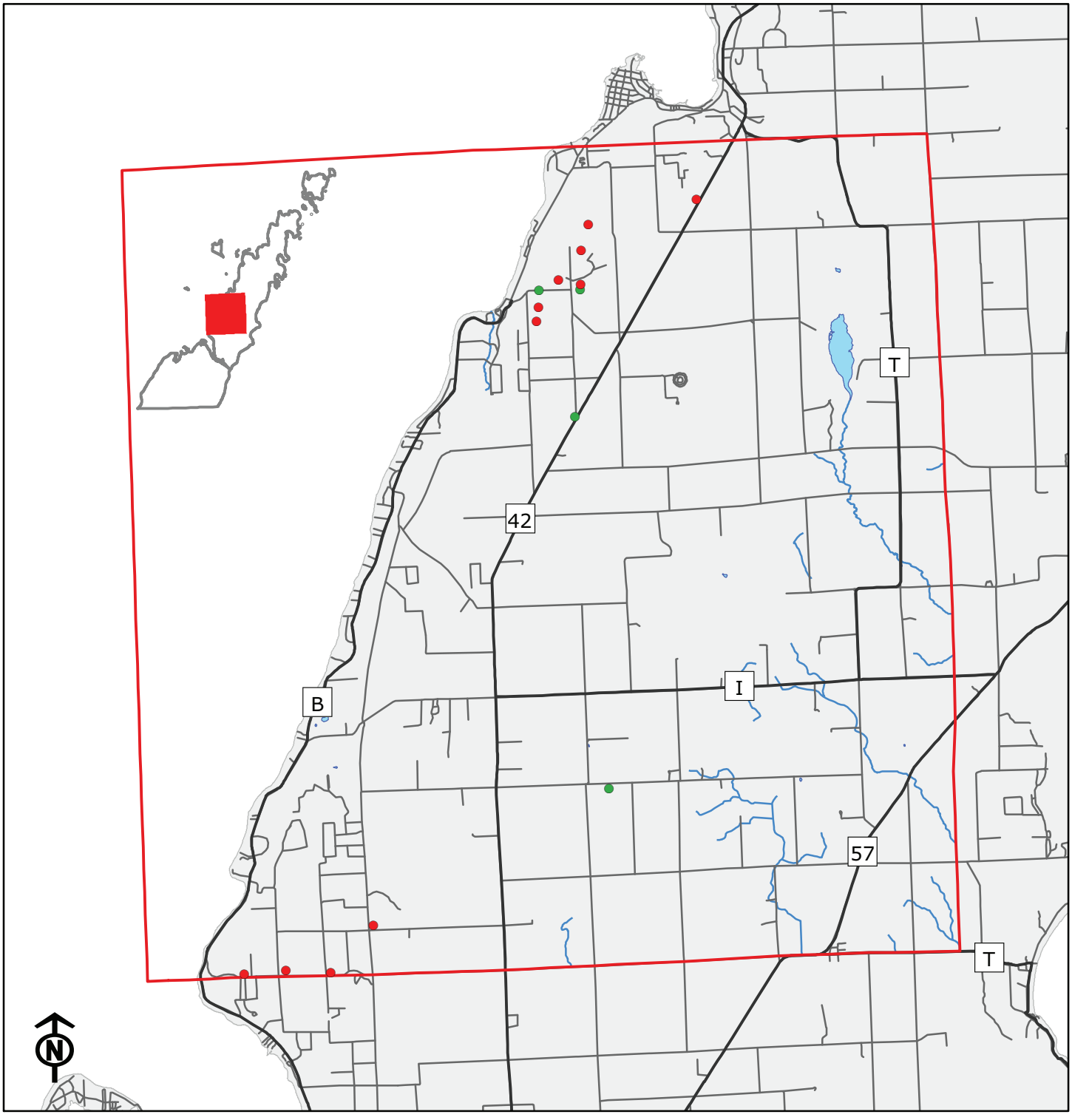
0 1 2
Miles



Wisconsin Geological and Natural History Survey
October 2014

Bay Shore Blufflands
Door County, Wisconsin

Plate 14
Groundwater Contamination (DNR, 2014)



Study Area Boundary

Door County

Scale 1:100,000

0 1 2

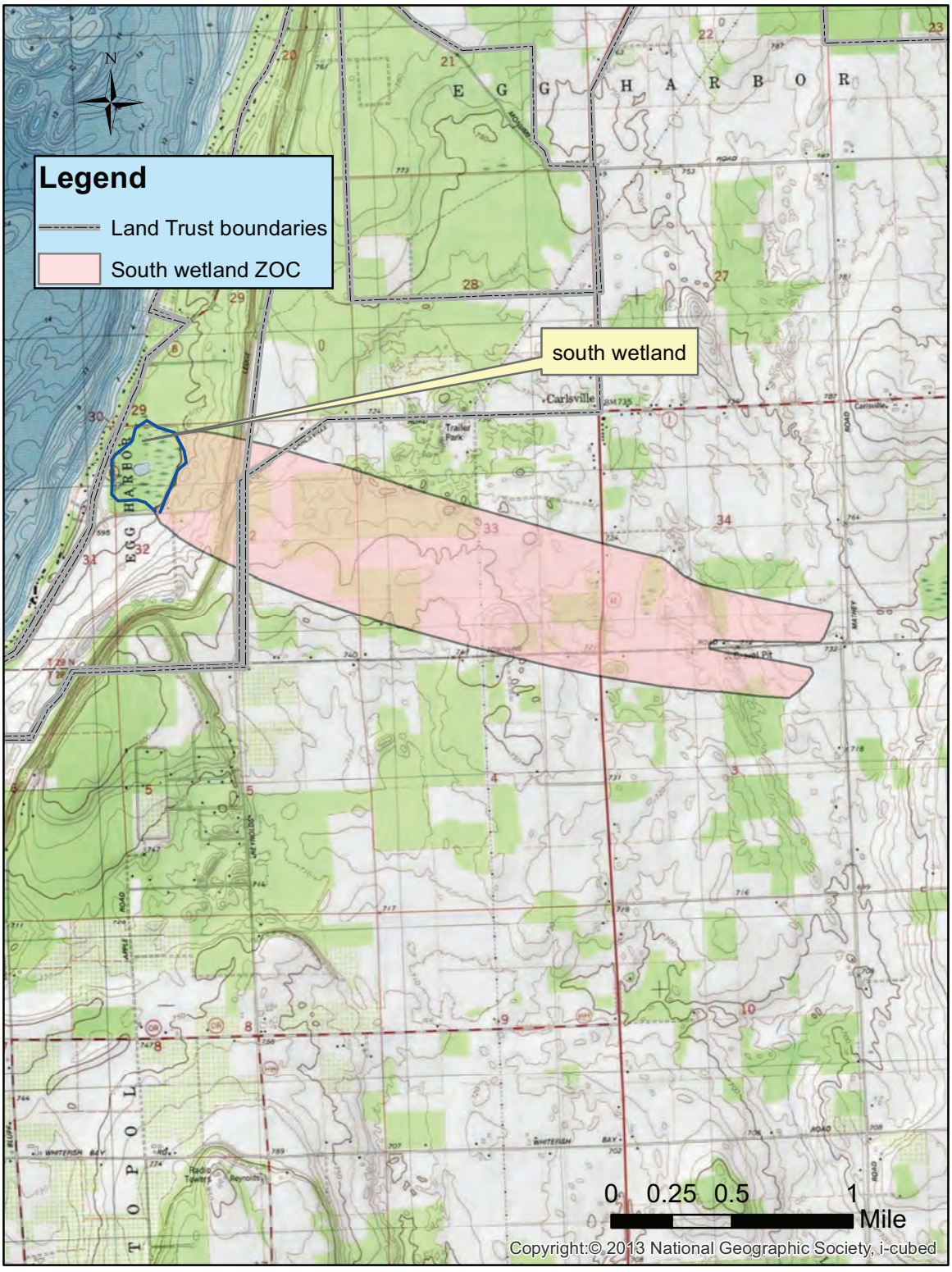
Miles

TYPE

- closed site completed cleanup
- open site ongoing cleanup

UW Extension
Wisconsin Geological and Natural History Survey

June 2014


N
Legend
Land Trust boundaries
South wetland ZOC
south wetland
EGG HARBOR
Carlsville
Trailer Park
0 0.25 0.5 1
Mile
Copyright:© 2013 National Geographic Society, i-cubed

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Green Bay Water Testing Preliminary Report

2014, Dan Collins

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

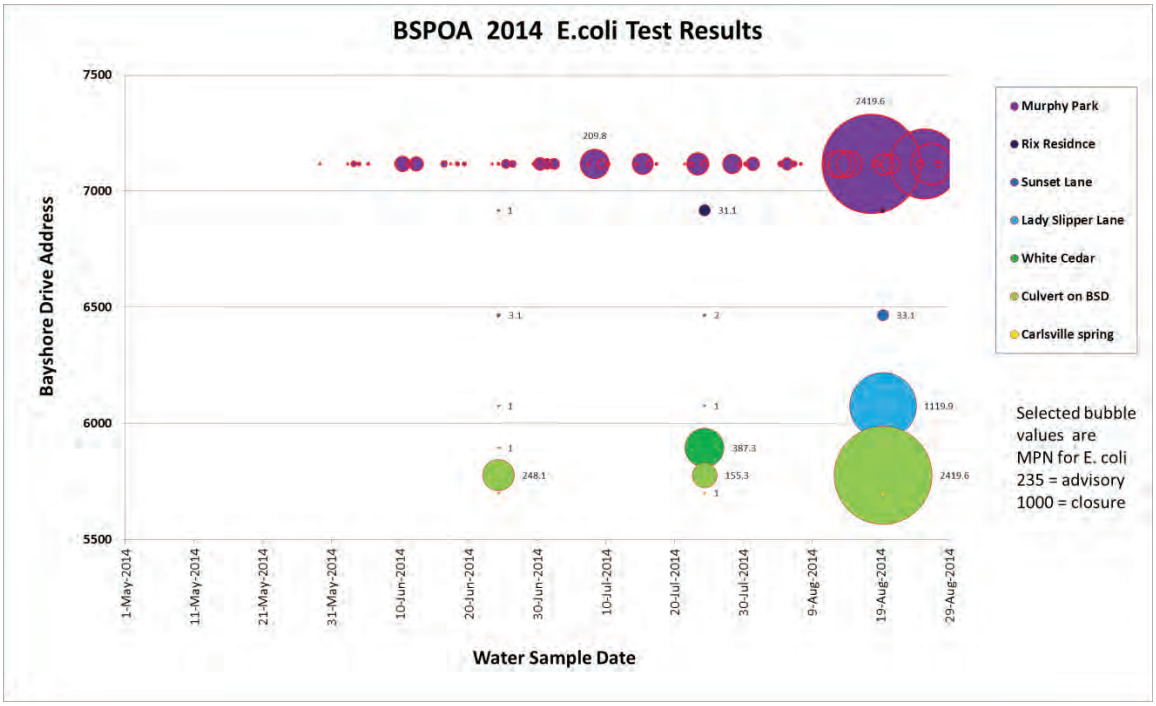
WISCONSIN COASTAL MANAGEMENT PROGRAM

BSPOA 2014 Green Bay Water testing preliminary report
9/27/2014

Water Samplers: Nancy Aten, Dan Collins, Beth Gauger, Bill Rix, Teresa Searing
Water Testing: UW-Oshkosh, laboratories under the supervision of Dr. Greg Kleinheinz

The BSPOA board approved funds to perform E. coli and total Phosphorus(1) testing at several sites along the BSPOA Green Bay shore area to assess the near shore water safety for the benefit of our members. The E. coli levels are tested at all public beaches in Door County, Monday through Thursday from Memorial Day to Labor Day. The BSPOA tests use the same protocols and laboratories but are run only one time each month. The total costs for this project to BSPOA will not exceed $400 for 2014 and is expected to be lower.

Samples for E. coli testing were collected at six locations along Bay Shore Drive in 2014. E. coli can be harmful to humans. The presence of E. coli can be caused by fecal matter from animals or humans coming in contact with water. When E. coli test results for public beaches generate standardized test readings above 235 a caution advisory is issued, above 1000 and the beach is closed. Twenty-one E. coli testing samples were collected over three months (June, July and August) from the waters of Green Bay. Of these samples one was above 235 and one was above 1000. The Culvert on Bay Shore Drive near 5777 (a.k.a. Schaefer Creek) was also tested and also presented one reading above 235 and one reading above 1000. The test data for BSPOA is combined with the publically available Frank Murphy Park data for purposes of comparison.



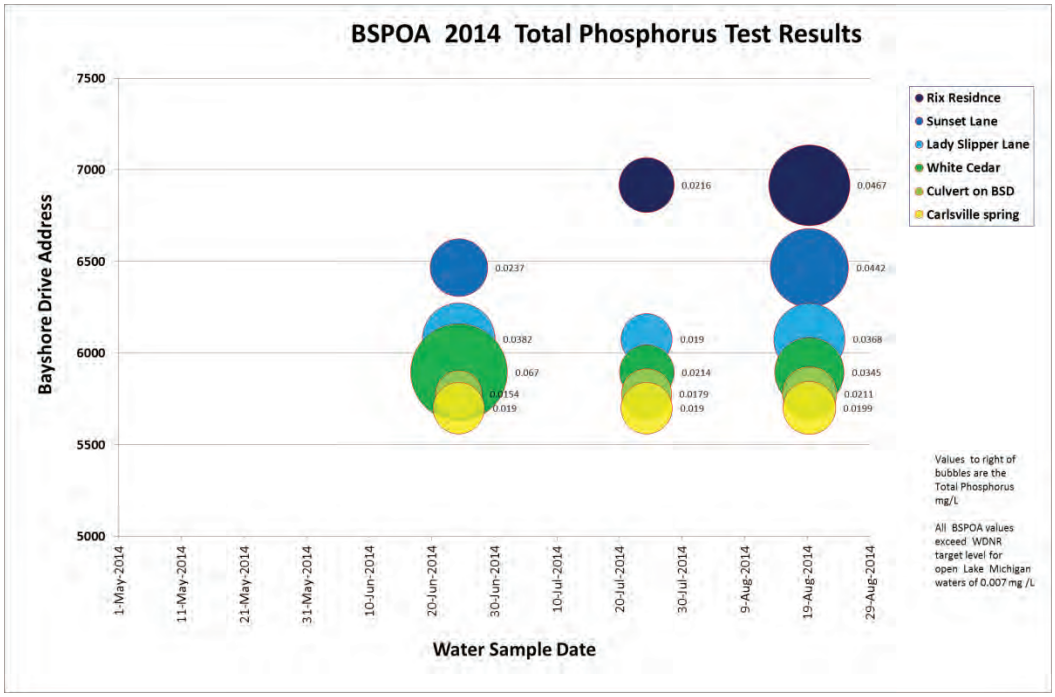
This chart shows BSPOA E. coli test result value (bubble size)
by date (bottom axis) vs. Bay Shore Drive Address (left axis)

Comments from Dr. Kleinheinz regarding the E. coli tests results:
"the (BSPOA) E.coli numbers are variable with some very high readings suggesting there is some contribution nearby...pet waste, etc. or possibly an issue with sampling. This may want to be investigated. It is rare to see those very high numbers that often in Door County."

Comments from Dr. Kleinheinz regarding the repeatedly high reading at the culvert under Bay Shore Drive:
"This is fairly common as wetlands and inputs from animals, etc. can cause elevated E.coli. We see this in many places. I would have to look at the site a bit more to better understand things. However, with the history I would suspect that there are a few input prior to the culvert. "

The BSPOA has tested for E. coli at various times and locations going back to 2004. Historic data is helpful in establishing trends and spotting any changes that might impact beach safety for BSPOA members. The summary historic data is combined with the data collected for 2014 seen in Table 1 at the end of the report.

Samples for Phosphorus were collected at six locations along Bay Shore Drive in 2014. Phosphorus can be a cause of several problems with beach usability including; noxious Cladophora and hypoxia an ecological functional collapse due to lack of oxygen. A condition of hypoxia is known to form in Green Bay waters between Sturgeon Bay and Dyckesville. The WDNR reports that 45% of the total Phosphorus in Green Bay is from agricultural activities. Sixteen samples were collected over three months from the waters of Green Bay for total Phosphorus testing. Of these samples all were above the WDNR's recommended level for Phosphorus of 0.007 mg/L (2) for open water measurements. Frank Murphy Park does not test for Phosphorus.



This chart shows Phosphorus test result value (bubble size)
by date (bottom axis) vs. Bay Shore Drive Address (left axis)

Comments from Dr. Kleinheinz regarding the Phosphorus tests results:
"P (Phosphorus) levels are actually pretty high compared to open water in Lake Michigan...see:
http://www.epa.gov/grtlakes/monitoring/limnology/index.html#phosphorus
I suspect the higher levels in the mouth of the Fox River are being diluted as they enter the bay and then move to the lake. I will see if we can find some details on the open bay."

Notes:
(1)The total phosphorus test measures all the forms of phosphorus in the sample (orthophosphate, condensed phosphate, and organic phosphate).

(2)Data provided by the state Department of Natural Resources show that phosphorus levels in parts of Green Bay have been, in most years, far beyond what is considered healthy. The target level for the open waters of Lake Michigan is 0.007 milligrams per liter. In recent years, levels 30 times that amount have been detected in the bay.

Summary / Comparison BSPOA E. coli Testing

	2004			2005			2006			2014			
	Total Tests	**Schaefer Creek**	**Bay Only**	**Total Tests**	**Schaefer Creek**	**Bay Only**	**Total Tests**	**Schaefer Creek**	**Bay Only**	**Total Tests**	**Schaefer Creek**	**Bay Only**	**Murphy Park**
# tests	96	12	72	175	19	156	112	16	96	21	3	15	54
#>235	5	2	3	14	9	5	4	2	2	2	1	1	2
%	5.2%	16.7%	4.2%	8.0%	47.4%	3.2%	3.6%	12.5%	2.1%	9.5%	33.3%	6.7%	3.7%
#>1000	1	1	0	5	4	1	0	0	0	2	1	1	1
%	1.0%	8.3%	0.0%	2.9%	21.1%	0.6%	0.0%	0.0%	0.0%	9.5%	33.3%	6.7%	1.9%

Table 1

Values in standard test MPN (Most Probable Number) of cells in test tray to show positive result.
Murphy Park test not included in 2014 Total tests

BSPOA water sampler Nancy Aten in action

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Quantitative Macroinvertebrate Survey

June - July 2014, Kurtis Quamme

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

Quantitative Macroinvertebrate Survey of the Door County Land Trust

June - July 2014

Door County Land Trust

Wisconsin Coastal Management Program

Kurtis Quamme

B.S., Conservation and Environmental Sciences

UW-Milwaukee

0.0 Background and Overview

This survey spans twelve sites throughout the southwestern portion of Door County in order to:

1) Outline common taxa found throughout the Door County Land Trust
2) Compare taxa with those found at 8 sites during a 1999 DNR survey
3) Apply an index of biological integrity as an indicator of overall water quality
4) Identify any rare, threatened, endangered, or invasive species

Regional dolomitic karst geology creates a unique hydrologic system in which water quality is governed by dolomitic bedding plane and vertical joint transport which may carry agricultural or municipally sourced nutrients and bacteria. This high porosity and often open channel transport lends little or no filtration of contaminants and allows rapid groundwater velocity over long distances and often multiple unpredictable flow paths. Water table levels fluctuate drastically throughout the summer season with dissipation of spring snow melt and groundwater pumping. With a typical bedrock depth of a few feet throughout the area of interest, wetlands and the Niagara dolomite upper aquifer system are intricately connected in both a physiochemical and biological nature.

These waterbodies include primarily cool water ephemeral pools which are spring fed and often further interconnected via surface flow pathways. As a result, macroinvertebrate habitats are extremely dependent on groundwater derived water quality and a consistent influx from groundwater springs for pools to remain cool and well oxygenated. These oligotrophic to mesotrophic wetlands are extremely sensitive to nutrient input, with invertebrate habitat drastically altered with the introduction of algae and excessive macrophyte growth.

These karstic wetlands are of unique value to the state of Wisconsin and represent pristine aquatic habitat for macroinvertebrates as well as frogs, salamanders, and occasionally fish. Additionally, these wetlands harbor macroinvertebrate genera exclusively endemic to ephemeral habitats (e.g. caddisfly family Limnephelidae, with eggs modified for drying periods). Waterfowl and other terrestrial organisms likewise depend on these systems throughout the spring to early fall as a crucial food and water resource. As such, both terrestrial and aquatic ecosystems throughout Door County and along the escarpment depend upon these exceptionally sensitive and pristine wetland complexes.

Genera listed in tables here include adult and larvae forms, number, lack or presence during a 1999 DNR survey, and common name. Additional information is available in Excel spreadsheets provided to the Land Trust, including feeding guilds, relative abundance, etc.

0.1 Table of Contents

1.0 Methods

Ponds and wetlands were surveyed following a Minnesota Pollution Control Agency Protocol: "*Macroinvertebrate Community Sampling Protocol for Depressional Wetland Monitoring Sites,"* and a corresponding index of biological integrity (Uzarski et. al., 2004) was applied defining all wetlands as "Wet Meadow Zone." This index of biological integrity incorporates various factors including relative abundance, richness, evenness, Shannon diversity index, and Simpson index to culminate in an overall generic score.

Dip net surveys are completed in two efforts, with each effort consisting of five dip net samples. Each dip net sample covers approximately ten feet of substrate. Dip net samples were taken amongst various microhabitats at each site in a proportional representation. Dip net samples were placed on a 1/2 inch wire frame, and vegetation was picked for approximately 10 minutes while invertebrates were allowed to fall into a tray below. Resulting samples were collected and stored in 70% isopropyl alcohol and glycerin.

Following dip net surveys, five bottle traps per site were placed over two nights in order to accommodate one complete diel cycle, targeting nocturnal and drifting species. Bottle traps in this case were especially useful in capturing adult coleoptera which are strong swimmers and may avoid dip net surveys, and as indicators for the presence of zooplankton, tadpoles and salamanders. During the July survey, bottle traps were not used, but rather a second dip net sample (two repetitions with ten samples each) was applied at each site in order to sample microhabitats more widely.

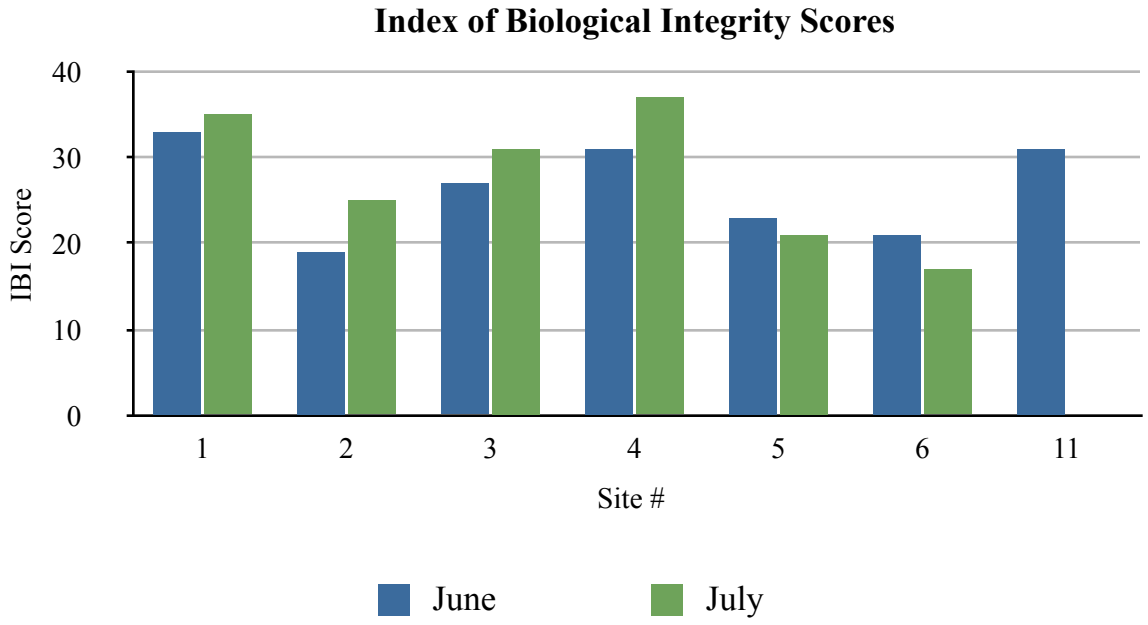
Invertebrates were keyed against invertebrate key "An Introduction to the Aquatic Insects of North America, Fourth Edition" (Merritt et. al., 2008), and Thorp and Covich (1991).

Chemistry samples were taken at each site with an Oakton Water Quality probe provided by the Land Trust. Parameters taken by this probe include temperature, pH, TDS (reported as TSS as filters were not available), and salinity. Salinity values given by the probe were extremely inconsistent and disregarded despite previous calibration (levels consistently greater than 300 parts per thousand). Throughout July sampling, samples were taken for total orthophosphate which was analyzed by absorbic acid method. All wetlands are slightly basic in pH which may be attributed to bicarbonate buffering capacity provided by groundwater inflow.

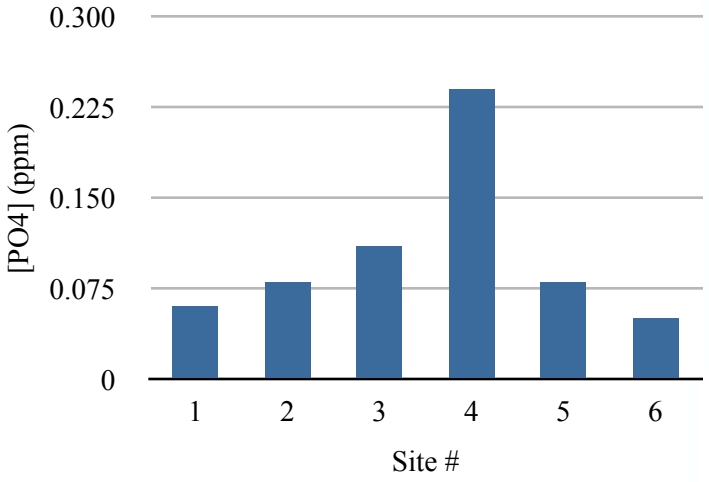
Due to drying, 7 sites were sampled in June, and 6 were sampled in July (pool at Bayshore Blufflands Natural Area had dried).

2.0 Site Overview

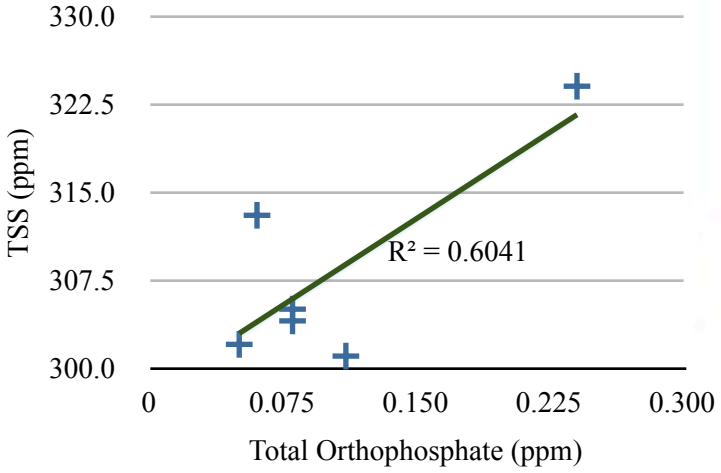
Site #	Description	Sample Date	Coordinates	°C	pH	TSS (ppm)	IBI Score	Genera Richness
1	Hutter Tract Vernal Pond	6/23/2014 7/12/2014	N 44° 56.726' W 087° 22.718'	13.8 25.2	7.6 8.02	N/A 313	33 35	11 15
2	Small Spring Pond North of Carlsville Road -Marquadt Property	6/22/2014 7/13/2014	N 44° 56.777' W 087° 22.628'	10.4 10.3	7.65 8.01	N/A 304	19 25	5 7
3	Large Spring Pond - Marquadt Property	6/22/2014 7/13/2014	N 44° 56.871' W 087° 22.661'	19.4 19.4	7.68 8.23	N/A 301	27 31	14 13
4	Ephemeral Pond - Marquadt Property	6/22/2014 7/13/2014	N 44° 56.934' W 087° 22.584'	18 23.6	7.88 8.68	N/A 324	31 37	15 10
5	Wetland Near Outlet - Marquadt Property	6/23/2014 7/12/2014	N 44° 56.975' W 087° 22.718'	14 17.2	7.72 7.91	N/A 305	23 21	10 9
6	Outlet Stream - Marquadt Property	6/23/2014 7/12/2014	N 44° 56.975' W 087° 22.727'	13.5 17.1	7.74 8.14	N/A 302	21 17	6 7
7	Seep to Woodland Pool - Spring Lane	5/22/2014	N 44° 59.869' W 087° 20.201'	9	N/A	-	23	5
8	Woodland Pool - Spring Lane	5/22/2014	N 44° 59.952' W 087° 20.187'	11.1	N/A	-	31	10
9	Sturtzl Property	No Sample	-	-	-	-	-	-
10	Carlyle Property	No Sample	-	-	-	-	-	-
11	Bayshore Blufflands Natural Area	6/23/2014	N 44° 56.232' W 087° 22.903'	20	7.46	-	31	4
12	Outlet to Green Bay at Park	Dry - No Sample	N 45° 00.805' W 087° 20.078'	-	-	-	-	-



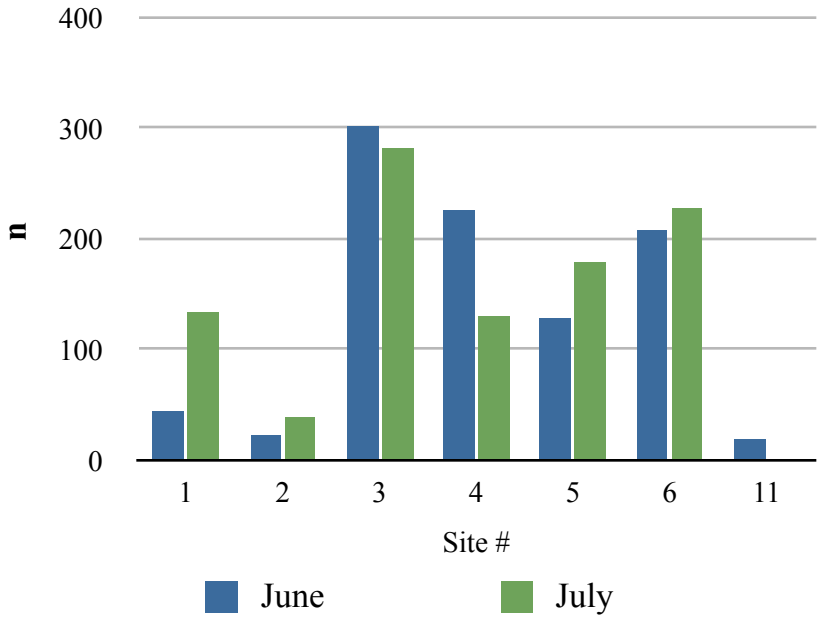
July Total Orthophosphate



July TSS vs. Total Orthophosphate Levels

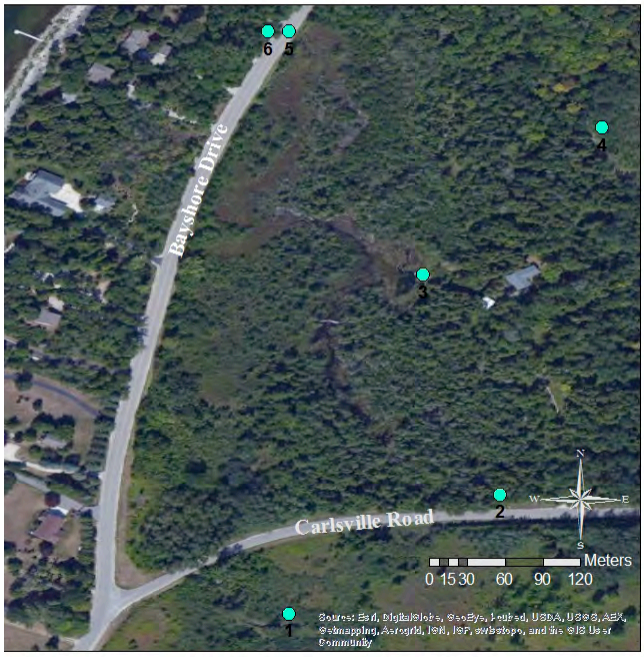


Sample Size



Aquatic Invertebrate Survey Sites

Sites 1-6



Due to the karst hydrology of these systems, a number of sampling sites dried at various times throughout the summer months. Sites #7 and 8, a part of the same wetland complex south of Spring Lane, were sampled in late May and it was decided that sampling would be delayed for one month as the samples showed little diversity and lacked ephemeroptera larvae and anisoptera nymphs, among others. This wetland complex, the largest of any sampled throughout the area of interest, quickly dried between the May and June survey dates. This drying time is much earlier than expected (late summer to early fall), and rapidly drained a surface area of several thousand square meters with a maximum depth greater than four feet. It is likely that this ephemeral wetland is being impacted by nearby groundwater pumping which may have reversed flow from the spring at the southeast corner (Site #7). Other sites drying prior to the June sampling date include Site #10 (Carlyle Property), a privately owned wetland west of Bayshore Drive bordering Green Bay, and Site #12, an outlet to Green Bay at Murphy County Park just southwest of the beach area and parking lot. This outflow is highly seasonal and dependent upon spring runoff.

Names used to describe these pools and property owners were borrowed from the 1999 survey carried out by Dr. Kurt Schmude as to provide a simple means for comparison. Land owners in many cases have changed since this survey and may no longer be current.

2.1 Hutter Tract Vernal Pond

This is a relatively small pond located just south of Carlsville Road and east of Bayshore Drive. The fetch runs from east to northwest and deepens westwardly toward Bayshore Drive. The pool is relatively narrow in width (approximately 7 to 20 feet). Given the relatively small surface area of this pool, the macroinvertebrate community is robust and extremely diverse. This pool holds an exceptional number of predatory macroinvertebrates including anisoptera, zygoptera, and diving beetles, which as predators depend upon a well developed prey community as a food source. This pool in particular is a key resource for anisoptera nymph development and should be considered of utmost importance to the Land Trust.

Site #1

Habitat throughout this vernal pond includes light algal growth, emergent and submerged vegetation, and leaf litter. The substrate is primarily vegetative. Surrounding plant growth includes short brush and alders, with some overhanging branches providing shaded cover. In July, this was the warmest of all water bodies sampled (25.2°C). Water here is rather stagnant and likely warms throughout the summer months due to lack of flow. The pool retained significant volumes of water throughout all sampling dates.

2.1.1 Taxonomy

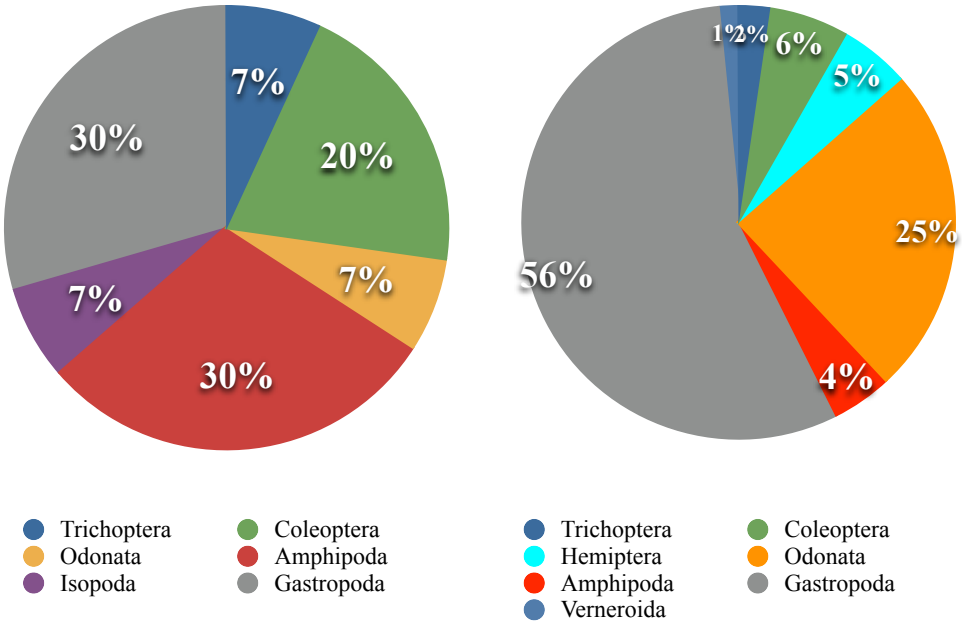
June Sample

Order	Suborder	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Trichoptera		Limnephelidae	Limnephilus	L	3	F:Y G:Y	Caddisfly
Coleoptera		Dytiscidae	Dytiscus	L	5	F:Y G:Y	Pred. Diving Beetle
Coleoptera		Dytiscidae	Agabus	L	1	F:Y G:N	Pred. Diving Beetle
Coleoptera		Dytiscidae	Copelatus	A	1	F:Y G:N	Pred. Diving Beetle
Coleoptera		Dytiscidae	Eretes	A	2	F:Y G:N	Pred. Diving Beetle
Odonata	Anisoptera	Libellulidae	Sympetrum	L	1	F:N G:N	Dragonfly
Odonata	Zygoptera	Coenagrionidae	Enallagma	L	2	F:N G:N	Narrow Winged Damself
Amphipoda	Gammaridae	Crangonyctidae	Crangonyx	A	13	F:Y G:Y	Cave Amphipod
Isopoda	Asellota	Asellidae	Caecidotea	A	3	F:Y G:Y	Freshwater Sow Bug
Basomattophora		Lymnaeidae	Stagnicola	A	12	F:Y G:Y	Snail
		Physidae	Physa	A	1	F:N G:N	Snail

July Sample

Order	Suborder	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Trichoptera		Limnephelidae	Limnephilus	L	3	F:Y G:Y	Caddisfly
Coleoptera		Dytiscidae	Dytiscus	L	1	F:Y G:Y	Pred. Diving Beetle
Coleoptera		Dytiscidae	Laccodytes	A	3	F:Y G:N	Pred. Diving Beetle
Coleoptera		Dytiscidae	Copelatus	A	1	F:Y G:N	Pred. Diving Beetle
Coleoptera		Dytiscidae	Cybister	A	1	F:Y G:N	Pred. Diving Beetle
Coleoptera		Dytiscidae	Laccophilus	A	2	F:Y G:Y	Pred. Diving Beetle
Hemiptera		Gerridae	Trepobates	A	3	F:Y G:N	Water Strider
Hemiptera		Pleidae	Neoplea	A	4	F:N G:N	Pygmy Backswimmer
Odonata	Anisoptera	Libellulidae	Sympetrum	L	32	F:N G:N	Dragonfly
Odonata	Zygoptera	Lestidae	Lestes	L	1	F:Y G:Y	Damselfly
Amphipoda	Gammaridae	Crangonyctidae	Crangonyx	A	6	F:Y G:Y	Cave Amphipod
Basomattophora		Lymnaeidae	Stagnicola	A	53	F:Y G:Y	Snail
		Physidae	Physa	A	9	F:N G:N	Snail
Basomattophora		Planorbidae	Gyraulus	A	13	F:Y G:Y	Snail
Veneroida	Sphaeriacea	Sphaeriidae		A	2	F:Y	Fingernail Clam

Site #1: June Relative Abundance Site #1: July Relative Abundance



The presence of anisoptera nymphs in this vernal pond increased drastically from June to July (from 1 to 32 individuals). The ecosystem is heavily centered upon predaceous genera of anisoptera, zygoptera, and aquatic coleoptera. The largest adult predaceous coleoptera of all sampling sites were found within Site #1. Crangonyx likely serve as an important food source for these predatory macroinvertebrates, along with various hemiptera. Correspondingly, amphipod, trichoptera, and isopod relative abundance declined throughout summer months as predatory odonata and hemiptera increase. Ephemeroptera (mayflies) were not present at this site despite being rather ubiquitous among other sites, which may be attributed to heavy predation along with the loss of isopods in the July sample.

2.2 Small Spring Pond - Marquadt Property

This is a small spring pond just North of Carlsville Road and east of Bayshore Drive. The pond lies just northeast (across Carlsville Road) of the Hutter Tract Vernal Pond. Sandy groundwater springs feed this pond which connects at the northwest corner to a stream running through the Marquadt property. Water clarity is exceptional, and the pond is not highly productive. The macroinvertebrate community is dominated by crustacea (amphipoda and isopoda). Bottle traps showed no indication of zooplankton, tadpoles or salamanders. Although index of biological integrity scores are fairly low for this pool, this likely reflects lack of habitat diversity and little vegetation rather than poor water quality. No predatory genera were found here, and as such the community composition remained fairly constant throughout sampling dates.

2.2.1 Taxonomy

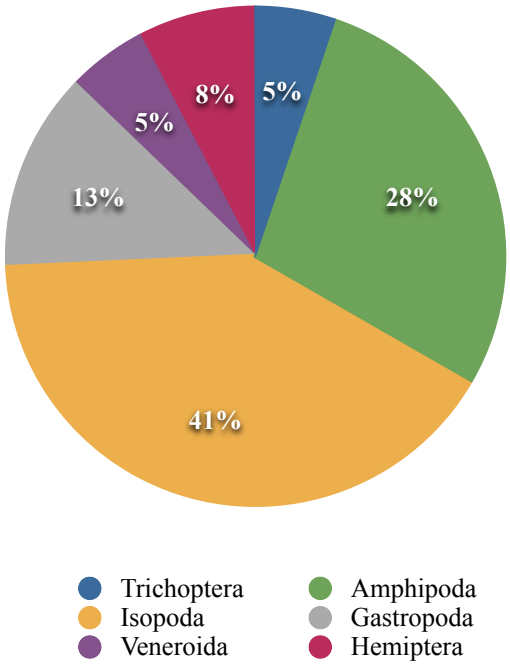
June

Order	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Trichoptera	Limnephelidae	Limnephilus	L	2	F:Y G:Y	Caddisfly
Amphipoda	Crangonyctidae	Crangonyx	A	11	F:Y G:Y	Cave Amphipod
Isopoda	Asellidae	Caecidotea	A	6	F:Y G:Y	Freshwater Sow Bug
Basomattophora	Lymnaeidae	Stagnicola	A	1	F:N G:N	Snail
Basomattophora	Planorbidae	Gyraulus	A	2	F:N G:N	Snail

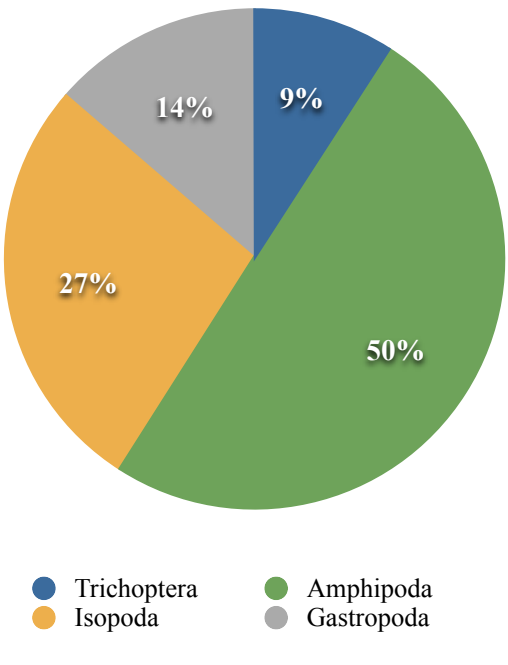
July

Order	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Trichoptera	Limnephelidae	Limnephilus	L	2	F:Y G:Y	Caddisfly
Hemiptera	Gerridae	Trepobates	L	3	F:Y G:N	Water Strider
Amphipoda	Crangonyctidae	Crangonyx	A	11	F:Y G:Y	Cave Amphipod
Isopoda	Asellidae	Caecidotea	A	16	F:Y G:Y	Freshwater Sow Bug
Basomattophora	Lymnaeidae	Stagnicola	A	3	F:N G:N	Snail
Basomattophora	Planorbidae	Gyraulus	A	2	F:N G:N	Snail
Veneroida	Sphaeriidae	Pisidium	A	2	F:N G:N	Fingernail Clam

Site #2: July Relative Abundance



Site #2: June Relative Abundance



2.3 Large Spring Pond - Marquadt Property

Site #3

This is the largest and deepest permanent water body sampled. A number of springs arise and feed the pond directly. At the northwestern corner, the pond is connected to a shallow wetland system (Site #5), as well as a small low flow creek at the southeastern edge. This pond is most drastically influenced by nutrients and has become extremely eutrophic. Nuisance algae growth has largely overtaken endemic macrophytes. Substrate samples indicate that the pond is transitioning from a primarily sand substrate toward an organic rich silt from excess deposition of organic carbon. Although this pond is highly productive due to significant primary production, gastropods have become exceptionally abundant (see relative abundance) scraping upon filamentous algae. This condition is common for vernal pools suffering from eutrophication (Colburn, 2004). This site held county records for Microvelia bunoi, Gerris insperatus, Enochrus cinctus, and Enochrus horni during the 1999 survey. Most unfortunately, no members of these genera were found in 2014, which may be due to the shift in community structure following algae colonization and substrate transformation.

2.3.1 Taxonomy

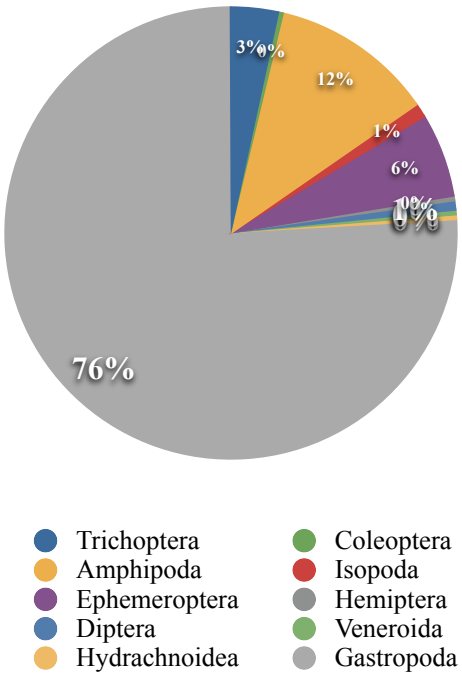
June

Order	Suborder	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Coleoptera		Dytiscidae	Hygrotus	A	1	F:Y G:Y	Pred. Diving Beetle
Odonata	Anisoptera	Libellulidae	Plathemis	L	1	F:Y G:N	White Tail Skimmer D
Odonata	Anisoptera	Aeshnidae	Anax	L	1	F:Y G:Y	Darner Dragonfly
Hemiptera	Heteroptera	Notonectidae	Notonecta	A	1	F:N G:N	Pred. Diving Beetle
Trichoptera		Polycentropodidae	Polycentropus	L	1	F:N G:N	Caddisfly
Trichoptera		Limnephelidae	Limnephilus	L	9	F:Y G:Y	Caddisfly
Ephemeroptera		Leptophlebiidae	Leptophlebia	L	18	F:Y G:Y	Mayfly
Diptera		Chironomidae		L	2	F:N G:N	Chironomid / Midges
Amphipoda	Gammaridae	Crangonyctidae	Crangonyx	A	35	F:Y G:Y	Cave Amphipod
Isopoda		Asellidae	Caecidotea	A	3	F:Y G:Y	Freshwater Sow Bug
		Lymnaeidae	Stagnicola	A	121	F:N G:N	Snail
		Physidae	Physa	A	107	F:N G:N	Snail
Veneroida	Sphaeriacea	Sphaeriidae	Pisidium	A	1	F:N G:N	Fingernail Clam
Trombidifor	Prostigmata			A	1	N	True Water Mite

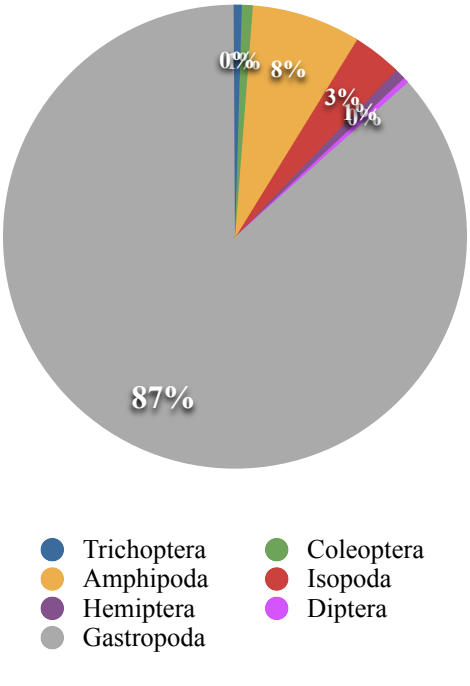
July

Order	Suborder	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Coleoptera		Dytiscidae	Derovatellus	A	1	F:Y G:N	Pred. Diving Beetle
Coleoptera		Dytiscidae		A	1	F:Y G:N	Pred. Diving Beetle
Odonata	Anisoptera	Libellulidae	Sympetrum	L	3	F:Y G:N	White Tail Skimmer D
Odonata	Zygoptera	Lestidae	Lestes	L	16	F:N G:N	Darner Dragonfly
Hemiptera	Heteroptera	Notonectidae	Notonecta	A	1	F:N G:N	Pred. Diving Beetle
Hemiptera	Heteroptera	Corixidae		A	1	F:Y	Pred. Diving Beetle
Trichoptera		Limnephelidae	Anabolia	L	1	F:Y G:Y	Caddisfly
Diptera		Chironomidae	Chironomus	L	1	F:N G:N	Chironomid / Midges
Amphipoda	Gammaridae	Crangonyctidae	Crangonyx	A	20	F:Y G:Y	Cave Amphipod
Isopoda		Asellidae	Caecidotea	A	9	F:Y G:Y	Freshwater Sow Bug
		Lymnaeidae	Stagnicola	A	128	F:N G:N	Snail
		Physidae	Physa	A	76	F:N G:N	Snail
Basomattophora		Planorbidae	Gyraulus	A	24	F:Y G:Y	Ram's Horn Snail

Site #3: June Relative Abundance



Site #3: July Relative Abundance



2.4 Ephemeral Pond: Marquadt Property

The Marquadt Ephemeral Pond is a wooded wetland which shows exceptional genera richness (10 and 15 in June and July, respectively). Habitat is rich in leaf litter, submerged and emergent vegetation, floating logs and detritus, with good water clarity and little algae growth. Trichoptera production here outweighs all other sampling sites, with trichoptera being very abundant adjacent to shorelines throughout both wooded and vegetative areas, but declining in the July sample likely due to both predation and hatching. Trichoptera collected here in July were nearly all preparing for hatch (strongly encased and developing wing pads). Site #4 was also the only found to host Megaloptera (fishfly larvae) in 2014.

Site #4

2.4.1 Taxonomy

June

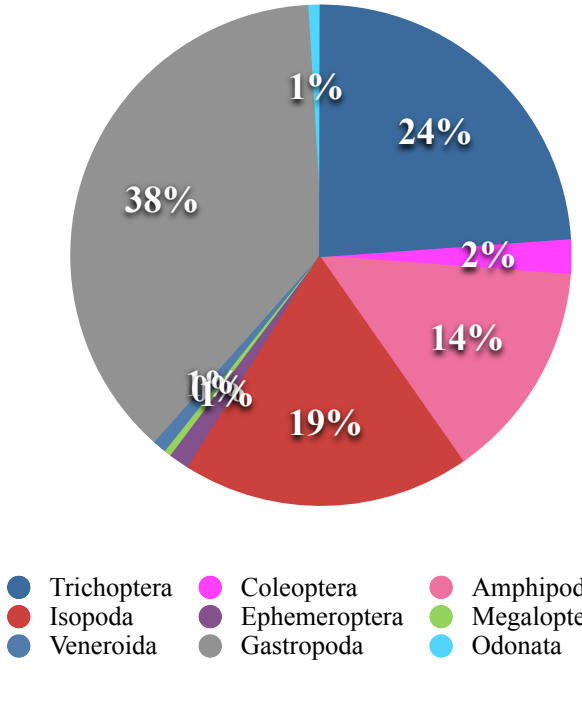
Order	Family	Genus	Species	Larvae /Adult	#	Present 1999	Common Name
Coleoptera	Dytiscidae	Dytiscus		L	3	F:Y G:Y	Pred. Diving Beetle
Coleoptera	Dytiscidae	Hydrotrupinae	hydrotupes	A	1	F:Y G:N	Pred. Diving Beetle
Coleoptera	Dytiscidae	Hydroporinae		A	1	F:Y G:N	Pred. Diving Beetle
Megaloptera	Corydalidae	Chauliodes	latreille	L	1	F:N G:N	Fishfly
Odonata	Libellulidae	Erythemis		L	1	F:N G:N	Pondhawk Dragonfly
Odonata	Lestidae	Lestes		L	1	F:Y G:Y	Spread Winged Damselfly
Trichoptera	Limnephelidae	Limnephilus		L	53	F:Y G:Y	Caddisfly
Trichoptera	Phyrganeidae	Hagenella	cana	L	1	F:N G:N	Caddisfly
Ephemeropter	Leptophlebiidae	Leptophlebia		L	3	F:Y G:Y	Mayfly
Amphipoda	Crangonyctidae	Crangonyx		A	32	F:Y G:Y	Cave Amphipod
Isopoda	Asellidae	Caecidotea		A	42	F:Y G:Y	Freshwater Sow Bug
	Lymnaeidae	Stagnicola		A	49	F:N G:N	Snail
	Physidae	Physa		A	4	F:N G:N	Snail
Basomattopho	Planorbidae	Gyraulus		A	32	F:Y G:Y	Snail
Veneroida	Sphaeriidae	Pisidium		A	2	F:Y G:Y	Fingernail Clam

July

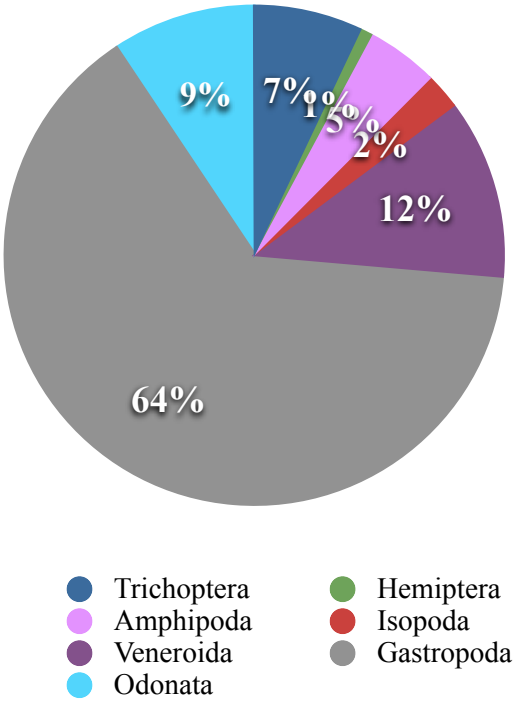
Order	Suborder	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Hemiptera		Corixidae	Micronecta	L	1	F:N G:N	Pred. Diving Beetle
Odonata	Anisoptera	Libellulidae	Pseudoleun	L	6	F:N G:N	Pondhawk Dragonfly

Order	Suborder	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Odonata	Zygoptera	Lestidae	Lestes	L	6	F:Y G:Y	Spread Winged Damselfly
Trichoptera	Integripalpia	Limnephelidae	Limnephilus	L	9	F:Y G:Y	Caddisfly
Diptera		Chironomidae		L	1	F:N G:N	Bloodworm
Amphipoda	Gammaridae	Crangonyctidae	Crangonyx	A	6	F:Y G:Y	Cave Amphipod; Scud/Si
Isopoda		Asellidae	Caecidotea	A	3	F:Y G:Y	Freshwater Sow Bug
		Lymnaeidae	Stagnicola	A	56	F:N G:N	Snail
Basomattophora		Planorbidae	Gyraulus	A	27	F:Y G:Y	Snail
Veneroida	Sphaeriacea	Sphaeriidae		A	15	F:Y G:N	Fingernail Clam

Site #4: June Relative Abundance



Site #4: July Relative Abundance



2.5 Wetland Near Outlet: Marquadt Property

Flowing from east to west to an outflow culvert beneath Bayshore Drive toward Green Bay, this wetland holds habitat consisting primarily of stalked emergent marsh grasses, along with moderate amounts of submerged vegetation. Substrate was primarily gravel near Bayshore Drive, organic matter, and stalked emergent vegetation. Bottle traps set in this sampling site showed no signs of tadpoles, minnows, nor zooplankton. Water levels are fairly shallow here, with the greatest bottle trap depth being 16 inches. The site is indirectly connected at the eastern end to Site #3, likely holding many invertebrates originating there.

2.5.1 Taxonomy

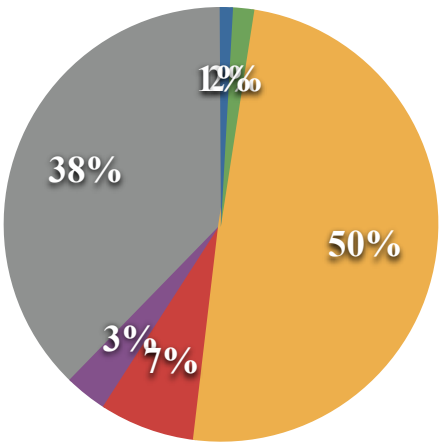
June

Order	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Diptera	Stratiomyidae	Stratiomysis	L	1	F:N G:N	Soldierfly
Coleoptera	Dytiscidae		L	1	F:Y	Pred. Diving Beetle
Coleoptera	Lampyridae		L	1	F:N G:N	Firefly
Trichoptera	Limnephelidae	Limnephilus	L	1	F:Y G:Y	Caddisfly
Ephemeroptera	Leptophlebiidae	Leptophlebia	L	4	F:Y G:Y	Mayfly
Amphipoda	Crangonyctidae	Crangonyx	A	63	F:Y G:Y	Cave Amphipod
Isopoda	Asellidae	Caecidotea	A	9	F:Y G:Y	Freshwater Sow Bug
	Lymnaeidae	Stagnicola	A	26	F:Y G:Y	Snail
	Physidae	Physa	A	3	F:N G:N	Snail
Basomattophora	Planorbidae	Gyraulus	A	19	F:N G:N	Snail

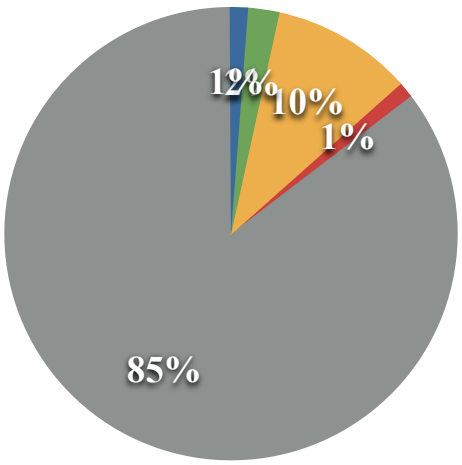
July

Order	Family	Genus	Larvae/ Adult	#	Present 1999?	Common Name
Diptera	Stratiomyidae	Stratiomysis	L	2	F:N G:N	Soldierfly
Coleoptera	Dytiscidae	Dytiscus	L	1	F:Y G:N	Pred. Diving Beetle
Coleoptera	Dytiscidae	Hydaticus	L	1	F:Y G:N	Pred. Diving Beetle
Coleoptera	Dytiscidae	no id (molting)	L	2	F:Y	Pred. Diving Beetle
Amphipoda	Crangonyctidae	Crangonyx	A	18	F:Y G:Y	Cave Amphipod
Isopoda	Asellidae	Caecidotea	A	2	F:Y G:Y	Freshwater Sow Bug
	Lymnaeidae	Stagnicola	A	127	F:Y G:Y	Snail
	Physidae	Physa	A	13	F:N G:N	Snail
Basomattoph	Planorbidae	Gyraulus	A	13	F:N G:N	Snail

Site #5: June Relative Abundance



Site #5: July Relative Abundance



Trichoptera
Amphipoda
Ephemeroptera
Coleoptera
Isopoda
Gastropoda
Diptera
Amphipoda
Gastropoda
Coleoptera
Isopoda

2.6 Outlet Stream from Marquadt Property

Site #6 is the outflow of site #5 at the western side of Bayshore Drive. Flow is fairly rapid in this outlet stream in the early summer months, and provides consistent flow of clear water from the Marquadt wetland. Flow had declined significantly from June to July sampling times, and submerged vegetation became much more prominent. The substrate transitions from gravel near the culvert to rich organic farther downstream, including root structures, emergent vegetation, and submerged timber. Water depths were consistently less than one foot in depth in June and declined in July (4.5" max depth at culvert). Richness and diversity increased for this site as compared to 1999.

2.6.1 Taxonomy

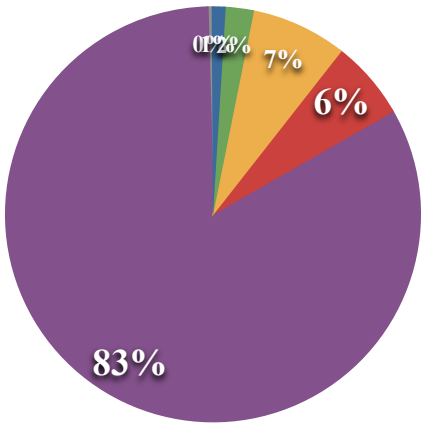
June

Order	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Trichoptera	Limpnephelidae	Ironoquia	L	4	F:Y G:N	Caddisfly
Ephemeroptera	Leptophlebiidae	Leptophlebia	L	5	F:Y G:N	Mayfly
Amphipoda	Crangonyctidae	Crangonyx	A	108	N	Cave Dwell. Amph
Isopoda	Asellidae	Caecidotea	A	18	N	Sow Bug
Basomattophora	Lymnaeidae	Lymnaea	A	61	N	Snail
Basomattophora	**Planorbidae**	Gyraulus	A	12	N	Snail

July

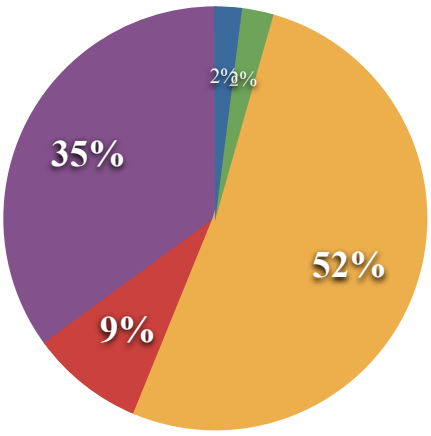
Order	Family	Genus	Larvae/ Adult	#	Present 1999	Common Name
Trichoptera	Limpnephelidae	Limnephilus	L	2	F:Y G:Y	Caddisfly
Ephemeroptera	Leptophlebiidae	Leptophlebia	L	5	F:Y G:Y	Mayfly
Coleoptera	Dytiscidae	Dytiscus	L	1	F:N G:N	Pred. Diving Beetle
Amphipoda	Crangonyctidae	Crangonyx	A	17	N	Cave Amphipod
Isopoda	Asellidae	Caecidotea	A	14	N	Freshwater Sow Bug
Basomattophor	Lymnaeidae	Lymnaea	A	179	N	Snail
Basomattophor	**Planorbidae**	Gyraulus	A	10	N	Snail

Site #6: July Relative Abundance



Trichoptera
Amphipoda
Gastropoda
Ephemeroptera
Isopoda

Site #6: June Relative Abundance



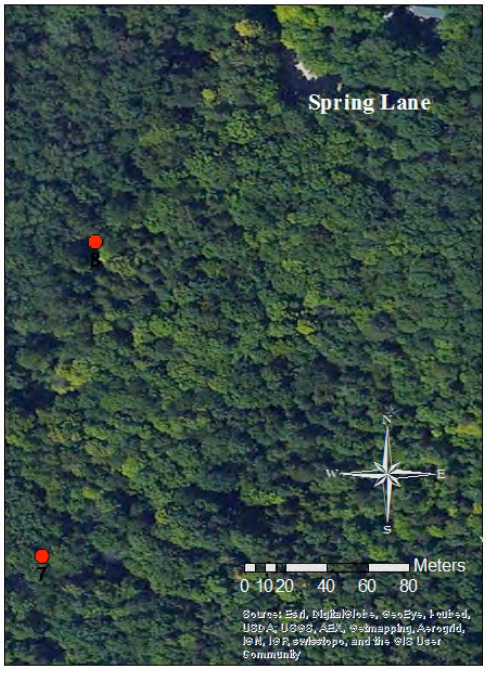
Trichoptera
Amphipoda
Gastropoda
Ephemeroptera
Isopoda
Coleoptera

2.7 Spring Seep Site to Woodland Pool - Spring Lane

This site is at the inflow from a natural groundwater spring at the southeast corner of the Spring Lane wetland complex. This spring is crucial for maintaining water levels within this woodland pool, which holds several thousand cubic meters of water. Cladophorous algae growth was significant during May sampling events, and indicative of spring sourced nutrient loads, as algae growth quickly declined with distance from the spring site (see Photo Log Site #7). Secondary production was low here despite drastic primary production, and diversity was noticeably low. Both sites seven and eight were surveyed in May and it was decided that sampling would be postponed for one month as these samples lacked diversity.

The impact of groundwater pumping and contamination of this site is perhaps the most urgent issue to be considered by the Door County Land Trust in the conservation master plan. This wetland complex (including both sites 7 and 8) quickly dried from a significantly large woodland pool to nearly no water in a matter of one month (See Photo Log Site #8).

Spring Lane Sites 7-8

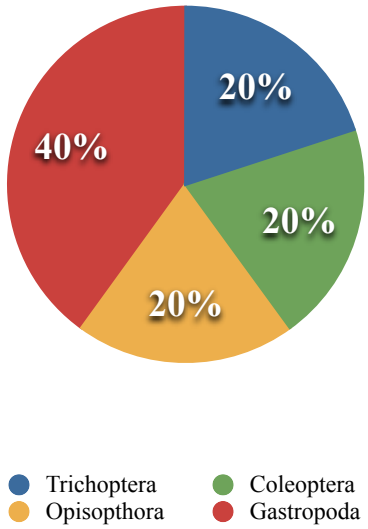


2.7.1 Taxonomy

May

Order	Family	Genus	Larvae/ Adult	#	Present 1999	Feeding Guild	Common Name
Trichoptera	Limnephilidae	Ironoquia	L	2	F:Y G:Y	Shredder	Caddisfly
Coleoptera	Dytiscidae	Copelatus	L	1	F:Y G:N	Predaceous	Pred. Diving Beetle
Coleoptera	Dytiscidae	Hybius	L	1	F:Y G:N	Predaceous	Pred. Diving Beetle
Opisopthora	Lumbriculidae	Lumbriculus	A	2	N	Gatherer	Earthworm
	Physidae	Aplexa	A	4	N	Scraper/Grazer	Snail

Site #7 : May Relative Abundance



2.8 Woodland Pool - Spring Lane

North of the spring (Site #7) lies the majority of the wetland complex, with a maximum depth of more than four feet during May. This woodland pool is amongst standing hardwoods with a heavy canopy - floating logs and leaves providing shaded cover for macroinvertebrates. Benthic substrate is woodland soils and root structures overlain with a thick layer of leaf litter. This large wetland remarkably dried along with its spring site (#7) in less than one month (see Photo Log).

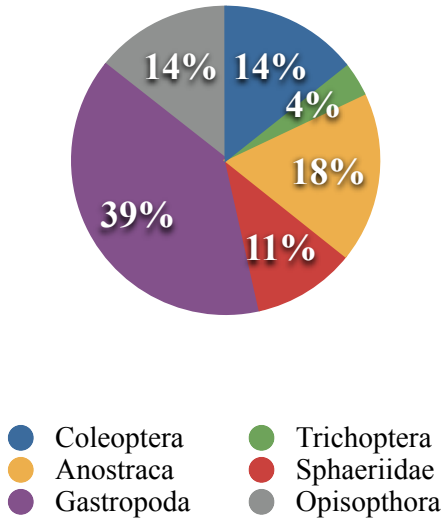
Both sites seven and eight are unique in that their crustacean population consists of anostraca (ferry shrimp) rather than isopoda and the cave Amphipod Crangonyx. These sites were the only sites in the area of interest found to harbor anostraca. Cladoceran zooplankton were most abundant here among all sites, with ample detritus and suspended organics.

2.8.1 Taxonomy

Order	Family	Genus	Larvae/ Adult	#	Present 1999	Feeding Guild	Common Name
Coleoptera	Dytiscidae	Eretes	A	1	F:Y G:N	Predaceous	Pred. Diving Beetl

Order	Family	Genus	Larvae/ Adult	#	Present 1999	Feeding Guild	Common Name
Coleoptera	Dytiscidae	Matus	A	1	F:Y G:N	Predaceous	Pred. Diving Beetl
Coleoptera	Dytiscidae	Hybius	L	1	F:Y G:N	Predaceous	Pred. Diving Beetl
Coleoptera	Dytiscidae	Dytiscus	L	1	F:Y G:N	Predaceous	Pred. Diving Beetl
Trichoptera	Limnephilidae	Limnephilus	L	1	F:Y G:Y	Shredder	Caddisfly
Anostraca			A	5	N	Collector	Ferry Shrimp
	Lymnaeidae	Stagnicola	A	8	N	Scraper / Graze	Snail
	Physidae	Aplexa	A	3	N	Scraper / Graze	Snail
Veneroida	Sphaeriidae		A	3	N	Filter-Feeder	Fingernail Clam
Opisopthora	Lumbriculidae	Lumbriculus	A	4	N	Gatherer	Earthworm

Site #8: May Relative Abundance



2.11 Bayshore Blufflands State Natural Area

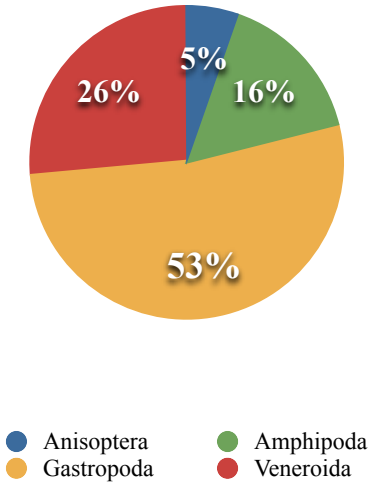
This site is a very small pool, lying in the valley below the wooden walking bridge passing through the Natural Area. Substrate was a heavy mud laden with root structure and leaf litter overlay. Only dip net samples were taken here in June as the water was too shallow for bottle traps. Although this pool is small, shallow, and dried prior to July sampling, some invertebrates develop here. This includes a small number of anisoptera, crangonyx, snails and fingernail clams. Site #11 was not sampled in 1999.

2.11.1 Taxonomy

June

Order	Suborder	Family	Genus	Larvae/ Adult	#	Feeding Guild	Common Name
Anisoptera		Libellulidae	Sympetrum	L	1	Predaceous	Dragonfly
Amphipoda	Gammaridae	Crangonyctidae	Crangonyx	A	3	Detrivore	Cave Amphipod
Basomattophora		Lymnaeidae	Stagnicola	A	10	Scraper / Grazer	Snail
Veneroida	Sphaeriacea	Sphaeriidae		A	5	Filter-Feeder	Fingernail Clam

Site #11: June Relative Abundance

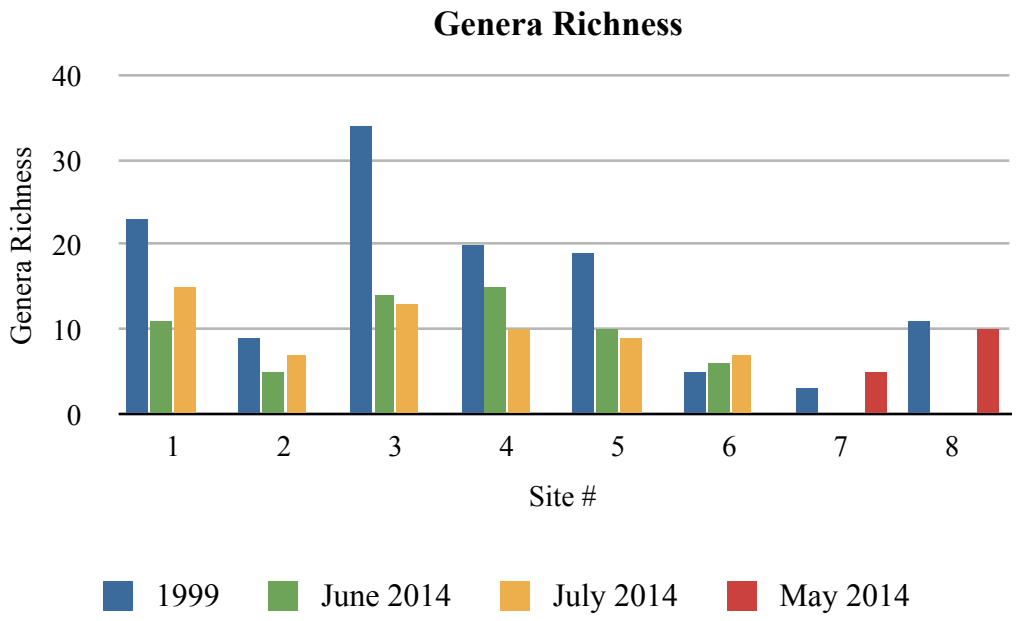


3.0 Taxonomic Overview

Although index of biological integrity scores from the MPCA method suggest degradation for many of these sites, these vernal pools are unique in their structure, and IBI scores should rather be considered as a relative comparison amongst these wetlands. Water and habitat quality throughout the area of interest is generally quite outstanding with the exception of nutrient loading at Site #3, 7, and 8. The incredibly unique community structure involving cladoceran zooplankton, groundwater sourced amphipods, a number of ephemeroptera and trichoptera larvae, with strong and diverse predatory populations shows that these vernal pools provide outstanding habitat for macroinvertebrate development and adult stages. As mentioned, maintaining these macroinvertebrate populations through nutrient management is crucial for not only the invertebrate community but higher trophic levels of both aquatic and terrestrial domains along the escarpment.

Genera richness was generally shown to decline as compared to the 1999 survey, although this may be attributed in part to sampling methodology. Between June and July samples, sites 1, 2, and 6 increased in genera richness, while sites 3, 4, and 5 declined in richness. Ephemeroptera larvae appear to have hatched between June and July sampling dates, with the Leptophlebia family being found only at site #6 during the July sample. Trichoptera populations likewise declined as expected throughout summer months indicative of hatching and predation.

While species identified here are not found on the Wisconsin DNR National Heritage Inventory working list, a number of members of encountered genera can be found on the list. This includes species of the following genera: Matus (1), Enallagma (3), Agabus (8), Copelatus (1), Aeshna (3), Laccophilus (1), Hygrotus (5), Notonecta (1). These rare species are primarily of the predaceous diving beetle (Dytiscidae) family.


Genera Richness
40
30
20
10
0
Genera Richness
1
2
3
4
5
6
7
8
Site #
1999
June 2014
July 2014
May 2014

4.0 Land Management Recommendations

Given my understanding of the invertebrate communities throughout the area of interest, water chemistry and habitat quality, I recommend the following precautions in prioritized order:

1) Identify nearby pumping wells at the Spring Lane wetland complex (Sites #7 and 8), which may have contributed to rapid drawdown throughout the month of June.
2) Consider nutrient sources for Site #3, and develop a nutrient management plan for this waterbody. Such a plan may restore sediment and vegetative habitat in this pond, restore community evenness, and further strengthen the invertebrate community at Site #5.
3) Identify likely sources of nutrients contaminating Sites #7 and 8 via groundwater spring.
4) Work with local agriculture to develop nutrient management plans and continue to communicate the incredibly strong connection between shallow groundwater tables, nutrient / bacterial transport, and surrounding wetland habitats.
5) Maintain buffer strips along sites 1 and 2 (Carlsville Road) to encourage good water quality and development of odonata nymphs.
6) Consider continued water quality, invertebrate and herpetology surveys in these wetlands to understand community dynamics of vernal pools following initiation of land management plans.
7) Continue to examine seasonality of the outflow to Green Bay, to identify any fish that may use this creek as spawning, and to identify any macroinvertebrates which may enter Green Bay from the escarpment.
8) Communicate to land owners (especially along Green Bay at Bayshore Drive) the importance of these wetland complexes, sensitivity to groundwater withdrawals, nutrient inputs, and buffer strips from roads and yard space.
9) Continued habitat management at Site #4 which harbors a number of indicator species, strong diversity and richness.

References

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Zhang, J., Holsinger, J. (2003). *Systematics of the freshwater amphipod genus Crangonyx (Crangonyctidae) in North America.* Martinsville, VA: Virginia Museum of Natural History

This document was exported from Numbers. Each table was converted to an Excel worksheet. All other objects on each Numbers sheet were placed on separate worksheets. Please be aware that formula calculations may differ in Excel.

Numbers Sheet Name	Numbers Table Name	Excel Worksheet Name
Site 1		
	June	Site 1 - June
	July	Site 1 - July
	"All Drawings from the Sheet"	Site 1 - Drawings
Site 2 (Spring Site Near Road - Marquadt Property)		
	May	Site 2 (Spring Site Near Road -
	June	Site 2 (Spring Site Near Road 1
	July	Site 2 (Spring Site Near Road 2
	"All Drawings from the Sheet"	Site 2 (Spring Site Near Road 3
Site 3		
	June	Site 3 - June
	July	Site 3 - July
	"All Drawings from the Sheet"	Site 3 - Drawings
Site 4		
	June	Site 4 - June
	July	Site 4 - July
	"All Drawings from the Sheet"	Site 4 - Drawings
Site 5		
	June	Site 5 - June
	July	Site 5 - July
	"All Drawings from the Sheet"	Site 5 - Drawings
Site 6		
	June	Site 6 - June
	July	Site 6 - July
	"All Drawings from the Sheet"	Site 6 - Drawings
Site 7 (Woodland Pool Seep Site Spring Lane)		
	May	Site 7 (Woodland Pool Seep Site
Site 8 (Woodland Pool - Spring Lane)		
	May	Site 8 (Woodland Pool - Spring
Site 11		
	June	Site 11 - June
Overview		
	Table 1	Overview - Table 1
	IBI Scores	Overview - IBI Scores
	Table 3	Overview - Table 3
	Table 4	Overview - Table 4
	"All Drawings from the Sheet"	Overview - Drawings

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae/Adult	#
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**		Limnephelidae	Limnephilus		L	3
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Dytiscus		L	5
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Agabus		L	1
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Copelatus		A	1
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Eretes		A	2
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Anisoptera	Libellulidae	Sympetrum		L	**1**
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Zygoptera	Coenagrionidae	Enallagma		L	2
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	13
Arthropoda	**Crustacea**	**Malacostraca**			**Isopoda**	Asellota	Asellidae	Caecidotea		A	3
Mollusca		**Gastropoda**			**Basomattophora**		Lymnaeidae	Stagnicola		A	12
Mollusca		**Gastropoda**					Physidae	Physa		A	1

R.A. (%)	Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index
6.82	DN	F:Y G:Y	Shredder	Caddisfly		0.005	0.190	3	-0.183107546267056	1.95
11.36	DN/BT	F:Y G:Y	Predaceous	Pred. Diving Beetle		0.013			-0.247130877441382	
2.27	BT	F:Y G:N	Predaceous	Pred. Diving Beetle		0.001			-0.0860043098617787	
2.27	DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.001			-0.0860043098617787	
4.55	DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.002			-0.140501929698105	
2.27	DN	F:N G:N	Predaceous	Dragonfly		0.001			-0.0860043098617787	
4.55	DN	F:N G:N	Predaceous	Narrow Winged Damselfly		0.002			-0.140501929698105	
29.55	DN	F:Y G:Y	Detrivore	Cave Dwelling Amphipod		0.087			-0.360230081680396	
6.82	DN	F:Y G:Y	Herbivore	Freshwater Sow Bug		0.005			-0.183107546267056	
27.27	DN/BT	F:Y G:Y	Scraper / Grazer	Snail		0.074			-0.354349904762798	
2.27	DN	F:N G:N	Scraper/Grazer	Snail		0.001			-0.0860043098617787	

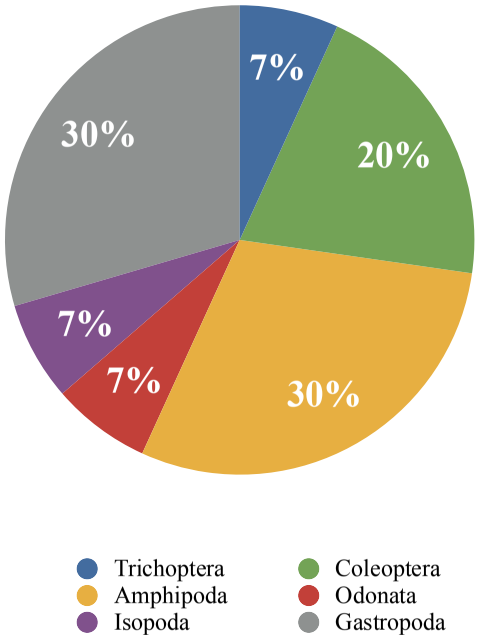
Shannon Score	Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
5.00	0.85	5.00	1.00	5.00	3.00	3.00	3.00	5.00	33.00	Moderately Impacted - “Wetland shows few, but obvious, signs of anthropogenic disturbance”	6.82	44
Trichoptera	Coleoptera	Amphipoda	Odonata	Isopoda	Gastropoda							
3	9	13	3	3	13							

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae/ Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**		Limnephelidae	Limnephilus		L	3	2.24
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Dytiscus		L	1	0.75
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Laccodytes		A	3	2.24
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Copelatus		A	1	0.75
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Cybister		A	1	0.75
	Hexapoda	**Insecta**			**Coleoptera**		Dytiscidae	Laccophilus		A	2	1.49
Arthropoda	**Hexapoda**	**Insecta**			**Hemiptera**		Gerridae	Trepobates		A	3	2.24
Arthropoda	**Hexapoda**	**Insecta**			**Hemiptera**		Pleidae	Neoplea		A	4	2.99
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Anisoptera	Libellulidae	Sympetrum		L	32	23.88
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Zygoptera	Lestidae	Lestes		L	1	0.75
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	6	4.48
Mollusca		**Gastropoda**			**Basomattophora**		Lymnaeidae	Stagnicola		A	53	39.55
Mollusca		**Gastropoda**					Physidae	Physa		A	9	6.72
Mollusca		**Gastropoda**			**Basomattophora**		Planorbidae	Gyraulus		A	13	9.70
Mollusca		**Pelecypoda**	**Heterodonta**		**Veneroida**	Sphaeriacea	Sphaeriidae			A	2	1.49

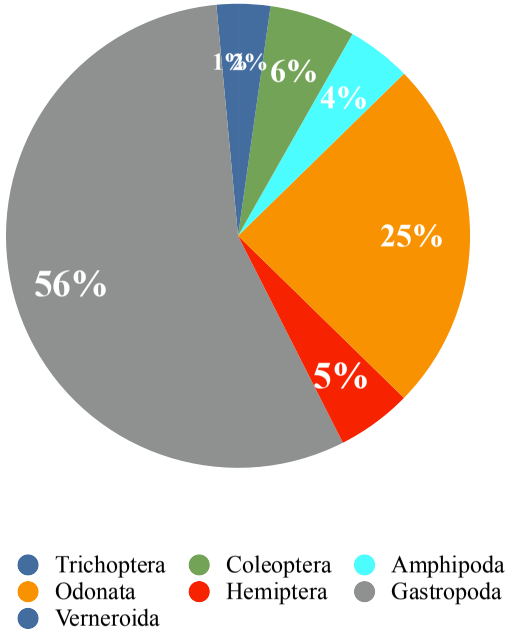
Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness
DN	F:Y G:Y	Shredder	Caddisfly		0.001	0.232	3	-0.0850573323421523	1.89	5.00	0.82
DN	F:Y G:Y	Predaceous	Pred. Diving Beetle		0.000			-0.0365510432832157			
DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.001			-0.0850573323421523			
DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0365510432832157			
DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0365510432832157			Trichoptera
DN	F:Y G:Y	Predaceous	Pred. Diving Beetle		0.000			-0.0627566062595667			3
DN	F:Y G:N	Predaceous	Water Strider		0.001			-0.0850573323421523			
DN	F:N G:N	Predaceous	Pygmy Backswimmer		0.001			-0.104822251905404			
DN	F:N G:N	Predaceous	Dragonfly		0.057			-0.341994960513716			
DN	F:Y G:Y	Predaceous	Damselfly		0.000			-0.0365510432832157			
DN	F:Y G:Y	Detrivore	Cave Dwelling Amphipod		0.002			-0.13907822376371			
DN	F:Y G:Y	Scraper / Grazer	Snail		0.156			-0.366865955068178			
DN	F:N G:N	Scraper/Grazer	Snail		0.005			-0.181384604503972			
DN	F:Y G:Y	Scraper / Grazer	Snail		0.009			-0.226325192181805			
DN	F:Y	Filter-Feeder	Fingernail Clam		0.000			-0.0627566062595667			

Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
5.00	3.00	5.00	3.00	3.00	3.00	5.00	35.00	Mildly Impacted - “Wetland beginning to show signs indicative of anthropogenic disturbance”	2.24	134
Coleoptera	Amphipoda	Odonata	Hemiptera	Gastropoda	Verneroida					
8	6	33	7	75	2					

Site #1: June Relative Abundance



Site #1: July Relative Abundance



Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)	Tolerance Val
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	Amphipoda	Gammaridae	Crangonyctidae	Crangonyx		A	9	100	

Method	Present 1999	Notes	Feeding Guild	Common Name	Other Notes
BT	Y	-Creamy / White in Color; Shorter antenna >1/2 Length of Longer Antenna; Telson distinctly divided into two parts; Urosome 1 and 2 smooth w/o setae; Approximately 5-7 mm In Length.	Detrivore	Scuds / Sideswimmers	-This is solely a bottle trap sample - non representative. Interestingly, amphipods are abundant here while absent from the woodland spring sites.

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae/ Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**		Limnephelidae	Limnephilus		L	2	9.09
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	11	50.00
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**		Asellidae	Caecidotea		A	6	27.27
Mollusca		**Gastropoda**			**Basomattophora**		Lymnaeidae	Stagnicola		A	1	4.55
Mollusca		**Gastropoda**			**Basomattophora**		Planorbidae	Gyraulus		A	2	9.09

Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness
DN	F:Y G:Y	Shredder	Caddisfly		0.008	0.343	1	-0.217990479345306	1.28	5.00	0.55
DN/BT	F:Y G:Y	Detrivore	Cave Dwelling Amphipod		0.250			-0.346573590279973			
DN	F:Y G:Y	Herbivore	Freshwater Sow Bug		0.074			-0.354349904762798			
DN	F:N G:N	Scraper / Grazer	Snail		0.002			-0.140501929698105			
DN	F:N G:N	Scraper / Grazer	Snail		0.008			-0.217990479345306			

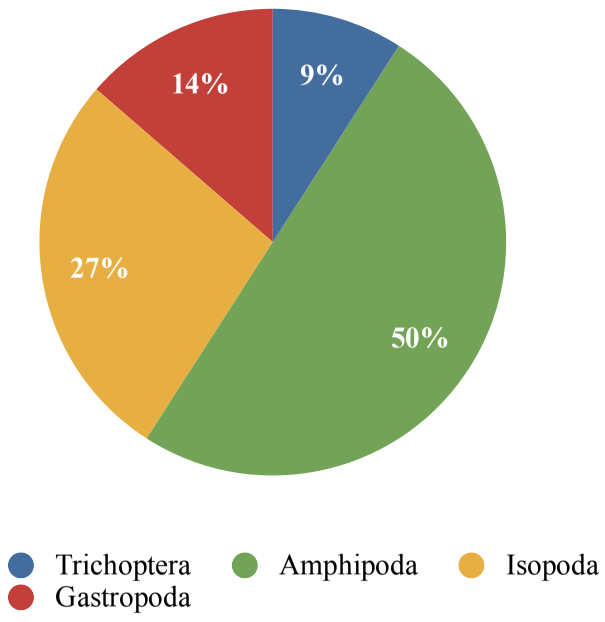
Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
3.00	1.00	3.00	1.00	3.00	1.00	1.00	19.00	Degraded - “wetland shows obvious signs of anthropogenic disturbance”	9.09	22
Trichoptera	Amphipoda	Isopoda	**Gastropoda**							
2	11	6	3							

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**		Limnephelidae	Limnephilus		L	2	5.13
Arthropoda	**Hexapoda**	**Insecta**			**Hemiptera**	Heteroptera	Gerridae	Trepobates		L	3	7.69
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	11	28.21
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**		Asellidae	Caecidotea		A	16	41.03
Mollusca		**Gastropoda**			**Basomattophora**		Lymnaeidae	Stagnicola		A	3	7.69
Mollusca		**Gastropoda**			**Basomattophora**		Planorbidae	Gyraulus		A	2	5.13
Mollusca		**Pelecypoda**	**Heterodonta**		**Veneroida**	Sphaeriacea	Sphaeriidae	Pisidium		A	2	5.13

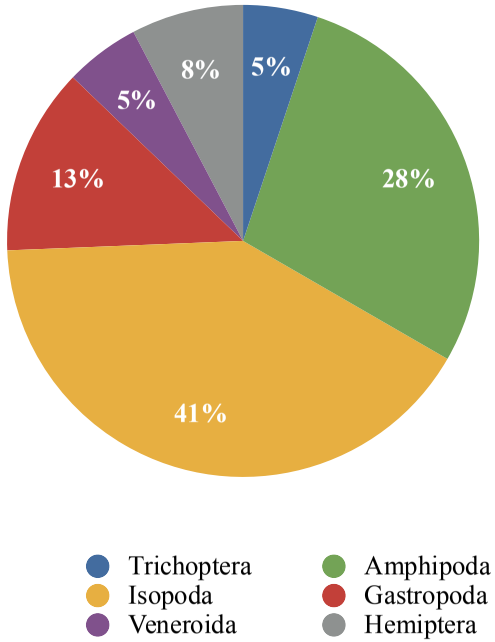
Method	Present 1999	Present June?	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score
DN	F:Y G:Y	F:Y G:Y	Shredder	Caddisfly		0.003	0.268	3	-0.152328946952292	1.57	5.00
DN	F:Y G:N	F:N G:N	Predator	Water Strider		0.006			-0.197303796727811		
DN	F:Y G:Y	F:Y G:Y	Detrivore	Cave Dwelling Amphipod		0.080			-0.356982823247283		
DN	F:Y G:Y	F:Y G:Y	Herbivore	Freshwater Sow Bug		0.168			-0.365527353390714		
DN	F:N G:N	F:Y G:Y	Scraper / Grazer	Snail		0.006			-0.197303796727811		
DN	F:N G:N	F:Y G:Y	Scraper / Grazer	Snail		0.003			-0.152328946952292		
DN	F:N G:N	N	Filter Feeder	Fingernail Clam		0.003			-0.152328946952292		

Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
0.68	3.00	5.00	3.00	1.00	3.00	1.00	1.00	25.00	Degraded - “wetland shows obvious signs of anthropogenic disturbance”	5.13	39
	Trichoptera	Amphipoda	Isopoda	Gastropoda	Veneroida	Hemiptera					
	2	11	16	5	2	3					

Site #2: June Relative Abundance



Site #2: July Relative Abundance



Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Superfamily	Family	Genus	Species
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**			Dytiscidae	Hygrotus	
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Anisoptera		Libellulidae	Plathemis	
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Anisoptera		Aeshnidae	Anax	
Arthropoda	**Hexapoda**	**Insecta**			**Hemiptera**	Heteroptera		Notonectidae	Notonecta	Linnaeus
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**			Polycentropodidae	Polycentropus	
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**			Limnephelidae	Limnephilus	
Arthropoda	**Hexapoda**	**Insecta**			**Ephemeroptera**			Leptophlebiidae	Leptophlebia	
Arthropoda	**Hexapoda**	**Insecta**			**Diptera**			Chironomidae		
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae		Crangonyctidae	Crangonyx	
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**			Asellidae	Caecidotea	
Mollusca		**Gastropoda**						Lymnaeidae	Stagnicola	
Mollusca		**Gastropoda**						Physidae	Physa	
Mollusca		**Pelecypoda**	**Heterodonta**		**Veneroida**	Sphaeriacea		Sphaeriidae	Pisidium	
Arthropoda	**Chelicerata**	**Arachnida**	**Acari**	**Acariformes**	**Trombidiformes**	Prostigmata	Hydrachnoidea			

Larvae /Adult	#	R.A. (%)	Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])
A	1	0.33	DN/BT	F:Y G:Y	Predaceous	Pred. Diving Beetle		0.000	0.304	1	-0.0189086987330294
L	1	0.33	DN	F:Y G:N	Predaceous	White Tail Skimmer Dragonfly		0.000			-0.0189086987330294
L	1	0.33	DN	F:Y G:Y	Predaceous	Darner Dragonfly		0.000			-0.0189086987330294
A	1	0.33	BT	F:N G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0189086987330294
L	1	0.33	BT	F:N G:N	Shredder	Caddisfly		0.000			-0.0189086987330294
L	9	2.98	BT	F:Y G:Y	Shredder	Caddisfly		0.001			-0.104698085961417
L	18	5.96	DN	F:Y G:Y	Shredder / Scraper	Mayfly		0.004			-0.168082763809989
L	2	0.66	DN	F:N G:N		Chironomid / Midges		0.000			-0.0332270187868538
A	35	11.59	DN/BT	F:Y G:Y	Detrivore	Cave Dwelling Amphipod		0.013			-0.249760806145665
A	3	0.99	DN	F:Y G:Y	Herbivore	Freshwater Sow Bug		0.000			-0.0458127290931135
A	121	40.07	DN/BT	F:N G:N	Scraper / Grazer	Snail		0.161			-0.366460308228985
A	107	35.43	DN/BT	F:N G:N	Scraper / Grazer	Snail		0.126			-0.367625846263865
A	1	0.33	DN	F:N G:N		Fingernail Clam		0.000			-0.0189086987330294
A	1	0.33	DN	N	Pred/Parasite	True Water Mite		0.000			-0.0189086987330294

Shannon Index	Shannon Score	Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score
1.47	5.00	0.64	3.00	3.00	5.00	3.00	3.00	3.00	1.00	27.00
	Trichoptera	Coleoptera	Amphipoda	Isopoda	Ephemeroptera	Hemiptera	Diptera	Veneroida	Hydrachnoidea	Gastropoda
	10	1	35	3	18	1	2	1	1	228

MPCA “Wet Meadow Disturbance”	%EPT	Coleoptera	Trichoptera	Gastropoda	Opisopthora	n
Moderately Impacted - “Wetland shows few, but obvious, signs of anthropogenic disturbance”	9.27	1.32	0.33	75.50	0.33	302

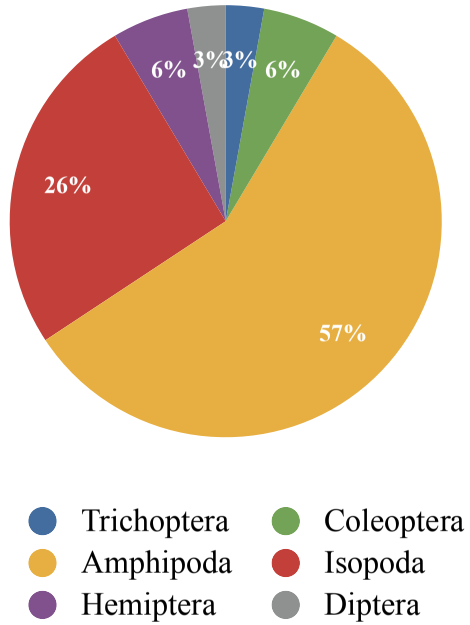
Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Superfamily	Family	Genus	Species	Larvae /Adult
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**			Dytiscidae	Derovatellus		A
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**			Dytiscidae			A
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Anisoptera		Libellulidae	Sympetrum		L
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Zygoptera		Lestidae	Lestes		L
Arthropoda	**Hexapoda**	**Insecta**			**Hemiptera**	Heteroptera		Notonectidae	Notonecta		A
Arthropoda	**Hexapoda**	**Insecta**			**Hemiptera**	Heteroptera		Corixidae			A
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**			Limnephelidae	Anabolia		L
Arthropoda	**Hexapoda**	**Insecta**			**Diptera**			Chironomidae	Chironomus		L
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae		Crangonyctidae	Crangonyx		A
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**			Asellidae	Caecidotea		A
Mollusca		**Gastropoda**						Lymnaeidae	Stagnicola		A
Mollusca		**Gastropoda**						Physidae	Physa		A
Mollusca		**Gastropoda**	**Pulmonata**		**Basomattophora**			Planorbidae	Gyraulus		A

#	R.A. (%)	Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score
1	0.35	DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.000	0.295	3	-0.0200067626629011	1.55	5.00
1	0.35	DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0200067626629011		
3	1.06	DN	F:Y G:N	Predaceous	White Tail Skimmer Dragonfly		0.000			-0.0483329232156383		
16	5.67	DN	F:N G:N	Predaceous	Darner Dragonfly		0.003			-0.162798204181466		
1	0.35	DN	F:N G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0200067626629011		
1	0.35	DN	F:Y	Predaceous	Pred. Diving Beetle		0.000			-0.0200067626629011		
1	0.35	DN	F:Y G:Y	Shredder	Caddisfly		0.000			-0.0200067626629011		
1	0.35	DN	F:N G:N		Chironomid / Midges		0.000			-0.0200067626629011		
20	7.09	DN	F:Y G:Y	Detrivore	Cave Dwelling Amphipod		0.005			-0.187671971445682		
9	3.19	DN	F:Y G:Y	Herbivore	Freshwater Sow Bug		0.001			-0.10993667532772		
128	45.39	DN	F:N G:N	Scraper / Grazer	Snail		0.206			-0.358525642902013		
76	26.95	DN	F:N G:N	Scraper / Grazer	Snail		0.073			-0.353365969962892		
24	8.51	DN	F:Y G:Y	Scraper / Grazer	Ram's Horn Snail		0.007			-0.209689637497036		

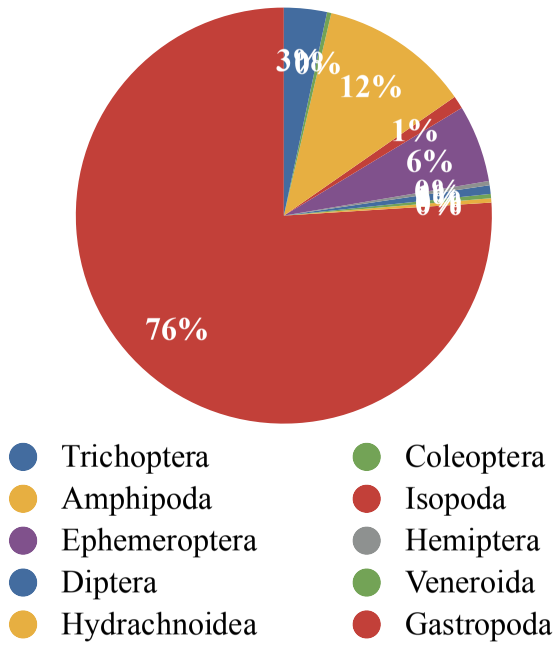
Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”
0.67	3.00	1.00	5.00	3.00	3.00	3.00	5.00	31.00	Moderately Impacted - “Wetland shows few, but obvious, signs of anthropogenic disturbance”
Trichoptera	Coleoptera	Amphipoda	Isopoda	Ephemeroptera	Hemiptera	Diptera	Veneroida		Gastropoda
1	2	20	9		2	1			228

%EPT	Sphaeriidae	Odonata	Gastropoda	Opisopthora	n
0.35	0	6.74	80.85	8.51	282

Site #3: July Relative Abundance



Site #3: June Relative Abundance



Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Superfamily	Family	Genus
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**			Dytiscidae	Dytiscus
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**			Dytiscidae	Hydrotrupinae
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**			Dytiscidae	Hydroporinae
Arthropoda	**Hexapoda**	**Insecta**			**Megaloptera**			Corydalidae	Chauliodes
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Anisoptera		Libellulidae	Erythemis
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Zygoptera		Lestidae	Lestes
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**	Integripalpia	Limnephiloidea	Limnephelidae	Limnephilus
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**			Phyrganeidae	Hagenella
Arthropoda	**Hexapoda**	**Insecta**			**Ephemeroptera**			Leptophlebiidae	Leptophlebia
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae		Crangonyctidae	Crangonyx
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**			Asellidae	Caecidotea
Mollusca		**Gastropoda**	**Prosobranchia**					Lymnaeidae	Stagnicola
Mollusca		**Gastropoda**	**Prosobranchia**					Physidae	Physa
Mollusca		**Gastropoda**	**Pulmonata**		**Basomattophora**			**Planorbidae**	Gyraulus
Mollusca		**Pelecypoda**	**Heterodonta**		**Veneroida**	Sphaeriacea		Sphaeriidae	Pisidium

Species	Larvae /Adult	#	R.A. (%)	Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])
	L	3	1.3	DN/BT	F:Y G:Y	Predaceous	Pred. Diving Beetle		0.000	0.178	3	-0.0573706554504979
hydrotupes	A	1	0.4	BT	F:Y G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0239846681383729
	A	1	0.4	DN	F:Y G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0239846681383729
latreille	L	1	0.4	BT	F:N G:N		Fishfly		0.000			-0.0239846681383729
	L	1	0.4	DN	F:N G:N	Predaceous	Pondhawk Dragonfly		0.000			-0.0239846681383729
	L	1	0.4	DN	F:Y G:Y	Predaceous	Spread Winged Damselfly		0.000			-0.0239846681383729
	L	53	23.5	DN	F:Y G:Y	Shredder	Caddisfly		0.055			-0.340101254615791
cana	L	1	0.4	DN	F:N G:N	Shredder	Caddisfly		0.000			-0.0239846681383729
	L	3	1.3	DN	F:Y G:Y	Shredder	Mayfly		0.000			-0.0573706554504979
	A	32	14.2	DN	F:Y G:Y	Detrivore	Cave Amphipod; Scud/Side Swimmer		0.020			-0.276785712774876
	A	42	18.6	DN	F:Y G:Y	Herbivore	Freshwater Sow Bug		0.035			-0.3127448938121
	A	49	21.7	DN/BT	F:N G:N	Scraper / Grazer	Snail		0.047			-0.33144699272974
	A	4	1.8	DN/BT	F:N G:N	Scraper / Grazer	Snail		0.000			-0.0714024891708389
	A	32	14.2	DN	F:Y G:Y	Scraper / Grazer	Snail		0.020			-0.276785712774876
	A	2	0.9	DN	F:Y G:Y	Filter-Feeder	Fingernail Clam		0.000			-0.0418352904310827

Shannon Index	Shannon Score	Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA "Wet Meadow Disturbance"
1.91	5.00	0.83	5.00	3.00	5.00	3.00	3.00	3.00	1.00	31.00	Moderately Impacted - "Wetland shows few, but obvious, signs of anthropogenic disturbance"
	Trichoptera	Coleoptera	Amphipoda	Isopoda	Ephemeroptera	Megaloptera	Veneroida	Gastropoda	Odonata		
	54	5	32	42	3	1	2	85	2		

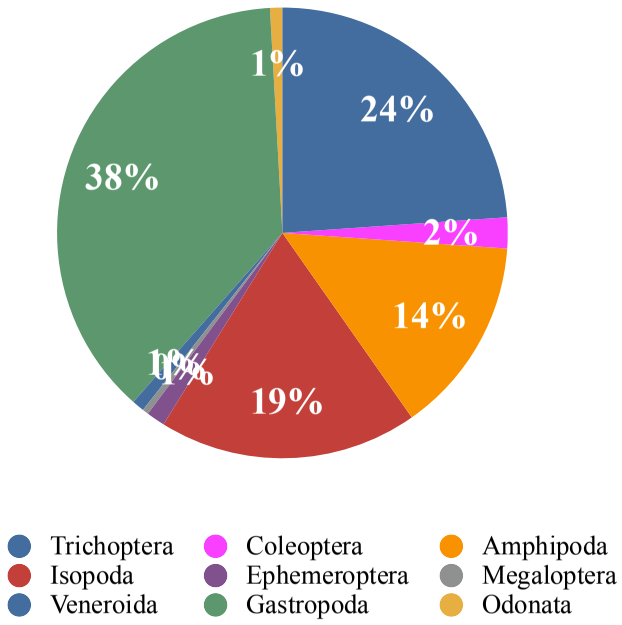
%EPT	Coleoptera	Trichoptera	Ephemeroptera	Sphaeriidae	Gastropoda	Odonata	Megaloptera	Amphipoda	Isopoda	n
25.2	2.2	23.9	1.3	0.9	37.6	0.9	0.44	14.2	18.6	226

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Superfamily	Family	Genus	Species
Arthropoda	**Hexapoda**	**Insecta**			**Hemiptera**			Corixidae	Micronecta	
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Anisoptera		Libellulidae	Pseudoleun	
Arthropoda	**Hexapoda**	**Insecta**			**Odonata**	Zygoptera		Lestidae	Lestes	
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**	Integripalpia	Limnephiloidea	Limnephelidae	Limnephilus	
					Diptera			Chironomidae		
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae		Crangonyctidae	Crangonyx	
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**			Asellidae	Caecidotea	
Mollusca		**Gastropoda**	**Prosobranchia**					Lymnaeidae	Stagnicola	
Mollusca		**Gastropoda**	**Pulmonata**		**Basomattophora**			Planorbidae	Gyraulus	
Mollusca		**Pelecypoda**	**Heterodonta**		**Veneroida**	Sphaeriacea		Sphaeriidae		

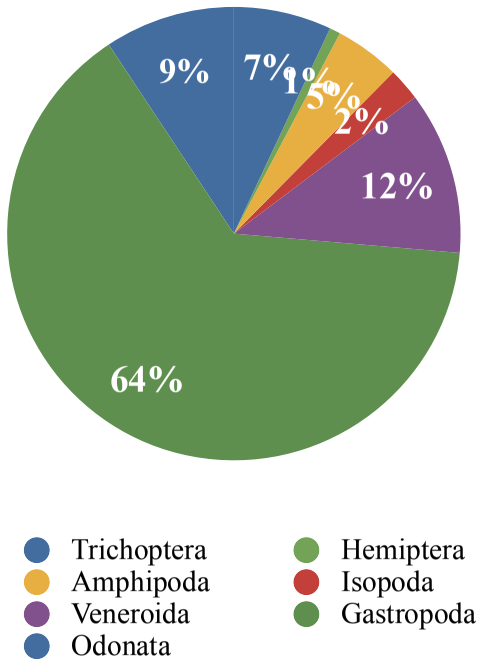
Larvae /Adult	#	R.A. (%)	Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index
L	1	0.8	DN	F:N G:N	Predaceous	Pred. Diving Beetle		0.000	0.254	3	-0.0374425726958122	1.71
L	6	4.6	DN	F:N G:N	Predaceous	Pondhawk Dragonfly		0.002			-0.141958845287424	
L	6	4.6	DN	F:Y G:Y	Predaceous	Spread Winged Damselfly		0.002			-0.141958845287424	
L	9	6.9	DN	F:Y G:Y	Shredder	Caddisfly		0.005			-0.184867606600571	
L	1	0.8	DN	F:N G:N		Bloodworm		0.000			-0.0374425726958122	
A	6	4.6	DN	F:Y G:Y	Detrivore	Cave Amphipod; Scud/Side Swimmer		0.002			-0.141958845287424	
A	3	2.3	DN	F:Y G:Y	Herbivore	Freshwater Sow Bug		0.001			-0.0869751268104801	
A	56	43.1	DN	F:N G:N	Scraper / Grazer	Snail		0.186			-0.362786419571879	
A	27	20.8	DN	F:Y G:Y	Scraper / Grazer	Snail		0.043			-0.326429498309106	
A	15	11.5	DN	F:Y G:N	Filter-Feeder	Fingernail Clam		0.013			-0.249171259540774	

Shannon Score	Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
5.00	0.74	5.00	5.00	5.00	3.00	3.00	3.00	5.00	37.00	Mildly Impacted - wetland is beginning to show signs indicative of anthropogenic disturbance”	6.9	130.0
Trichopter	Hemiptera	Amphipoda	Isopoda	Ephemeroptera	Diptera	Veneroida	Gastropoda	Odonata				
9	1	6	3		1	15	83	12				

Site #4: June Relative Abundance



Site #4: July Relative Abundance



Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Diptera**		Stratiomyidae	Stratiomysis		L	1	0.78
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae			L	1	0.78
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Lampyridae			L	1	0.78
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**		Limnephelidae	Limnephilus		L	1	0.78
Arthropoda	**Hexapoda**	**Insecta**			**Ephemeroptera**		Leptophlebiidae	Leptophlebia		L	4	3.13
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	63	49.22
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**		Asellidae	Caecidotea		A	9	7.03
Mollusca		**Gastropoda**					Lymnaeidae	Stagnicola		A	26	20.31
Mollusca		**Gastropoda**					Physidae	Physa		A	3	2.34
Mollusca		**Gastropoda**	**Pulmonata**		**Basomattophora**		Planorbidae	Gyraulus		A	19	14.84

Method	Present 1999	Feeding Guild	Common Name	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness
DN	F:N G:N	Shredder / Grazer	Soldierfly	0.000	0.312	1	-0.037906486436872	1.49	5.00	0.65
DN	F:Y	Predaceous	Pred. Diving Beetle	0.000			-0.037906486436872			
DN	F:N G:N	Predaceous Larvae	Firefly	0.000			-0.037906486436872			
DN	F:Y G:Y	Shredder	Caddisfly	0.000			-0.037906486436872		Trichopter	Coleoptera
DN/BT	F:Y G:Y	Shredder	Mayfly	0.001			-0.108304246962491		1	2
DN/BT	F:Y G:Y	Detrivore	Cave Dwelling Amphipod	0.242			-0.348909522377104			
DN	F:Y G:Y	Herbivore	Freshwater Sow Bug	0.005			-0.186666024837895			
DN	F:Y G:Y	Scraper / Grazer	Snail	0.041			-0.323767788073059			
DN	F:N G:N	Scraper / Grazer	Snail	0.001			-0.0879707337949572			
DN	F:N G:N	Scraper / Grazer	Snail	0.022			-0.28315808133055			

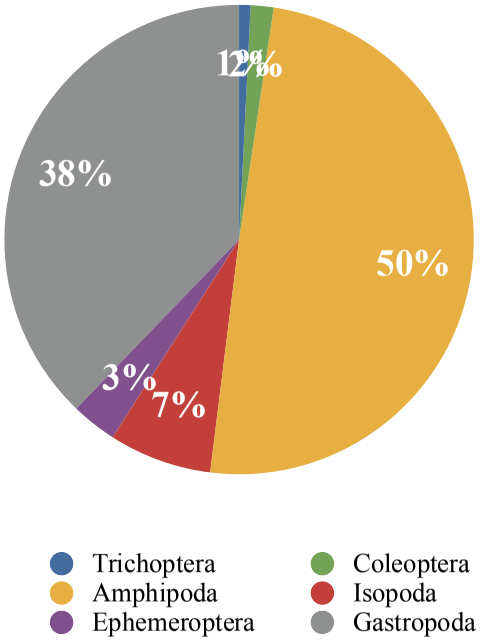
Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
3.00	1.00	5.00	3.00	3.00	1.00	1.00	23.00	“Moderately Degraded - shows many obvious signs of anthropogenic disturbance”	3.91	128
Amphipoda	Isopoda	Ephemeroptera	Gastropoda							
63	9	4	48							

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Diptera**		Stratiomyidae	Stratiomysis		L	2	1.12
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Dytiscus		L	1	0.56
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Hydaticus		L	1	0.56
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae			L	2	1.12
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	18	10.06
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Isopoda**		Asellidae	Caecidotea		A	2	1.12
Mollusca		**Gastropoda**					Lymnaeidae	Stagnicola		A	127	70.95
Mollusca		**Gastropoda**					Physidae	Physa		A	13	7.26
Mollusca		**Gastropoda**	**Pulmonata**		**Basomattophora**		Planorbidae	Gyraulus		A	13	7.26

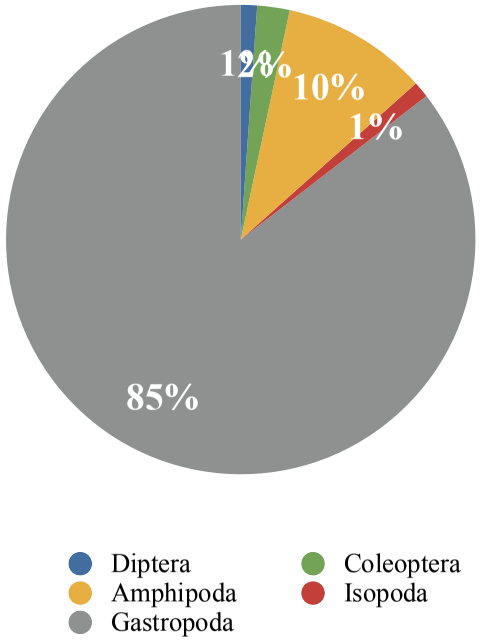
Method	Present 1999?	Present June?	Feeding Guild	Common Name	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness
DN	F:N G:N	F:Y G:Y	Shredder / Grazer	Soldierfly	0.000	0.524	1	-0.0502149567070481	1.06	5.00	0.46
DN	F:Y G:N	F:Y G:Y	Predaceous	Pred. Diving Beetle	0.000			-0.0289798089711774			
DN	F:Y G:N	F:Y G:N	Predaceous	Pred. Diving Beetle	0.000			-0.0289798089711774			
DN	F:Y	F:Y	Predaceous	Pred. Diving Beetle	0.000			-0.0502149567070481			
DN	F:Y G:Y	F:Y G:Y	Detrivore	Cave Dwelling Amphipod	0.010			-0.230984652865936		Diptera	Coleoptera
DN	F:Y G:Y	F:Y G:Y	Herbivore	Freshwater Sow Bug	0.000			-0.0502149567070481		2	4
DN	F:Y G:Y	F:Y G:Y	Scraper / Grazer	Snail	0.503			-0.243498532746004			
DN	F:N G:N	F:Y G:Y	Scraper / Grazer	Snail	0.005			-0.19045627837391			
DN	F:N G:N	F:Y G:Y	Scraper / Grazer	Snail	0.005			-0.19045627837391			

Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
3.00	1.00	5.00	1.00	3.00	1.00	1.00	21.00	“Moderately Degraded - shows many obvious signs of anthropogenic disturbance”	0	179
Amphipoda	Isopoda	Gastropoda								
18	2	153								

Site #5: June Relative Abundance



Site #5: July Relative Abundance



Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**		Limpnephelidae	Ironoquia		L	4	1.92
					Ephemeroptera		Leptophlebiidae	Leptophlebia		L	5	2.40
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	108	51.92
					Isopoda		Asellidae	Caecidotea		A	18	8.65
Mollusca		**Gastropoda**			**Basomattophora**		Lymnaeidae	Lymnaea		A	61	29.33
		Gastropoda			**Basomattophora**		**Planorbidae**	Gyraulus		A	12	5.77

Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness
DN	F:Y G:N	Shredder	Caddisfly		0.000	0.367	1	-0.0759854561265659	1.24	5.00	0.54
DN/BT	F:Y G:N	Shredder / Scraper	Mayfly		0.001			-0.0896177924823851			
DN/BT	N	Detrivore	Cave Dwelling Amphipod		0.270			-0.340307404222724			
DN	N	Herbivore	Freshwater Sow Bug		0.007			-0.211774008617754		Trichoptera	Ephemeroptera
DN/BT	N	Scraper / Grazer	Snail		0.086			-0.35974287090004		4	5
DN/BT	N	Scraper / Grazer	Snail		0.003			-0.164574890187307			

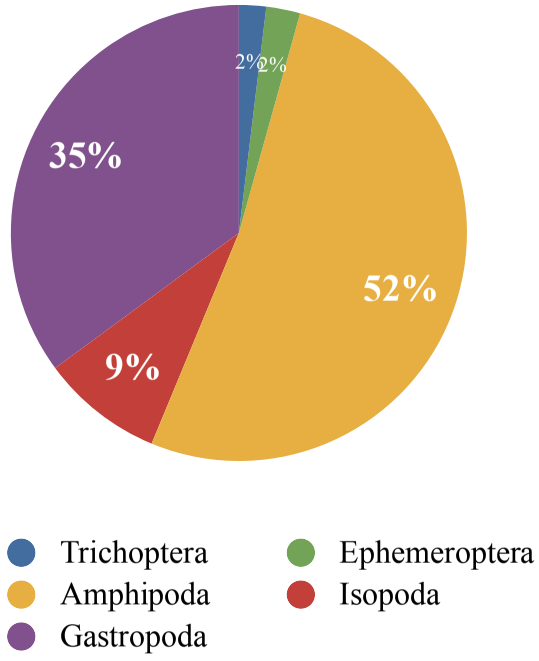
Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA "Wet Meadow Disturbance"	%EPT	n
3.00	1.00	5.00	1.00	3.00	1.00	1.00	21.00	Moderately Degraded- "wetland shows many obvious signs indicative of anthropogenic disturbance"	4.33	208
Amphipoda	Isopoda	Gastropoda								
108	18	73								

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Trichoptera**		Limpnephelidae	Limnephilus		L	2	0.88
Arthropoda	**Hexapoda**	**Insecta**			**Ephemeroptera**		Leptophlebiidae	Leptophlebia		L	5	2.19
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**		Dytiscidae	Dytiscus		L	1	0.44
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	17	7.46
Arthropoda	**Crustacea**	**Malacostraca**			**Isopoda**		Asellidae	Caecidotea		A	14	6.14
Mollusca		**Gastropoda**			**Basomattophora**		Lymnaeidae	Lymnaea		A	179	78.51
Mollusca		**Gastropoda**			**Basomattophora**		**Planorbidae**	Gyraulus		A	10	4.39

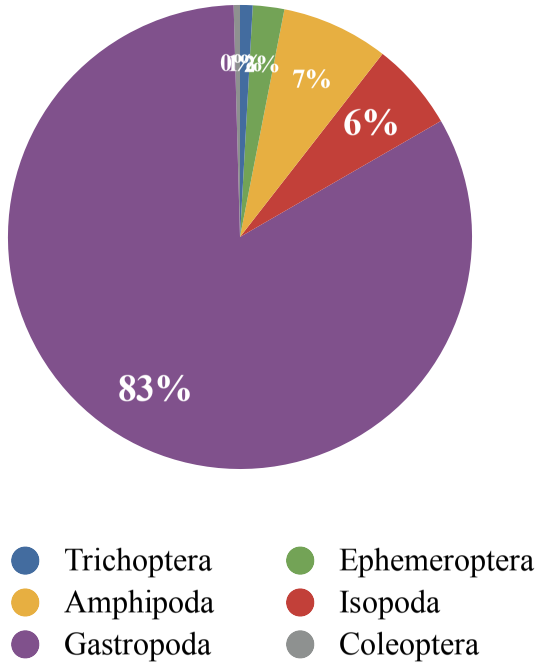
Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness
DN	F:Y G:Y	Shredder	Caddisfly		0.000	0.628	1	-0.0415456004245131	0.84	3.00	0.37
DN/BT	F:Y G:Y	Shredder / Scraper	Mayfly		0.000			-0.0837699060640426			
	F:N G:N	Predaceous	Pred. Diving Beetle		0.000			-0.0238129194252388			
DN/BT	N	Detrivore	Cave Dwelling Amphipod		0.006			-0.193571266856447			
DN	N	Herbivore	Freshwater Sow Bug		0.004			-0.171333492064687			Trichoptera
DN/BT	N	Scraper / Grazer	Snail		0.616			-0.18995968569013			2
DN/BT	N	Scraper / Grazer	Snail		0.002			-0.137138619998263			

Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	% EPT	n
1.00	1.00	5.00	1.00	3.00	1.00	1.00	17.00	Degraded- “wetland shows obvious signs of anthropogenic disturbance”	3.07	228.00
Ephemeroptera	Amphipoda	Isopoda	Gastropoda	Coleoptera						
5	17	14	189	1						

Site #6: June Relative Abundance



Site #6: July Relative Abundance



Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae/ Adult	#	R.A. (%)	Method
Arthropoda	**Hexapoda**	**Insecta**			Trichoptera		Limnephilidae	Ironoquia		L	2	20	Dip Net
Arthropoda	**Hexapoda**	**Insecta**			Coleoptera		Dytiscidae	Copelatus		L	1	10	Dip Net
Arthropoda	**Hexapoda**	**Insecta**			Coleoptera		Dytiscidae	Hybius		L	1	10	Dip Net
Annelida		**Clitellata**	**Oligochaeta**		Opisopthora		Lumbriculidae	Lumbriculus		A	2	20	Dip Net
Mollusca		**Gastropoda**					Physidae	Aplexa	elongata	A	4	40	Dip Net

Present 1999	Notes	Feeding Guild	Common Name	Other Notes	%EPT	pi^2	Simpson's Index
Y	Bark Case - Found Near Spring; Metanotum w/ Multiple Sclerites and scattered setae; Mesonotum mostly covered w/ Sclerotized Plates; Metathoracic leg and claw structures similar to mesothoracic; Mesonotum w/o sclerotized bars; Antennae very short and inconspicuous; Pronotum w/ shallow furrow; setae and sclerites at SA1 of metanotum; Tubercles present at metanotum; Anterolateral Margins of Pronotum Rounded; Antenna mid way between eye and mandible; Anterior of mesonotum w/o mesal emargination; Head Ovoid. Gills in clusters >3, Most gills on basal segments in clusters of 6 or more; Meso and Meta Femur w/ About 5 Long Setae at Ventral Edge; Bark Case.	Shredder	Caddisfly	-No Macroinvertebrates / Zooplankton in Bottle Traps.	20	0.04	0.26
F:Y G:N	Each Tarsus w/ 2 Claws; No Lateral Filaments, No Hooks on Last Abd. Segment; Urogomphi > Last Abdominal Segment; Segments 7 and 8 lacking natatory setae; Pro and Meso Thoracic Legs Non-Chelate; Urogomphi lacking secondary setae; Antennomere 4 Double; Mandible w/ Inner Serrations.	Predaceous	Pred. Diving Beetle			0.01	
F:Y G:N	Each Tarsus w/ 2 Claws; No Lateral Filaments or Conspicuous hooks on last segment; Urogomphi longer than last abdominal segment; Segments 7 and 8 w/o Natatory Setae; Legs not Chelate; Only Primary Setae on Urogomphus in 2 Whorls; Antennomere 4 Single; Non-Serrated Mandibles; Dorsal seta of basal urogomphal whorl not posterior to other two setae; last abdominal segment w/o long thing setae. NOTE: Urogomphus missing - possibility that genus = Agabus	Predaceous	Pred. Diving Beetle			0.01	
N		Gatherer	Earthworm			0.04	
N	Synistral coiling; 12mm; fusiform; narrowly conic; No Siphonal Canal; 5 Spires;	Scraper/Grazer	Snail			0.16	

Simpson Score	[(pi)*(ln(pi))]	Shannon Index	Shannon Score	Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score
3	-0.32188758248682	1.47	5.00	0.91	5.00	1.00	5.00	1.00	1.00	1.00	1.00	23.00
	-0.230258509299405											
	-0.230258509299405											
	-0.32188758248682											
	-0.366516292749662											

MPCA “Wet Meadow Disturbance”	Trichoptera	Coleoptera	Opisopthora	Gastropoda
Moderately Degraded - “Wetland shows obvious signs indicative of anthropogenic disturbance.”	20	20	20	40

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)
Arthropoda	**Hexapoda**	**Insecta**			**Coleoptera**	Polyphaga	Dytiscidae	Eretes		A	1	3.57
					Coleoptera	Polyphaga	Dytiscidae	Matus		A	1	3.57
					Coleoptera	Polyphaga	Dytiscidae	Hybius		L	1	3.57
					Coleoptera	Polyphaga	Dytiscidae	Dytiscus		L	1	3.57
					Trichoptera		Limnephilidae	Limnephilus		L	1	3.57
	Crustacea	**Branchiopoda**	**Sarsostraca**		**Anostraca**					A	5	17.86
Mollusca		**Gastropoda**					Lymnaeidae	Stagnicola	stagnalis	A	8	28.57
Mollusca		**Gastropoda**					Physidae	Aplexa	elongata	A	3	10.71
Mollusca		**Pelecypoda**	**Heterodonta**		**Veneroida**	Sphaeriacea	Sphaeriidae			A	3	10.71
Annelida		**Clitellata**	**Oligochaeta**		**Opisopthora**		Lumbriculidae	Lumbriculus		A	4	14.29

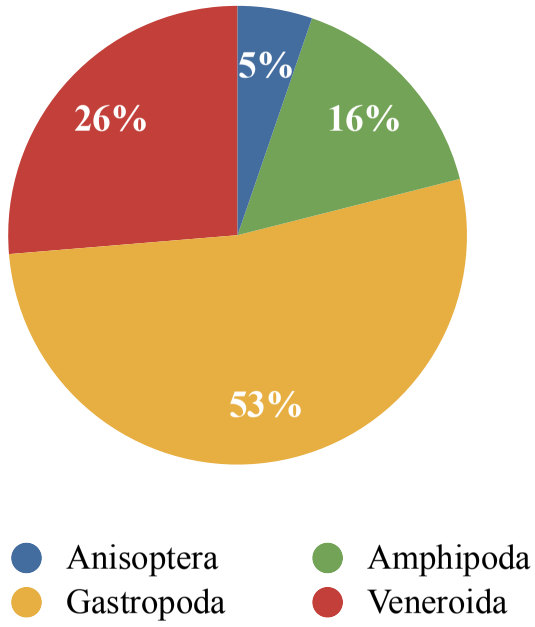
Method	Present 1999	Notes	Feeding Guild	Common Name
BT	F:Y G:N	1 pair eyes; Posterior legs modified for swimming; scutellum visible; 14.5mm; Metatarsus w/ 2 claws; 5 segmented pro and mesotarsi - 4th segment as long as 3rd; pointed prosternal process; >4 mm long; metatarsus w/ 2 claws; eye not emerginate above antenna; acute outer spur at apex of metatibia.	Predaceous	Pred. Diving Beetle
BT	F:Y G:N	Undivided eyes;; Undivided Eyes; 5 segmented mesotarsi - 4 as long as 3; Postcoxal process, meso and metasternum in same plane from lateral view; Spear-shaped prosternal process; Protibia w/o large curved apical spur; >4mm; Metatarsus w/ 2 claws; Scutellum Visible; Anterior portion of eye slightly emarginate; Prosternum w/ longitudinal furrow; 9mm length; Elytra w/o Striae; Metatarsal claws approximately equal in length; Elytra lacking aciculations; Elongate maxillary palp; Elytra dark.	Predaceous	Pred. Diving Beetle
DN	F:Y G:N	Tarsus w/ 2 claws; Abdomen lacking lateral filaments; Urogomphi longer than last abdominal segment; Non-Chelate pro and mesothoracic legs; Only primary setae on urogomphus; Antennomere 4 Single; Dorsal seta of basal urogomphal whorl not posterior to ventral seta; anteroventral spines on metatarsus paired w/ posteroventral spines; last abdominal segment lacking long setae	Predaceous	Pred. Diving Beetle
BT	F:Y G:N	Tarus w/ 2 claws; w/o lateral filaments; w/o hooks on last segment; urogomphi slightly shorter than last abdominal segment; elongated legs w/ natatory setae; pointed piercing mandibles; no lateral filaments; head w/o frontal projection; abdominal segments seven and eight w/ long natatory setae laterally; elongate maxillary stipe; urogomphi w/ lateral natatory setae; labium w/o projecting lobes.	Predaceous	Pred. Diving Beetle
DN	F:Y G:Y	Equally sized tarsal claws; Dorsal hump; Prosternal Horn; Rounded Head; Un-notched at anterior of mesonotum. Gills occur in clusters of no more than three; Non-Annulate legs; Uniformly colored dorsum of head; Lacking Setae at ventral portion of prolegs; Hump at first abdominal tergite	Shredder	Caddisfly
DN	N	11 Thoracic somites; 3 gravid females (60%)	Collector	Ferry Shrimp
DN / BT	N	Dextral Coiling; Lacking Periostracal Threads; 15-20mm	Scraper / Grazer	Snail
DN	N	Sinistral Coiling; Raised Spire; Elongate Glossy Shell;	Scraper / Grazer	Snail
DN	N		Filter-Feeder	Fingernail Clam
DN	N		Gatherer	Earthworm

Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness	Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score
	0.001	0.163	3	-0.119007303934829	2.02	5.00	0.88	5.00	5.00	5.00	3.00	3.00
	0.001			-0.119007303934829						**%EPT**	**Coleoptera**	**Trichoptera**
	0.001			-0.119007303934829						3.57	14.29	3.57
	0.001			-0.119007303934829								
	0.001			-0.119007303934829								
	0.032			-0.307636892453769								
	0.082			-0.357932276712962								
	0.011			-0.239313452304332								
	0.011			-0.239313452304332								
	0.020			-0.277987164150759								

Odonata Richness Score	Odonata RA Score	IBI Score	MPCA "Wet Meadow Disturbance"
1.00	1.00	**31.00**	Moderately Impacted - "Wetland shows few, but obvious, signs of anthropogenic disturbance"
Anostraca	**Sphaeriidae**	**Gastropoda**	**Opisopthora**
17.86	10.71	39.29	14.29

Phylum	Subphylum	Class	Subclass	Superorder	Order	Suborder	Family	Genus	Species	Larvae /Adult	#	R.A. (%)
Arthropoda				**Odonata**	**Anisoptera**		Libellulidae	Sympetrum		L	1	5.26
Arthropoda	**Crustacea**	**Malacostraca**		**Peracarida**	**Amphipoda**	Gammaridae	Crangonyctidae	Crangonyx		A	3	15.79
Mollusca		**Gastropoda**			**Basomattophora**		Lymnaeidae	Stagnicola		A	10	52.63
Mollusca		**Pelecypoda**	**Heterodonta**		**Veneroida**	Sphaeriacea	Sphaeriidae			A	5	26.32

Site #11: June Relative Abundance



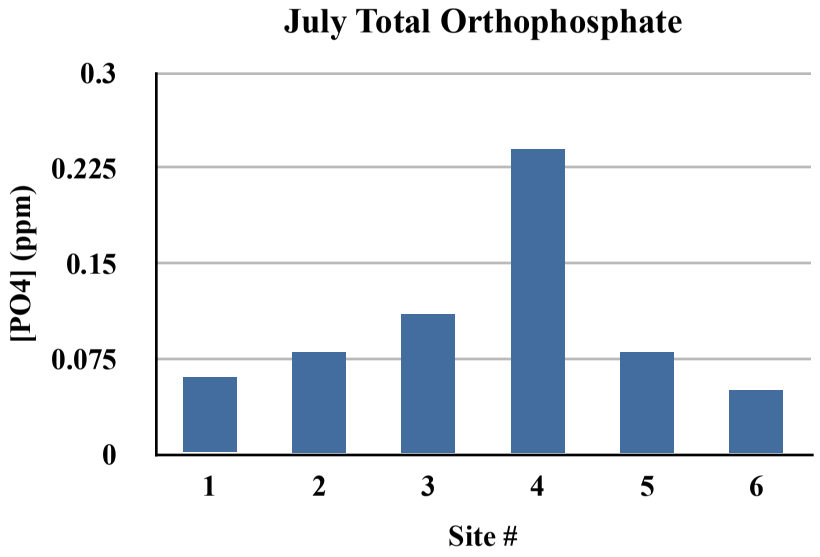
Method	Present 1999	Feeding Guild	Common Name	Other Notes	pi^2	Simpson's Index	Simpson Score	(pi)(ln[pi])	Shannon Index	Shannon Score	Evenness
DN/BT	N/A	Predaceous	Dragonfly		0.003	0.307	1	-0.154970472587707	1.14	5.00	0.49
DN/BT	N/A	Detrivore	Cave Dwelling Amphipod		0.003			-0.291446319552368			
DN/BT	N/A	Scraper / Grazer	Snail		0.025			-0.337817834827576		Anisoptera	Amphipoda
DN	N/A	Filter-Feeder	Fingernail Clam		0.277			-0.351316070192721		1	3

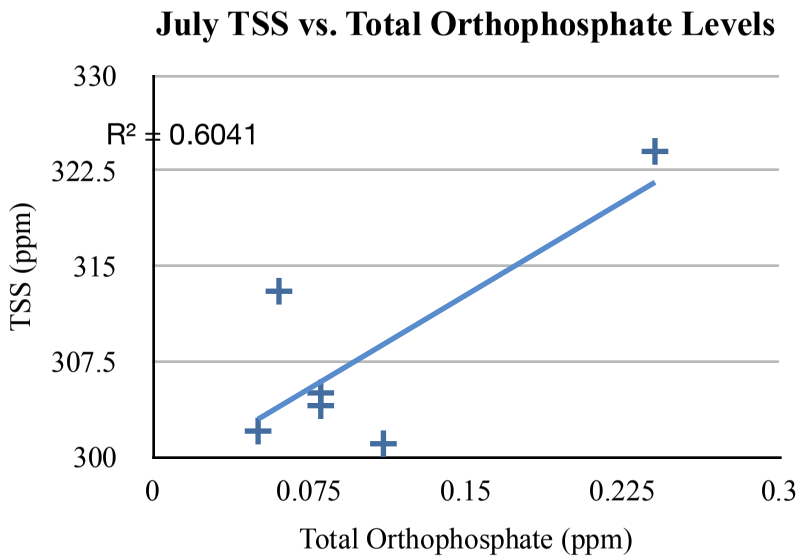
Evenness Score	Sph. Score	Gastropoda Score	Richness Score	Crustacea / Mollusca Score	Odonata Richness Score	Odonata RA Score	IBI Score	MPCA “Wet Meadow Disturbance”	%EPT	n
3.00	5.00	5.00	1.00	3.00	3.00	5.00	31.00	Moderately Impacted - “Wetland shows few, but obvious, signs of anthropogenic disturbance”	0	19
Gastropoda	Veneroida									
10	5									

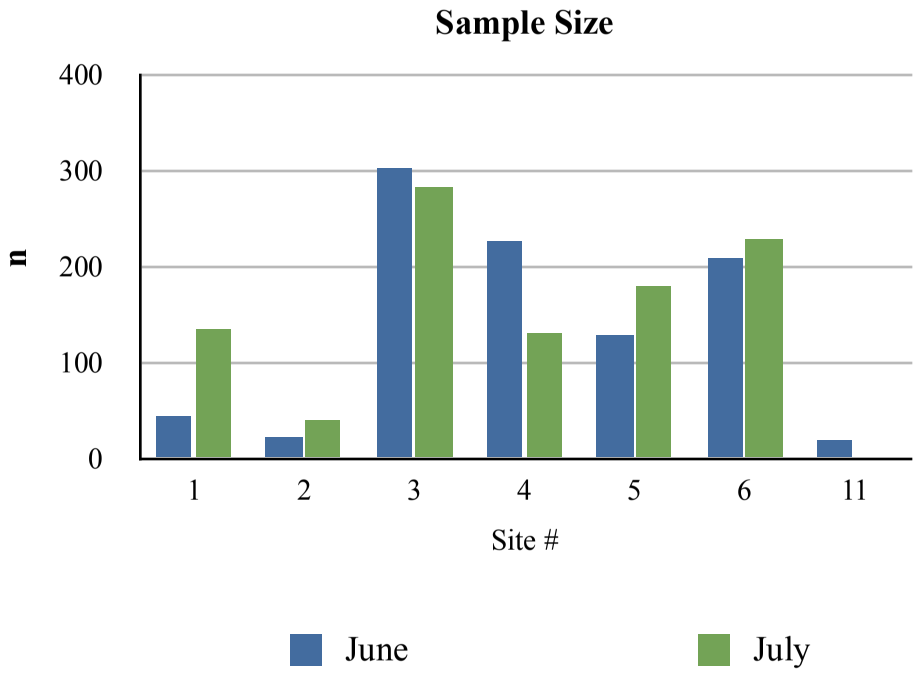
Site	Total PO4	June n	July n	July IBI	July Genera Richness	TSS
1	0.06	44	134	35	15	313
2	0.08	22	39	25	7	304
3	0.11	302	282	31	13	301
4	0.24	226	130	37	10	324
5	0.08	128	179	21	9	305
6	0.05	208	228	17	7	302
11		19				

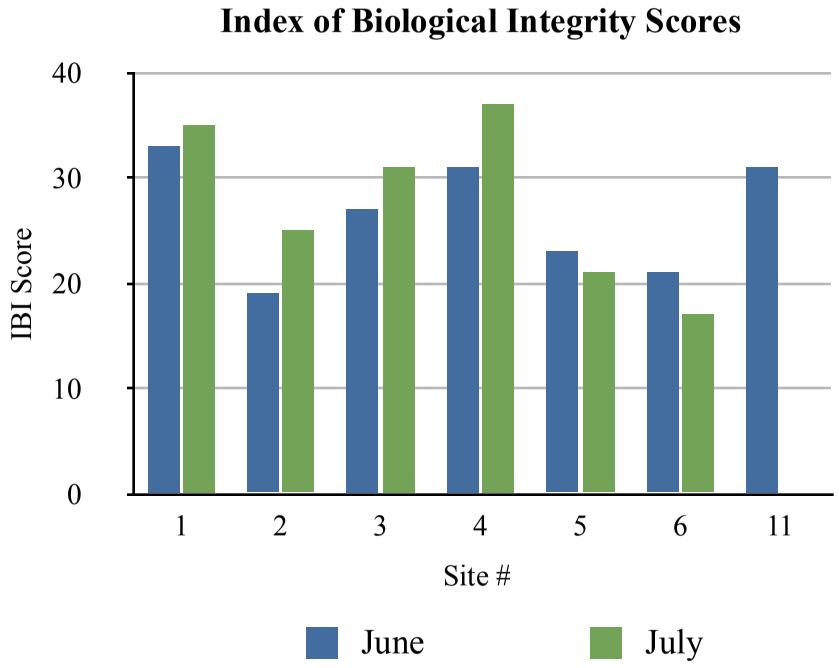
Site #	June	July	
1	33	35	
2	19	25	
3	27	31	
4	31	37	
5	23	21	
6	21	17	
11	31		

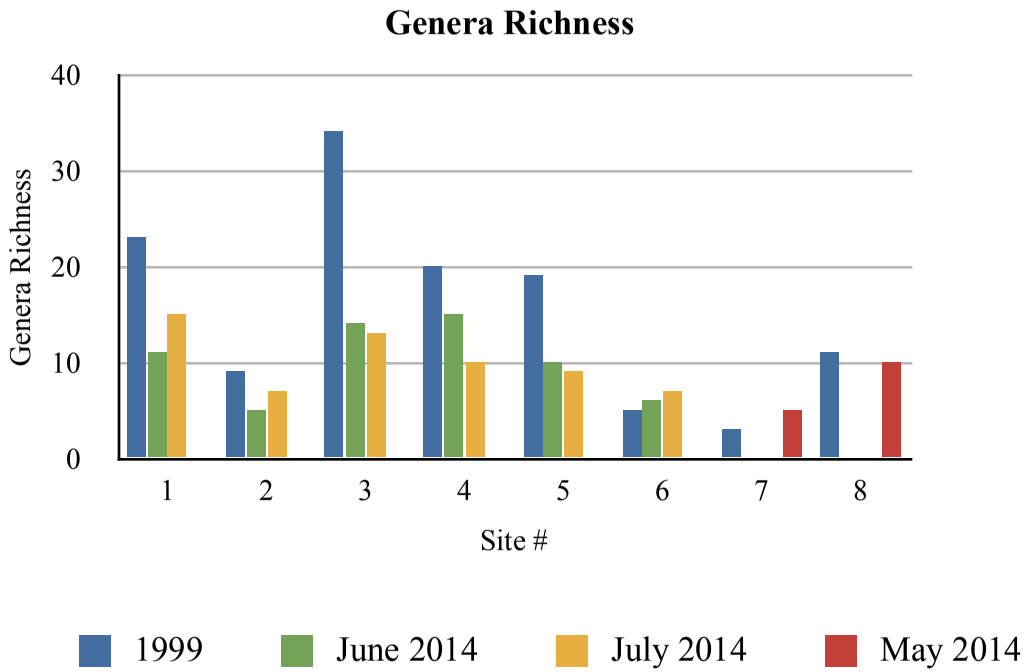
SITE #	1999 GR	JUNE GR	JULY GR	MAY GR
1	23	11	15	
2	9	5	7	
3	34	14	13	
4	20	15	10	
5	19	10	9	
6	5	6	7	
7	3			5
8	11			10


July Total Orthophosphate
[PO4] (ppm)
0.3
0.225
0.15
0.075
0
1
2
3
4
5
6
Site #


July TSS vs. Total Orthophosphate Levels
TSS (ppm)
330
322.5
315
307.5
300
R² = 0.6041
0
0.075
0.15
0.225
0.3
Total Orthophosphate (ppm)


Sample Size
n
400
300
200
100
0
1
2
3
4
5
6
11
Site #
June
July


Index of Biological Integrity Scores
IBI Score
40
30
20
10
0
1
2
3
4
5
6
11
Site #
June
July


Genera Richness
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30
20
10
0
Genera Richness
1
2
3
4
5
6
7
8
Site #
1999
June 2014
July 2014
May 2014

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Odonate Survey

2014, Mary Standish

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

Odonate survey

Mary Standish

2014 — Door County

Lat 44.94788
Long -87.37761
Spring pond North of Carlsville Road East of County B

Common	Name	How seen	Notes	Lat	Long	Date
Black Saddlebags	(*Tramea lacerata*)	Netted and released		44.94788	-87.37761	6/16/2014
Crimson-Ringed Whiteface	(*Leucorrhinia glacialis*)	Netted and released		44.94788	-87.37761	6/16/2014
Dot-Tailed Whiteface	(*Leucorrhinia intacta*)	Netted and released		44.94788	-87.37761	6/16/2014
Twelve-Spotted Skimmer	(*Libellula pulchella*)	Netted and released		44.94788	-87.37761	6/16/2014
Dot-Tailed Whiteface	(*Leucorrhinia intacta*)	Netted and released		44.94788	-87.37761	*7/23/2014*
Four-Spotted Skimmer	(*Libellula quadrimaculata*)	Netted and released		44.94788	-87.37761	*7/23/2014*
White-Faced Meadowhawk	(*Sympetrum obtrusum*)	Netted and released		44.94788	-87.37761	*7/23/2014*
Widow Skimmer	(*Libellula luctuosa*)	Netted and released		44.94788	-87.37761	*7/23/2014*
Williamson's Emerald	(*Somatochlora williamsoni*)	Photographed	*with P. Burton*	44.94788	-87.37761	*7/23/2014*
Twelve-Spotted Skimmer	(*Libellula pulchella*)	Observed		44.94788	-87.37761	7/26/2014
White-Faced Meadowhawk	(*Sympetrum obtrusum*)	Observed		44.94788	-87.37761	7/26/2014
Widow Skimmer	(*Libellula luctuosa*)	Observed		44.94788	-87.37761	7/26/2014
Common Whitetail	(*Libellula (Plathemis)lydia*)	Netted and released		44.94788	-87.37761	7/28/2014
Eastern Pondhawk	(*Erythemis simplicicollis*)	Netted and released		44.94788	-87.37761	7/28/2014
Twelve-Spotted Skimmer	(*Libellula pulchella*)	Netted and released		44.94788	-87.37761	7/28/2014
Widow Skimmer	(*Libellula luctuosa*)	Netted and released		44.94788	-87.37761	7/28/2014
Black Saddlebags	(*Tramea lacerata*)	Netted and released		44.94788	-87.37761	7/30/2014
Cherry-Faced Meadowhawk	(*Sympetrum internum*)	Netted and released		44.94788	-87.37761	7/30/2014
Twelve-Spotted Skimmer	(*Libellula pulchella*)	Netted and released		44.94788	-87.37761	7/30/2014
White-Faced Meadowhawk	(*Sympetrum obtrusum*)	Netted and released		44.94788	-87.37761	7/30/2014
Widow Skimmer	(*Libellula luctuosa*)	Netted and released		44.94788	-87.37761	7/30/2014
Canada Darner	(*Aeshna canadensis*)	Netted and released		44.94788	-87.37761	8/2/2014
Eastern Pondhawk	(*Erythemis simplicicollis*)	Netted and released		44.94788	-87.37761	8/2/2014

Lance-Tipped Darner	(*Aeshna constricta*)	Netted and released		44.94788	-87.37761	8/2/2014
Twelve-Spotted Skimmer	(*Libellula pulchella*)	Netted and released		44.94788	-87.37761	8/2/2014
Widow Skimmer	(*Libellula luctuosa*)	Netted and released		44.94788	-87.37761	8/2/2014
Brush-Tipped Emerald	(*Somatochlora walshii*)	Netted and released		44.94788	-87.37761	9/3/2014
Brush-Tipped Emerald	(*Somatochlora walshii*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Canada Darner	(*Aeshna canadensis*)	Netted and released		44.94788	-87.37761	9/3/2014
Canada Darner	(*Aeshna canadensis*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Eastern Forktail	(*Ischnura verticalis*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Eastern Pondhawk	(*Erythemis simplicicollis*)	Netted and released		44.94788	-87.37761	9/3/2014
Eastern Pondhawk	(*Erythemis simplicicollis*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Northern Spreadwing	(*Lestes disjunctus disjunctus*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Ruby Meadowhawk	(*Sympetrum rubicundulum*)	Netted and released		44.94788	-87.37761	9/3/2014
Ruby Meadowhawk	(*Sympetrum rubicundulum*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Shadow Darner	(*Aeshna umbrosa*)	Netted and released		44.94788	-87.37761	9/3/2014
Shadow Darner	(*Aeshna umbrosa*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Twelve-Spotted Skimmer	(*Libellula pulchella*)	Netted and released		44.94788	-87.37761	9/3/2014
Twelve-Spotted Skimmer	(*Libellula pulchella*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
White-Faced Meadowhawk	(*Sympetrum obtrusum*)	Netted and released		44.94788	-87.37761	9/3/2014
White-Faced Meadowhawk	(*Sympetrum obtrusum*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Widow Skimmer	(*Libellula luctuosa*)	Netted and released		44.94788	-87.37761	9/3/2014
Widow Skimmer	(*Libellula luctuosa*)	Netted and released	*with M. Grimm*	44.94788	-87.37761	9/3/2014
Brush-Tipped Emerald	(*Somatochlora walshii*)	Netted and released		44.94788	-87.37761	9/25/2014
Canada Darner	(*Aeshna canadensis*)	Netted and released		44.94788	-87.37761	9/25/2014
Cherry-Faced Meadowhawk	(*Sympetrum internum*)	Netted and released		44.94788	-87.37761	9/25/2014
Lance-Tipped Darner	(*Aeshna constricta*)	Netted and released		44.94788	-87.37761	9/25/2014
Ruby Meadowhawk	(*Sympetrum rubicundulum*)	Netted and released		44.94788	-87.37761	9/25/2014
White-Faced Meadowhawk	(*Sympetrum obtrusum*)	Netted and released		44.94788	-87.37761	9/25/2014

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Pilot Herptile Assessment

2014, Gary S. Casper and Ryne D. Rutherford

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Bay Shore Blufflands SNA Pilot Herptile Assessment

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Summary

We performed preliminary field surveys and reviewed all historical data for a 5-mile buffer of the Bay Shore Blufflands State Natural Area (SNA) (Figure 1). Our field surveys detected six frog (Eastern American Toad, Eastern Gray Treefrog, Green Frog, Northern Leopard Frog, Wood Frog, Spring Peeper), four salamander (Blue-spotted Salamander, Spotted Salamander, Four-toed Salamander, Eastern Red-backed Salamander), six snake (Eastern Milksnake, Western Foxsnake, Dekay's Brownsnake, Northern Red-bellied Snake, Common Gartersnake), and two turtle (Snapping Turtle, Painted Turtle) species in the SNA. Another two salamander, one turtle, and four snake species may occur in or near the SNA (Central Newt, Common Mudpuppy, Blanding's Turtle, Northern Ring-necked Snake, Northern Watersnake, Smooth Greensnake, Northern Ribbonsnake). This preliminary study identified seven herptile Species of Local Conservation Interest for the SNA, and an additional three species of high conservation priority for county-wide planning.

Introduction

The Door County Land Trust, through the Wisconsin Coastal Management Grant Program, is completing a Conservation Master Plan for the Bay Shore Blufflands State Natural Area (SNA) located in Door County, Town of Egg Harbor, T29N R26E, within parts of sections 10, 16, 20, 21, 29, 31, 32, and Door County, Town of Sevastepol, T28N R26E, Section 6 (Figure 1). A brief description of the SNA follows (from Wisconsin DNR website):

> Located along more than three miles of the Niagara Escarpment, Bayshore Blufflands is an ecologically complex site with a diversity of plant communities both above and below the escarpment and a series of seeps and springs at the base of the bluff's talus slopes. Rising 150-200 feet above the low terrace of Green Bay, the steep carbonate cliffs and outcrops support numerous rare land snails including the Cherrystone Drop Snail (*Hendersonia occulta*), a state-threatened species. Aspen, Sugar Maple, Red Oak, Hemlock, and White Cedar grow out of the talus affording complete shade to the escarpment maintaining the cool and damp conditions, which support a lush growth of mosses. The unique site conditions also support such uncommon species as Climbing Fumitory, Mountain Maple, Bulbet Fern, Common Polypody, and Fragile Fern. Above the escarpment is a dry-mesic forest of Red and White Pine with Red Oak. The ground layer is dense dominated by Round-Leaved Dogwood with Northern Bush Honeysuckle, Zig-Zag Goldenrod, Big-Leaved Aster, and Bracken Fern. The site slowly grades into a richer, more mesic forest containing Sugar Maple, Beech, and Red Oak with Hemlock, and White Pine. Also present is a wet-mesic forest of White Cedar, Big-Tooth Aspen, and Black Ash. Several White Cedars reach impressive sizes here.

Below the escarpment are seasonally flooded forests dominated by Silver Maple, and Green Ash with Swamp White Oak, American Bladdernut, and Great Water-Leaf. The site contains many rare plants including the federally threatened Dwarf Lake Iris (*Iris lacustris*). Other species are Variegated Horsetail (*Equisetum variegatum*), Hooker's Orchid (*Platanthera hookeri*), Long-Spurred Violet (*Viola rostrata*), and Large-Flowered Ground-Cherry (*Leucophysalis grandiflora*). Rare animals include Red-Shouldered Hawk (*Buteo linneatus*), Midwest Pleistocene Vertigo (*Vertigo hubrichti*), and Iowa Pleistocene Vertigo (*V. iowaensis*). Bayshore Blufflands is owned by the Door County Land Trust and The Nature Conservancy and was designated a State Natural Area in 2002.

The objective of this study was to identify the amphibian and reptile (herptile) species likely to be present and their approximate location and habitat within the project area, with recommendations for conservation planning, additional inventory, and long-term monitoring.

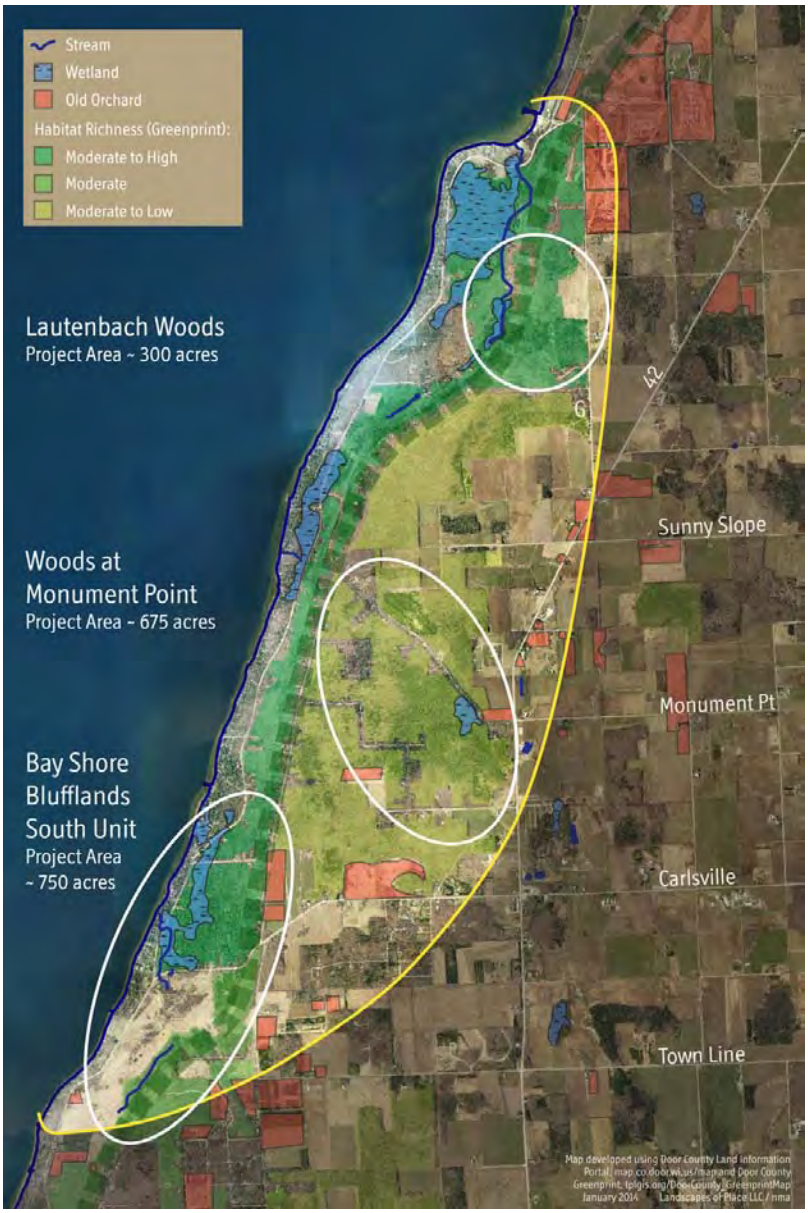

Figure 1: Bay Shore Blufflands SNA

Methods

We reviewed all available data for the whole of Door County from unpublished field notes (Nancy Aten, Gary Casper, Dan Collins, Ryne and Jenny Rutherford), the Wisconsin Natural Heritage Inventory (DNR), and the Wisconsin Herp Atlas (UWM Field Station) to construct a database of known occurrence records, and produce a Checklist of species status in the SNA. Records were georeferenced for mapping in GIS by assigning coordinates with precision error estimates. Records were also ranked for reliability following methodology developed for the Milwaukee River Basin by the senior author (Appendix A), and species occurring in the SNA were assigned a conservation ranking of Species of Local Conservation Interest (SLCI) if they were at least one of the following: a) listed as either state or federally Endangered, Threatened, or Special Concern; b) listed as Species of Greatest Conservation Need in the State Wildlife Action Plan; c) considered to be locally rare or declining; or d) were thought to be important as indicator species for long-term monitoring in the project area. These rankings drew upon the historical data, the results of our surveys, our extensive experience in herptile status in Wisconsin, and species' life history and ecological traits. Potential county-wide assessment rankings are also discussed.

We also conducted limited field work in April, May and June (Appendix A), intended to assist with assessing inventory and monitoring needs, rather than as comprehensive surveys. We conducted calling frog surveys, aquatic funnel trap surveys, snake board surveys, and visual searches. We assisted Nancy Aten and Dan Collins with deploying an automated recording device (Song Meter, Wildlife Acoustics Inc.) at one wetland as well, and reviewed the collected data.

Results

We reviewed 593 herptile occurrence records from 21 sources for the whole of Door County (Wisconsin Herp Atlas), and the 179 records from within the study area confirmed 17 species present in the SNA, with another 5 species possibly occurring. Two reported species, Blanchard's Cricket Frog and Boreal Chorus Frog, were rejected as erroneous (see below). Our field surveys completed calling frog surveys at four sites on 4 May, aquatic funnel trap surveys at two sites on 27-29 June, snake board surveys at six sites on 3 May and seven sites on 27-29 June, and visual searches on multiple sites on 28 April, 3-5 May, and 28-30 June. The Checklist of species presence in the project area with SLCI ranks is provided as Appendix B. Detailed records are provided in Appendix C with an ESRI Arcmap layer.

Species Accounts

Salamanders (4-5 species for SNA, 6 total for county)

Blue-spotted Salamander (*Ambystoma laterale*):

County-wide records for this species are limited to areas north of Sturgeon Bay, and in this SNA to the South Unit and Monument Point (Appendix C). However, this seemingly spotty distribution probably reflects poor sampling effort, as this is the most common salamander in the state and is likely found throughout the county in suitable habitat. It is associated with hardwood and mixed forests with embedded ephemeral wetlands for breeding, and sensitive to landscape integrity (Scott et. al. 2013). Egg searches are an efficient and reliable survey method useful for inventory and long-term monitoring studies.

Spotted Salamander (*Ambystoma maculatum*):
County-wide records for this species are limited to areas north of Sturgeon Bay, and in this SNA to the South Unit and Monument Point (Appendix C). Like the Blue-spotted Salamander, with which it is commonly sympatric, this seemingly spotty distribution probably reflects poor sampling effort, as this is a common salamander in the northern half of the state. It is likely found throughout the county in suitable habitat of higher quality hardwood and mixed forests with embedded ephemeral wetlands for breeding. Coarse downed woody debris and duff are additional habitat quality factors, and it is sensitive to landscape integrity (Scott et. al. 2013). Egg searches are an efficient and reliable survey method useful for inventory and long-term monitoring studies. This species is recommended as an SLCI due to its association with higher quality mature forest and ease of monitoring.

Four-toed Salamander (*Hemidactylium scutatum*):
County-wide records for this species are limited to Monument Point in this SNA (Appendix C), Chambers Island, and Toft Point. However, it is likely more widely distributed, which can be determined by additional surveys. It is a locally common salamander in the northern half of the state, found in higher quality hardwood and mixed forests with embedded ephemeral wetlands for breeding, coarse downed woody debris and a duff layer. Nesting habitat is very particular, requiring moist moss or similar vegetation suspended over pools of stagnant water. Nest/egg searches are an efficient and reliable survey method useful for inventory and long-term monitoring studies, but require special training and care to avoid damaging the sensitive nesting microhabitat. This species is recommended as a SLCI due to its association with higher quality mature forest and its sensitive nesting requirements, which make it vulnerable to ongoing climate change.

Common Mudpuppy (*Necturus maculosus*):
County-wide records for this completely aquatic species indicate it is found all along the Green Bay coast. However, there are no records for the Lake Michigan coast, or for this SNA (albeit we did not survey the very limited coastline currently preserved in this SNA). It is known from Lake Michigan further south (e.g. Sheboygan, Port Washington, Milwaukee and Chicago harbors; Wisconsin Herp Atlas), however, so its seeming absence from the Door County east coast may be an artifact of poor reporting and search effort. It is a locally common salamander in permanent waters of the state, where it is associated with high oxygen environments with suitable cover such as log jams and, especially, flat rocks (under which it nests). Survey methods are poorly developed so little is known about status, but it is believed to have substantially declined due to water pollution and sensitivity to lampricide treatments. Substantial changes in the benthic community it inhabits, with much of the zooplankton now displaced by non-native mussels and consequent cascading trophic effects, undoubtedly has effected this benthic predator which relies on this food base. This species is not recommended as a SLCI in this SNA at this time, unless significant shoreline areas are preserved with suitable habitat in the Green Bay littoral zone. It should, however, be evaluated county-wide as a sensitive species and potential SLCI, as it may be a good indicator for water quality, ecosystem health, and climate change. Promising survey methods include baited trapping and, where feasible, dipnet searches, but these methods require further research to develop detection probability based protocols.

Central Newt (*Notophthalmus viridescens louisianensis*):
County-wide records are limited to Chambers Island and the adjacent mainland, although this may be an artifact of insufficient sampling effort. Detecting this species requires labor intensive trapping of semi-permanent to permanent ponds, and it is therefore frequently overlooked. Like most other pond breeding amphibians, the terrestrial component of its habitat requirements makes it a good indicator of landscape level habitat quality and connectivity. More surveys are recommended to determine its status

in Door County. This species is not recommended as a SLCI in this SNA at this time, but could be added if determined to occupy the SNA at a later date (additional pond sampling is recommended). It is recommended as a county-wide SLCI due to its apparent rarity.

Eastern Red-backed Salamander (*Plethodon cinereus*):
This is a common and wide-spread salamander throughout the county and the SNA (although records are currently clustered at the north and south ends; Appendix C). This completely terrestrial salamander is associated with higher quality hardwood and mixed forests with abundant coarse downed woody debris in various stages of decomposition, and an intact duff layer which provides insulation from freezing winter temperatures as well as abundant invertebrate prey. Moisture levels are also important as the small body size increases vulnerability to desiccation. It can be reliably and efficiently monitored by visual searches in an occupancy study design, but monitoring population levels or trend is much more difficult due to its mostly fossorial habits. It appears abundant within the Niagara Escarpment where the fractured rock provides many moist retreats. While currently common, this species is recommended as a SLCI due to its association with higher quality mature forest, ease of monitoring, and potential for being impacted by climate change, making it a good indicator species.

Frogs and Toads (6 species for SNA and county)

Eastern American Toad (*Anaxyrus americanus americanus*):
Found throughout the county, including many islands, and the SNA (although currently we only have records for the extreme southern portion; Appendix C). This is a widespread and common amphibian often found in urban and disturbed environments. It colonizes new habitats readily and has high reproductive potential. This species is not recommended as a SLCI due to its generalized habitat requirements and widespread abundance, but its ease of monitoring through call surveys makes it a candidate for tracking occupancy trends from data collected by call surveys targeting other more sensitive species.

Eastern Gray Treefrog (*Hyla versicolor*):
Found throughout the county but records sparse, undoubtedly due to poor sampling effort. We located them only in the extreme southern portion of the SNA, but they likely occur throughout (Appendix C). This is a widespread and common amphibian regionally, but can disappear from urban and disturbed environments where its dual terrestrial/aquatic habitat linkages become compromised. Wetland habitat that is fish free, or provides tadpoles refuges from fish, is required, with connectivity to the preferred terrestrial forested or shrub habitat. It has high reproductive potential but terrestrial movements can be limited by desiccation and barriers. This species is not recommended as a SLCI due to its fairly general habitat requirements and widespread abundance, but its ease of monitoring through call surveys makes it a good candidate for tracking occupancy trends from data collected by call surveys.

Spring Peeper (*Pseudacris crucifer*):
Common and widespread throughout the county including the SNA, although records are currently missing from the middle portion (Appendix C). This is a widespread and common amphibian regionally, but can disappear from urban and disturbed environments where its dual terrestrial/aquatic habitat linkages become compromised. Wetland habitat that is fish free, or provides tadpoles refuges from fish, is required, with connectivity to the preferred terrestrial forested or shrub habitat. It has high

reproductive potential but terrestrial movements can be limited by desiccation and barriers. This species is not recommended as a SLCI due to its fairly general habitat requirements and widespread abundance, but its ease of monitoring through call surveys makes it a good candidate for tracking occupancy trends from data collected by call surveys.

Green Frog (*Lithobates clamitans*):
Probably common and widespread throughout the county but records are sparse, undoubtedly due to poor sampling effort. We located them only in the extreme southern portion of the SNA, but they likely occur throughout in most aquatic habitats (Appendix C). This is a widespread and common amphibian regionally, even in urban and disturbed environments where shoreline habitat is intact and competing American Bullfrogs (*Lithobates catesbeianus*) are absent. This is an aquatic frog which occupies shorelines of almost all wetland types, especially lakes and streams. It has high reproductive potential and an extended breeding period. This species is not recommended as a SLCI due to its fairly general habitat requirements and general abundance, but its ease of monitoring through call surveys makes it a good candidate for tracking occupancy trends from data collected by call surveys.

Northern Leopard Frog (*Lithobates pipiens*):
Probably common and widespread throughout the county. We located them only in the extreme southern portion of the SNA, but they likely occur throughout (Appendix C). This is a widespread and common amphibian regionally, even in urban and disturbed environments, but appears to have declined in many areas, possibly due to disease outbreaks. This is a frog with a complex life history, typically hibernating in well oxygenated permanent waters, breeding in ephemeral wetlands and marshes, and foraging in summer in terrestrial grasslands and meadows. It often occupies shorelines year-round. It has high reproductive potential. Urban and mixed agricultural environments can provide all of these habitat types, albeit often in a fragmented manner. This species is recommended as a SLCI due to its complex habitat requirements and widespread concern over declines. It can be monitored through call surveys but due to low detection probabilities a program based on automated recording systems is recommended for adequately tracking occupancy trends. Alternatively, shoreline searches yield good detection probabilities but a specific protocol for this should be further developed and address covariate effects.

Wood Frog (*Lithobates sylvaticus*):
Common and widespread throughout the county, including in the SNA (Appendix C). This is an ephemeral wetland obligate, preferring forested habitats. It is often absent from urban and agricultural settings. This species is recommended as a SLCI due to habitat requirements and sensitivity to landscape level habitat fragmentation (Rittenhouse and Semlitsch 2007, Harper et. al. 2008). It can be monitoring most effectively through a properly designed program utilizing visual egg surveys. Call surveys have low detection probabilities but automated recording systems can sample sufficiently to overcome this for tracking occupancy trends.

Suppressed Species

Blanchard's Cricket Frog (*Acris blanchardi*):
There are two unverified observational records from a single observer in 1983 from near Sturgeon Bay and near Whitefish Bay (Wisconsin Natural Heritage Inventory). These are well out of the normal range and are not included in the Checklist. Since these questionable records have persisted for some time, they are mentioned here to encourage avoiding future reference to them.

Boreal Chorus Frog (*Pseudacris maculata*):
There are two observational records from separate observers from the south end of the SNA (2014) and near Fish Creek (1991; Appendix C). These are here rejected as they would represent new county records but are unverified. This species is generally considered absent from northeastern Wisconsin (Vogt 1981, Casper 1996), hence we do not include it in the Checklist. Should this species be discovered in the future voucher specimens should be collected for verification, and status assessed at that time.

Turtles (2 species for SNA, 3 for county)

Snapping Turtle (*Chelydra serpentina*):
Locally common and widespread throughout the county, including in the SNA (Appendix C). We currently only have records for the extreme southern SNA, but they are expected to occur throughout where open canopy permanent and semi-permanent wetlands exist. A generalist aquatic species utilizing a wide variety of wetland types, preferring warmer waters with abundant aquatic macrophytes. Tolerant of degradation and pollution, occupying many urban and agricultural environments, and effectively detected or monitored by trapping. Greatest threats are road mortality from vehicles, and nest predation by subsidized mammals such as raccoons, which in some cases can devour most eggs at nesting sites every year. This species is not recommended as a SLCI due to its tolerance of habitat disturbance and degradation.

Painted Turtle (*Chrysemys picta*):
Locally common and probably widespread throughout the county, but available records all cluster in the central part of the peninsula. We recorded this species in the extreme southern SNA (Appendix C), but they are expected to occur throughout where open canopy permanent and semi-permanent wetlands exist. A generalist aquatic species utilizing a wide variety of wetland types, preferring warmer waters with abundant aquatic macrophytes. Tolerant of degradation and pollution, occupying many urban and agricultural environments, and effectively detected or monitored by trapping or visual surveys for basking turtles. Greatest threats are road mortality from vehicles, and nest predation by subsidized mammals such as raccoons. This species is not recommended as a SLCI due to its tolerance of habitat disturbance and degradation. However, we do recommend a year or two of visual basking surveys to obtain more realistic baseline distribution data throughout the county (including islands).

Blanding's Turtle (*Emydoidea blandingii*):
Only one verified record from the county from 1990 near the Gardner Swamp State Wildlife Area (Wisconsin Herp Atlas). Prefers large marshes or marsh-pond complexes, habitats not supported in this SNA. This species is not recommended as a SLCI in planning for this SNA due to its habitat requirements not being supported. However, any county-wide planning should include this species as a high priority SLCI due to its rarity.

Snakes (5 species)

Northern Ring-necked Snake (*Diadophis punctatus edwardsii*):
Currently, available records are restricted to the northern tip of the peninsula, including Washington Island. This seemingly limited distribution, however, may be an artifact of inadequate sampling, as habitat for the species exists all along the Niagara Escarpment and other areas with forest edge and bedrock exposures. Ring-necked Snakes occupy forest edge and forest openings, especially near bedrock outcrops, gravel pits, or meadows with coarse downed woody debris. They should be present in this SNA and are recommended as a SLCI in planning, with a first step being an adequate survey to assess status. Visual searches and cover object surveys are feasible for this species.

Eastern Milksnake (*Lampropeltis triangulum triangulum*):
Locally common and found throughout the county, recorded on 2014 surveys within the SNA (Appendix C). Milksnakes utilize a wide variety of terrestrial habitats, but avoid forest interior. They are often found in urban and agricultural environments, and can be effectively detected or monitored by cover object surveys. This species is not recommended as a SLCI due to its widespread abundance and tolerance of habitat disturbance.

Northern Watersnake (*Nerodia sipedon sipedon*):
Found throughout the county but currently records are limited to north of Sturgeon Bay (Wisconsin Herp Atlas). We have no records for this SNA, where habitat suitability is probably restricted to the Green Bay coastline. A semi-aquatic species, occupying shorelines of lakes and streams, where natural vegetation and rocky substrates provide retreats and cover from predators, and habitat for the small fishes and amphibians which make up the bulk of its diet. Not currently recommended as a SLCI for this SNA, unless future surveys determine that they occupy shoreline areas. County-wide, this species is recommended as a SLCI for conservation planning, being sensitive to shoreline disturbance and often persecuted by fishermen, who mistakenly believe they may impact game fish populations, or who simply dislike sharing shorelines with snakes. With proper education the latter can be overcome, and in some instances fishermen learn to feed the snakes for amusement, a practice which the snakes seem to equally enjoy. Watersnakes can be detected and monitored through visual shoreline searches.

Smooth Greensnake (*Opheodrys vernalis*):
The first and only county record is from Chambers Island in 1993, although the observer has seen them subsequently (Wisconsin Herp Atlas). Its status elsewhere in the county is unknown, and it is rare or absent from Brown, Kewaunee and Manitowoc counties (Wisconsin Herp Atlas). Generally associated with drier soils (especially sandy soils) and meadows (Vogt 1981) where their insect prey resides. Greensnakes are thought to have declined as a result of insecticide applications targeting caterpillar populations, a major food source (e.g. Gypsy Moth and Spruce Budworm control). Comprehensive snake surveys throughout the county are recommended for status assessment, and if additional populations are found they might warrant SLCI ranking for conservation planning and monitoring. Greensnakes are easily inventoried and monitored by appropriately designed cover object surveys.

Western Foxsnake (*Pantherophis vulpinus*):
Locally common and widespread throughout the county, Dan Collins confirmed this species in the extreme southern SNA in 2014 (Appendix C), but they are expected to occur throughout. Foxsnakes utilize a variety of open and semi-forested habitats, including forest edge, urban and agricultural areas, rocky outcrops, meadows, and larger marshes. Door County is one of the most reliable places in the state to find them, where they appear to take advantage of abundant underground retreats associated with the Niagara Escarpment for winter denning. This species is recommended as a SLCI due to its large

size and the regional importance of this healthy population. Door County is an important habitat area for this species and may support populations of statewide significance. Monitoring can be accomplished by properly designed cover object surveys.

Dekay's Brownsnake (*Storeria dekayi*):
Found throughout the county including Chambers and Washington islands (Wisconsin Herp Atlas). Confirmed at several places within the SNA in 2014 as well (Appendix C), and are expected to occur throughout. This species utilizes a variety of open and semi-forested habitats, including forest edge, urban and agricultural areas, grassy right of ways, old fields and meadows. Door County is near the northern limit of its range. This species is not recommended as a SLCI due to its general abundance, but long term monitoring is recommended for tracking changes in biodiversity and ecosystem health. Monitoring can be accomplished by properly designed cover object surveys.

Northern Red-bellied Snake (*Storeria occipitomaculata occipitomaculata*):
Found throughout the county including Chambers and Washington islands (Wisconsin Herp Atlas). Confirmed only at the extreme southern end of the SNA in 2014 but expected to occur throughout (Appendix C). Red-bellied Snakes utilize a variety of open and semi-forested habitats, including forest edge, urban and agricultural areas, grassy right of ways, old fields and meadows. This species is not recommended as a SLCI due to its general abundance, but long term monitoring is recommended for tracking changes in biodiversity and ecosystem health. Monitoring can be accomplished by properly designed cover object surveys.

Northern Ribbonsnake (*Thamnophis sauritus septentrionalis*):
Reported and recently confirmed only from Peninsula State Park, this Endangered Species is known from only a few populations statewide in widely scattered locations (e.g. Door, Dane, Sheboygan counties; Wisconsin Herp Atlas). Considered to be a "glacial relict", where a formerly wide range has receded to a few widely scattered populations as a result of post-Pleistocene climate change. It is currently found only in shrubby bog habitats, typically with floating vegetative mats supporting sphagnum and tamarack, and either a central ponded area or a ponded moat, where it is semi-arboreal and feeds mainly on amphibians. It will likely be found in more locations if adequate surveys are conducted. Suitable habitat to support this species does not appear to be present within this SNA, hence SLCI status is not recommended. However, county-wide this should be a high priority SLCI due to its rarity. The greatest initial conservation need is adequate surveys to determine its real distribution and status.

Common Gartersnake (*Thamnophis sirtalis*):
Found throughout the county including Chambers and Washington islands (Wisconsin Herp Atlas). Confirmed within the SNA and expected to occur throughout (Appendix C). Utilizes a variety of open and semi-open wetland and terrestrial habitats, but avoids forest interior. Often found in urban and agricultural areas, grassy right of ways, old fields and meadows. This species is not recommended as a SLCI, but long term monitoring is recommended for tracking changes in biodiversity and ecosystem health. Monitoring can be accomplished by properly designed cover object surveys.

Discussion

Door County is a special place, surrounded on all sides by the waters of Lake Michigan and Green Bay, and with the Niagara Escarpment exposed along much of its length. These features make for unusual herptile habitat, with the lake effect ameliorating climate extremes, and the escarpment providing convenient denning sites. Hence some species like Common Mudpuppies and Western Foxsnakes appear to reach high abundances, and herptile diversity is relatively high overall. Indeed, the region may qualify as an Important Herptile Habitat Area, a Partners in Amphibian and Reptile Conservation (www.parcplace.org) initiative modeled after the Important Bird Area initiative (www.wisconsinbirds.org/IBA/). Identifying Important Herptile Habitat Areas in Wisconsin is currently being considered by Wisconsin PARC (www.wiparc.org). The concepts are presented in Sutherland and deMaynadier (2012).

We recommend that herptile inventory and monitoring programs be considered to collect better data on species present, and to begin monitoring for future change, both county-wide and for this SNA. The main inventory questions for the SNA are whether or not Northern Ring-necked Snake or Central Newt are present. Surveys for them may utilize visual searches and cover object surveys (Northern Ring-necked Snake), and aquatic funnel traps (Central Newt). Smooth Greensnake presence is doubtful, but could also be determined by cover object surveys. The presence of Common Mudpuppy and Northern Watersnake are also of interest, but the current land preservation configuration of the SNA does not appear to include good survey sites for these species (aquatic and shoreline habitats). Should more shoreline acquisition occur, surveys for these species may be warranted.

Six species are currently recommended as a focus for monitoring, owing to their usefulness as indicators of change, a philosophy of keeping common species common, and ease of monitoring: Northern Leopard Frog, Wood Frog, Spotted Salamander, Four-toed Salamander, Eastern Red-backed Salamander, and Western Foxsnake. We recommend the following programs be developed, possibly in cooperation with other partners for cost sharing and wider coverage. The program development should address partnerships, a study design, site selection, training, and data analysis and reporting.

Auditory surveys: A key part of long term monitoring, including for climate change, is tracking trends in amphibians. This can be accomplished by setting up a network of automated recording devices (e.g. Song Meters) modeled after the National Park Service program. These devices can be programmed to record 5-minute digital samples equivalent to the Wisconsin DNR frog and toad survey protocol, and can efficiently over-sample to either avoid false absences, or allow for statistically significant occupancy modeling. Ideally, a network of 10 sites would be selected throughout the county as permanent sampling sites that could be folded into the Park Service's long term monitoring program for the western Great Lakes, with shared data analyses. This program makes use of semi-automated data processing and is significantly more robust than any other program currently in place, allowing for discovery of declines in a timely manner. As an added incentive, the units can also be programmed to simultaneously monitor breeding birds utilizing the same protocol.

Visual surveys: Visual search protocols for shorelines, terrestrial habitat, and eggs are available for monitoring four recommended SLCI: Wood Frog, Spotted Salamander, Four-toed Salamander, and Eastern Red-backed Salamander. The egg search protocol also adequately monitors Blue-spotted Salamanders.

Cover object surveys: The cover object methods used on this study are effective for monitoring several snakes, including Northern Ring-necked Snake, Eastern Milksnake, Smooth Greensnake, Western Foxsnake, Dekay's Brownsnake, Northern Red-bellied Snake, and Common Gartersnake.

If a county-wide coalition can be achieved to advance herptile inventory and monitoring, priority should be given to distribution and status assessments for species that are currently data deficient, which are most species (see species accounts above). In general, most species have records clustered north of Sturgeon Bay, and in popular natural areas. A comprehensive assessment would utilize maps based on existing knowledge to perform gap surveys to better assess distribution and status, including on islands, and prioritize SLCI on a regional basis for better conservation planning and partnerships. Currently, the highest inventory priorities are the State Endangered Northern Ribbonsnake, Blanding's Turtle, and Smooth Greensnake, all of which are known from only one site each in the county (Wisconsin Herp Atlas).

Incidental Observations

We captured one Northern Pike in an aquatic funnel trap in the stream just north of the junction of Bay Shore Dr. and W. Carlsville Rd (44.947310, -87.377946, WGS84) on 29 June 2014, and numerous others while dipnetting.

Attachments:

Appendix A: Ranking system
Appendix B: Checklist with SLCI ranks (Excel file)
Appendix C: Detailed records for SNA (Excel file) with ESRI Arcmap layer (shapefile)

Literature Cited:

Casper, G. S. 1996. Geographic Distributions of the Amphibians and Reptiles of Wisconsin. Milwaukee Public Museum, 87 pp.

Harper, E. B., T. A. G. Rittenhouse, R. D. Semlitsch. 2008. Demographic Consequences of Terrestrial Habitat Loss for Pool-Breeding Amphibians: Predicting Extinction Risks Associated with Inadequate Size of Buffer Zones. Conservation Biology 22(5):1205–1215.

Rittenhouse, T. A. G. and R. D. Semlitsch. 2007. Distribution of amphibians in terrestrial habitat surrounding wetlands. Wetlands 27(1):153–161.

Scott, D. E., M. J. Komoroski, D. A. Croshaw, and P. M. Dixon. 2013. Terrestrial distribution of pond-breeding salamanders around an isolated wetland. Ecology 94(11):2537–2546.

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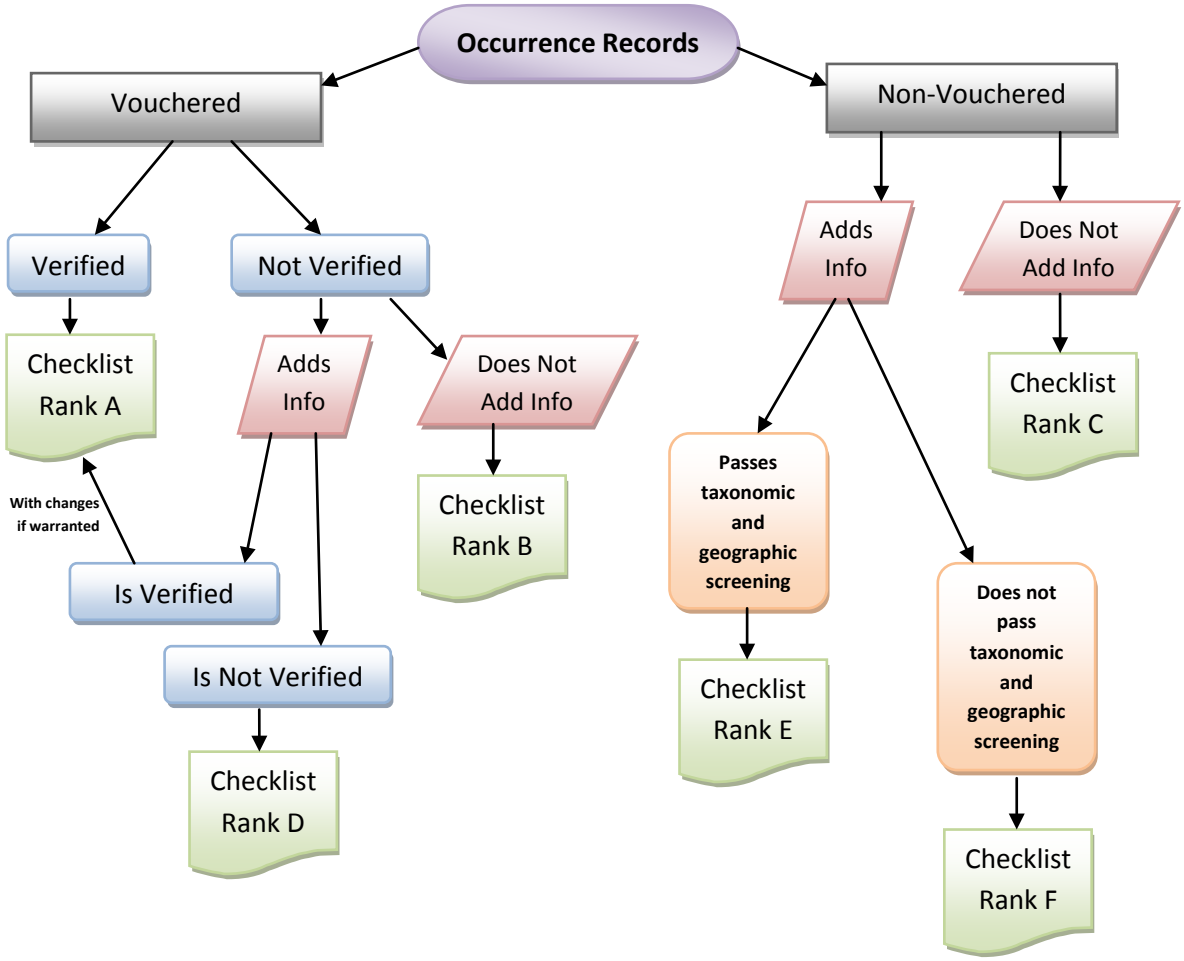
Vogt, R. C. 1981. Natural History of Amphibians and Reptiles of Wisconsin. Milwaukee Public Museum, Milwaukee, WI. 205 pp.

Milksnake eating a Brownsnake, Bay Shore Blufflands 2014 (photo by R. Rutherford)

Appendix A: Species Occurrence Data Vetting



Definitions and Checklist Ranks:

Vouchered = an occurrence record with physical evidence that can be independently verified (i.e., a publically available specimen or photograph)

Non-Vouchered = an occurrence record without physical evidence that can be independently verified (i.e., observational records, or purported evidence that is lost or cannot be accessed)

A – Vouchered record that has been independently verified.

B - Vouchered record that has not been independently verified, but does not add any significant new information (i.e., falls within already verified occurrence area and/or time period selected for the project).

C – Non-Vouchered record that does not add any significant new information (as defined for B).

D - Vouchered record that has not been independently verified and does add significant new information (i.e., extends geographic range or fills substantial geographic range gap, and/or extends species occurrence time period for species thought to be extirpated) - these records should be verified if possible.

E - Non- Vouchered record that does add significant new information (as defined for D), and passes screening*.

F - Non- Vouchered record that does add significant new information (as defined for D), and does not pass screening*.

Species checklists are very informative for planning purposes, being a record of biodiversity for an area which can be used to evaluate which species are of conservation interest, and to assess species richness and habitat conservation potential. Checklist records are ranked in order of confidence from the highest Rank A (very confident record is good) to the lowest Rank F (record is questionable and cannot be verified). Historical species checklists are defined as all species that are likely to have ever occurred in a project area. They are cumulative over time and typically categorize species in various ways to inform project objectives, such as by conservation status, habitat requirements, or how recent records are. For these checklists ranks A-D are typically appropriate, with Rank D records subjected to species by species scrutiny with expert opinion weighed and uncertainty eliminated by independently verifying the specimens, and/or by new field surveys, when warranted. If records in Ranks E and F are of interest the locations may be verified for species occurrence through new field surveys, with voucher specimens (or photographs) collected and deposited at a public institution. Rank E sites are more likely to produce the species.

* - Screening for taxonomic and geographic outliers is a process whereby a putative occurrence is examined to see if it, a) falls within the species' known geographic range, b) could have been confused with other more likely taxa, and c) if suitable habitat for the species existed at the time and place of the observation. Outliers are those records that fail these tests, or are otherwise questionable (e.g. a transcription error is suspected in data), and generally should not be used for analyses. If these records are important to the project, they should be reconfirmed by new surveys.

It is important to acknowledge the presence-only nature of most records in a checklist database. Without repeated visits, credible survey protocols followed, and survey effort tracked, most records cannot be treated as survey data, and the absence of observations cannot be used as evidence of species absence. If proving absence is important, either for gaps where no records are available, or as part of a vetting process for records in Ranks D, E or F, field surveys designed to confirm presence or absence must incorporate detection probabilities in the study design and sample sufficiently to meet 95% confidence in avoiding Type II Error (false absences). However, in some instances gaps in occurrence records can be accepted as real if no suitable habitat exists (e.g. developed areas).

A final point regarding observational data - Ranks C, E and F. Past practice has often ranked observational data by observer credibility, whereby observations from known experts are considered more reliable. While this is often the case, this assumption is also frequently violated, as experts do make mistakes, taxonomy changes, and unknown persons are often just as reliable (sometimes more so). This ranking system avoids such personal judgment calls, relying instead on the scientific method with the ability to perform independent verification. Rather than accepting records on faith ("just trust me"), scientific evidence can be examined (in this case, specimens or photographs). This process, like all good science, is self-correcting as future workers continue to examine the evidence.

NOTE: This vetting system was developed by Gary S. Casper (UWM Field Station) for an Ozaukee County, Wisconsin, conservation planning project. Inquiries on use and acknowledgement should be made to Dr. Casper (gscasper@uwm.edu, 262-689-4095).

Appendix B: Bay Shore Blufflands SNA Herptile Species Checklist

Prepared by Gary S. Casper (Great Lakes Ecological Services, PO Box 375, Slinger, WI 53086), Sept. 2014

Group	Common Name	Scientific Name	Global Rank	State Rank	Federal Status	WI Status	SGCN	NHI Tracked	SLCI	Wetland Type	Focal Species	Comments
Frog	Eastern Am	*Anaxyrus an*	G5	S5						P, S, T		Present in SNA and generally common. Generalist habitat requirements.
Frog	Gray Treefr	*Hyla versico*	G5	S5						S, T		Present in SNA and generally common. Prefers shrub and forested habitat with suitable breeding sites.
Frog	Green Frog	*Lithobates c*	G5	S5						P		Present in SNA and generally common. Prefers aquatic shoreline habitat.
Frog	Northern Le	*Lithobates p*	G5	S4?		SC/H		W	Y	P, S		Present in SNA and generally common. Complex habitat requirements. Recommended for monitoring.
Frog	Wood Frog	*Lithobates s*	G5	S4					Y	S, T		Present in SNA and generally common. Landscape sensitive habitat requirements, ephemeral wetland obligate. Recommended for monitoring.
Frog	Spring Peep	*Pseudacris c*	G5	S5						S, T		Present in SNA and generally common. Prefers shrub and forested habitat with suitable breeding sites.
Salamander	Blue-spotted	*Ambystoma*	G5	S4/S5						S, T		Present in SNA and generally common. Occupies forest habitat with embedded ephemeral wetlands.
Salamander	Spotted Sala	*Ambystoma*	G5	S4					Y	S, T		Present in SNA and locally common in higher quality forested habitat with embedded ephemeral wetlands, coarse downed woody debris, and duff. Recommended for monitoring.
Salamander	Four-toed Sa	*Hemidactyli*	G5	S3?		SC/H	Y	W	Y	S, T		Present in SNA and locally common in higher quality forested habitat with embedded ephemeral wetlands that provide the specialized nesting microhabitat conditions.
Salamander	Common Mu	*Necturus ma*	G5	S3S4		SC/H	Y	W		P		Present in county but only suitable aquatic habitat within SNA is Green Bay littoral zone. Thought to be declining and in need of conservation research.
Salamander	Central New	*Notophthaln*	G5	S4						P, S		Local and apparently rare. Not currently known from this SNA. Data deficient.
Salamander	Eastern Red	*Plethodon ci*	G5	S4					Y			Present in SNA and generally common. Occupies moist forest habitat with high quality duff and coarse downed woody debris. Recommended for monitoring.
Snake	Northern Ri	*Diadophis p*	G5T5	S3				W	Y			Possibly present in the SNA but no records (known from Door Co.). Forest edge and forest openings, especially near bedrock outcrops. Recommended for monitoring.
Snake	Eastern Mill	*Lampropelti*	G5	S4								Present in SNA and probably locally common. Occupies urban and agricultural environments, meadows, clearings, forest edge.
Snake	Common W	*Nerodia sipe*	G5	S4								Possibly present in the SNA but no records (known from Door Co.). Natural shorelines of lakes and larger streams.
Snake	Smooth Gre	*Opheodrys v*	G5	S4								Only county record is from Chambers Island in 1993. Prefers sandy soils and meadows. Status unknown.
Snake	Western Fox	*Pantherophi*	G5	S4/S5					Y			Present in SNA and probably locally common. Occupies urban and agricultural environments, meadows, clearings, forest edge, dens in escarpment. Door County may support populations of statewide significance. Recommended for monitoring.

Snake	Dekay's Bro	*Storeria dek*	G5	S5								Present in SNA and probably locally common. Occupies urban and agricultural environments, meadows, clearings, forest edge.
Snake	Northern Re	*Storeria occ*	G5	S4S5								Present in SNA and probably locally common. Occupies urban and agricultural environments, meadows, clearings, forest edge.
Snake	Northern Ril	*Thamnophis*	G5	S1		END	Y	Y				Present in county but not SNA. Needs more survey work.
Snake	Common Ga	*Thamnophis*	G5	S4S5								Present in SNA and localy common. Occupies a variety of open canopy wetland and upland habitats.
Turtle	Snapping Tu	*Chelydra se*	G5	S4S5								Present in SNA and localy common. Occupies permanent to semi-permanent wetlands with abundant aquatic macrophytes.
Turtle	Painted Turt	*Chrysemys p*	G5	S5								Present in SNA and localy common. Occupies permanent to semi-permanent wetlands with abundant aquatic macrophytes.
Turtle	Blanding's T	*Emydoidea b*	G4	S3S4		SC/H	Y	Y				Rare in the county and not supported in the SNA. Occupies large marshes and pond complexes.

Global Rank	G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
from www.natureserve.org/explorer/	G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
	G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single state or physiographic region) or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.
	G4 = Apparently globally secure, though it may be quite rare in parts of its range, especially at the periphery.
	G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
	GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered.
	GNR = Not ranked. Replaced G? rank and some GU ranks
	GU = Possibly in peril range-wide, but their status is uncertain. More information is needed.
	GX = Believed to be extinct throughout its range (e.g. Passenger pigeon) with virtually no likelihood that it will be rediscovered.
	Species with a questionable taxonomic assignment are given a "Q" after the global rank.
	Subspecies and varieties are given subranks composed of the letter "T" plus a number or letter. The definition of the second character of the subrank parallels that of the full global rank. (Examples: a rare subspecies of a rare species is ranked G1T1; a rare subspecies of a common species is ranked G5T1.)
State Rank	S1 = Critically imperiled in Wisconsin because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.
from www.natureserve.org/explorer/	S2 = Imperiled in Wisconsin because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
	S3 = Rare or uncommon in Wisconsin (21 to 100 occurrences).
	S4 = Apparently secure in Wisconsin, with many occurrences.
	S5 = Demonstrably secure in Wisconsin and essentially ineradicable under present conditions.
	SA = Accidental (occurring only once or a few times) or casual (occurring more regularly although not every year); a few of these species (typically long-distance migrants such as some birds and butterflies) may have even bred on one or more of the occasions when they were recorded.
	SE = An exotic established in the state; may be native elsewhere in North America.
	SH = Of historical occurrence in Wisconsin, perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an element would become SH without such a 20-year delay if the only known occurrence were destroyed or if it had been extensively and unsuccessfully looked for.

	SN = Regularly occurring, usually migratory and typically non-breeding species for which no significant or effective habitat conservation measures can be taken in Wisconsin. This category includes migratory birds and bats that pass through twice a year or, may remain in the winter (or, in a few cases, the summer) along with certain lepidoptera which regularly migrate to Wisconsin where they reproduce, but then completely die out every year with no return migration. Species in this category are so widely and unreliably distributed during migration or in winter that no small set of sites could be set aside with the hope of significantly furthering their conservation.
	SZ =Not of significant conservation concern in Wisconsin, invariably because there are no definable occurrences in the state, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long-distance migrants whose occurrence during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. Typically, the SZ rank applies to a non-breeding population.
	SR = Reported from Wisconsin, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports that are hard to dismiss because the habitat is now destroyed.
	SRF =Reported falsely (in error) from Wisconsin but this error is persisting in the literature.
	SU = Possibly in peril in the state, but their status is uncertain. More information is needed.
	SX = Apparently extirpated from the state.
	State Ranking of Long-Distance Migrant Animals = Ranking long distance aerial migrant animals presents special problems relating to the fact that their non-breeding status (rank) may be quite different from their breeding status, if any, in Wisconsin. In other words, the conservation needs of these taxa may vary between seasons. In order to present a less ambiguous picture of a migrant's status, it is necessary to specify whether the rank refers to the breeding (B) or non-breeding (N) status of the taxon in question. (e.g. S2B,S5N).
Federal Status	Federal protection status designated by the Office of Endangered Species, U.S. Fish and Wildlife Service indicating the biological status of a species in the United States. LE = listed endangered; LT = listed threatened; LE-LT = listed endangered in part of its range, threatened in another part; XN = nonessential experimental population(s) in part of its range; LT,PD = listed threatened, proposed for de-listing; C = candidate for future listing.
WI Status	Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern.
	WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H = take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.
	Special Concern species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.
SGCN	Identified as a Species of Greatest Conservation Need from Wisconsin's Wildlife Action Plan.
NHI Tracked	Indicates if species is tracked in the Wisconsin Natural Heritage Working List (version 5/31/12). W = watch list, which includes species that were formerly tracked but are no longer due to changed status ranks.

SLCI	Species of Conservation Interest are species that are at least one of the following: a) listed as either state or federally Endangered, Threatened, or Special Concern; b) listed as Species of Greatest Conservation Need in the State Wildlife Action Plan; c) considered to be locally rare or declining; or d) thought to be important as indicator species for long-term monitoring in the project area
Focal Species	This is a dynamic column, that can be used to select project specific species, such as for monitoring, as umbrella species to represent habitat restorations, etc.
Habitat Context	Brief description of status and habitat parameters associated with the species that may be relevant to conservation planning.
Wetland Type	Amphibians only. Breeding habitat type. P - permanent waters. S - Semi-permanent ponds and wetlands. T - temporary ponds and wetlands (seasonal, ephemeral).

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Great Lakes Coastal Wetlands
Monitoring Program 2014, Erin Giese et al

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

WISCONSIN COASTAL MANAGEMENT PROGRAM

Great Lakes Coastal Wetland Monitoring Program (GLCWMP) 2014

Bay Shore Blufflands Open Wetlands sites
Surveys conducted: Amphibians, Birds, Invertebrates and Vegetation Transects

Contact:
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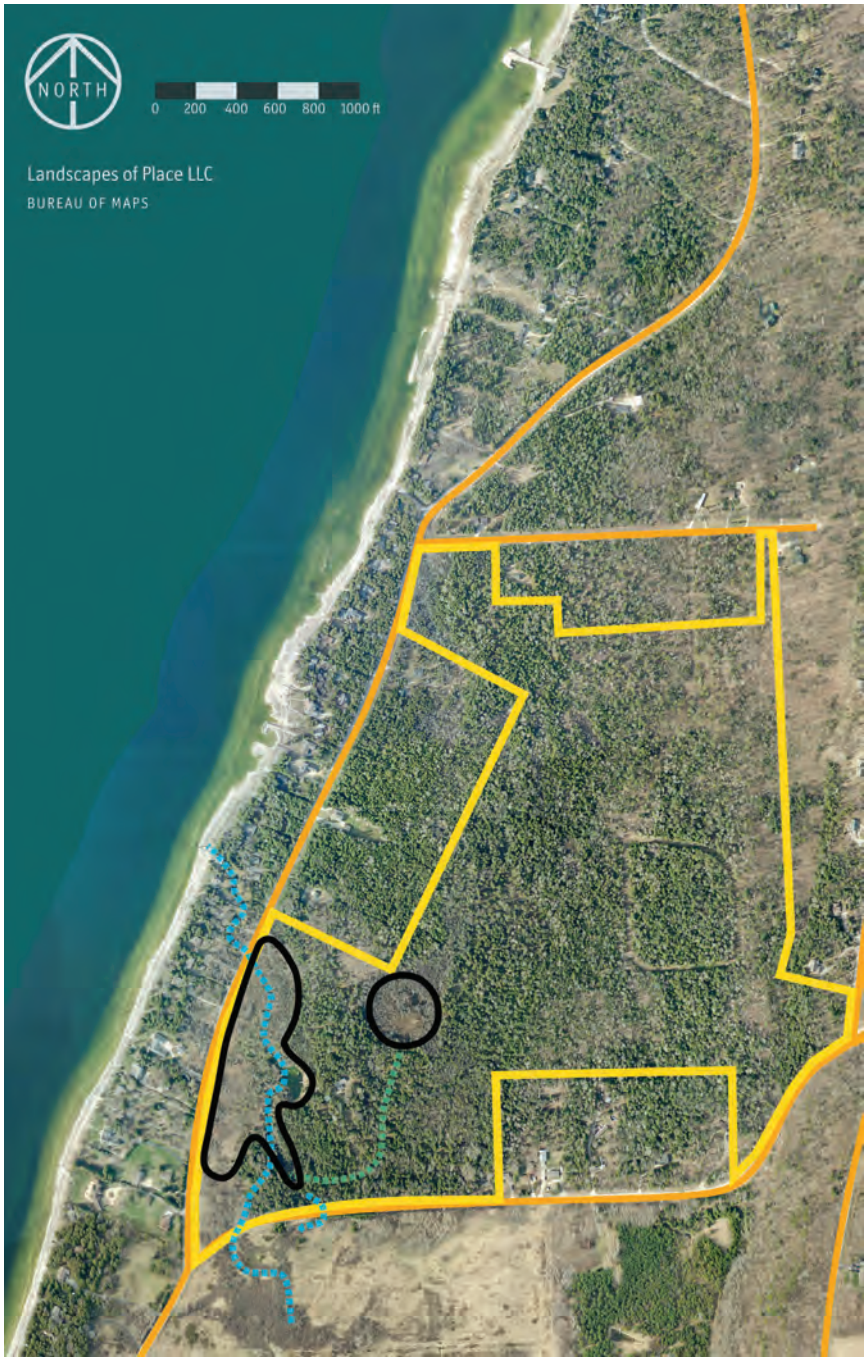


Amphibian - Metadata

Amphibian Data Collected at Egg Harbor Township Wetland (#1424) from the Great Lakes Coastal Wetland Monitoring Program (2014)

This file contains amphibian (frogs and toads only) point count data collected during surveys conducted in the spring/summer of 2014 at Egg Harbor Township Wetland (1424), a.k.a. Bayshore Blufflands, for the Great Lakes Coastal Wetland Monitoring Program (GLCWMP). These data were collected by UW-Green Bay students under the supervision of Dr. Robert Howe to assist the Landscapes of Place, The Nature Conservancy, and Door County Land Trust in acquiring biological information about this wetland for writing a long-term land management plan.

These data were double entered by UW-Green Bay students and subsequently compared by Erin Giese in July 2014. The final product are the contents of this file. Protocols, reference sheets, and paper data sheets were provided separately to the Landscapes of Place (Nancy Aten and Dan Collins), The Nature Conservancy (Mike Grimm), and Door County Land Trust (Jodi Milske).

Amphibian data were collected using a full circle, unlimited-distance 3-minute point count method by certified expert observers. All frogs and toads detected during this 3-minute period were recorded, regardless of distance to observer. Three counts were conducted at this wetland between the late spring and early summer and were separated by at least 15 days and minimum nighttime temperature requirements (5°C, 10°C, and 17°C).

Amphibian data were collected at sampling point count location, A1424.1 (site=1424; point_id=1) at geospatial coordinates 44.948970°, -87.376115° (WGS 84).
Waypoints were collected at each of the three samples (A1424.1.R1 = round 1 amphibian survey, A1424.1.R2 = round 2 amphibian survey, and A1424.1.R3 = round 3 amphibian survey), confirming that point counts were conducted at the correct location.

Tab "A_point" contains information about the point count itself (e.g., weather, time). Tab "A_observation" contains amphibian point count data (i.e., amphibian observations). The rest of the tabs in this file are described in greater detail below from the GLCWMP online database and generally explain the different fields provided in tabs "A_point" and "A_observation".

File prepared by Erin Giese on 11 July 2014.

Contact Information:
Erin Giese, UW-Green Bay's Cofrin Center for Biodiversity Research Specialist / Data Manager, giesee@uwgb.edu, (615) 403-6000.
Dr. Robert Howe, UW-Green Bay Professor and Director of the Cofrin Center for Biodiversity; GLCWMP Principal Investigator, hower@uwgb.edu, (920) 465-2272.

Coastal Monitoring Amphibian data dumped Fri Jul 11 01:57:59 2014

This is an *export* of data from the project's online database

Data CAN NOT BE ENTERED into the project database using this spreadsheet

Table	Fields	Records	Description
A_point	18	5932	Amphibian point count
A_observati	10	19521	Observations
A_taxa	3	13	NO COMMENT SUPPLIED
Ab_distance	2	4	NO COMMENT SUPPLIED
A_callcode	2	3	NO COMMENT SUPPLIED
G_timezone	3	2	NO COMMENT SUPPLIED
Ab_weather	2	4	NO COMMENT SUPPLIED
Ab_wind	2	6	NO COMMENT SUPPLIED
Ab_noise	2	5	NO COMMENT SUPPLIED

Table details

The following table descriptions show the fields in the project data base, which are somewhat different from the fields in this export. Descriptions of fields containing observed values are consistent.

A_point: Amphibian point count

Field	Units	Type	Description
site	N/A	link	to lookup list Site
point_id	N/A	text	Point number, 1-6
waypoint	N/A	text	Waypoint label on GPS, eg. B1234.2, NA if missing.
sample		integer	Sample number, 1-3
date	N/A	date	M/D/Y, e.g. 4/15/2011
start_time	N/A	time	HHMM, 24hr format, eg. 2343 or 0013
timezone	N/A	link	to table G_timezone
observer	N/A	text	F.Lastname, e.g. J.Doe
weather	N/A	link	to table Ab_weather
cloud_pcnt		real number	Cloud percent, 0-100
wind	N/A	link	to table Ab_wind
air_c		real number	Air temperature in C
water_c		real number	Water temperature in C
noise	N/A	link	to table Ab_noise
bearing		real number	Bearing faced on point, 0-360
comments	N/A	text	

Amphibian - Metadata

A_observation: Observations

Field	Units	Type	Description
point	N/A	link	to table A_point
taxa	N/A	link	to table A_taxa
distance	N/A	link	to table Ab_distance
in_front	N/A	true/false	
callcode	N/A	link	to table A_callcode
individuals		integer	

A_taxa: NO COMMENT SUPPLIED

Field	Units	Type	Description
code	N/A	text	
common	N/A	text	

Ab_distance: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

A_callcode: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

G_timezone: NO COMMENT SUPPLIED

Field	Units	Type	Description
name	N/A	text	
offset		real number	

Ab_weather: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

Ab_wind: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

Ab_noise: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

Amphibian - Points

site	point_id	date	sample	waypoint	start_time	observer	weather	cloud_pcnt	wind	air_c	water_c	noise	bearing	comments
1424	1	2014-04-25	1	A1424.1.R1	22:43:00	L.Bender	Dry	0	Calm; smoke rises vertically	3.5	8.6	No appreciable effect (owl calling)	170	
1424	1	2014-05-27	2	A1424.1.R2	22:07:00	T.Prestby	Dry	0	Light air movement; smoke drifts; leaves barely move	11.1		Seriously affecting sampling (continuous traffic nearby, 6-10 cars passing)	170	Deafening frogs - very hard to count/estimate
1424	1	2014-06-19	3	A1424.1.R3	22:38:00	L.Bender	Dry	100	Light air movement; smoke drifts; leaves barely move	15.9		Slightly affecting sampling (distant traffic, dog barking, car passing)	170	Water temp was not recorded because it was determined not safe from tall pier.

Amphibian - Observations

site	point_id	date	sample	taxa	distance	in_front	callcode	individuals
1424	1	2014-04-25	1	SPPE	0-50 m	False	1: Calls not simultaneous; individuals can be accurately counted	1
1424	1	2014-04-25	1	WOFR	0-50 m	False	1: Calls not simultaneous; individuals can be accurately counted	1
1424	1	2014-04-25	1	SPPE	50-100 m	False	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-04-25	1	CHFR	0-50 m	True	1: Calls not simultaneous; individuals can be accurately counted	1
1424	1	2014-04-25	1	SPPE	0-50 m	True	1: Calls not simultaneous; individuals can be accurately counted	1
1424	1	2014-04-25	1	SPPE	0-50 m	True	1: Calls not simultaneous; individuals can be accurately counted	3
1424	1	2014-04-25	1	WOFR	0-50 m	True	1: Calls not simultaneous; individuals can be accurately counted	2
1424	1	2014-04-25	1	WOFR	0-50 m	True	1: Calls not simultaneous; individuals can be accurately counted	2
1424	1	2014-04-25	1	SPPE	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-04-25	1	SPPE	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-04-25	1	SPPE	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	GRTR	0-50 m	False	2: Some calls simultaneous; individuals can be reliably estimated	2
1424	1	2014-05-27	2	GRTR	0-50 m	False	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	GRTR	0-50 m	False	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	GRTR	50-100 m	False	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	SPPE	50-100 m	False	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	SPPE	50-100 m	False	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	GRTR	0-50 m	True	2: Some calls simultaneous; individuals can be reliably estimated	1
1424	1	2014-05-27	2	GRTR	0-50 m	True	2: Some calls simultaneous; individuals can be reliably estimated	2
1424	1	2014-05-27	2	GRTR	0-50 m	True	2: Some calls simultaneous; individuals can be reliably estimated	3
1424	1	2014-05-27	2	SPPE	0-50 m	True	2: Some calls simultaneous; individuals can be reliably estimated	1
1424	1	2014-05-27	2	SPPE	0-50 m	True	2: Some calls simultaneous; individuals can be reliably estimated	1
1424	1	2014-05-27	2	SPPE	0-50 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	GRTR	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	GRTR	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	SPPE	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	SPPE	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-05-27	2	SPPE	50-100 m	True	3: Full chorus, calls continuous & overlapping; not reliably estimated	
1424	1	2014-06-19	3	GRTR	0-50 m	False	1: Calls not simultaneous; individuals can be accurately counted	1
1424	1	2014-06-19	3	GRTR	50-100 m	True	1: Calls not simultaneous; individuals can be accurately counted	1

distance	description
1	0-50 m
2	50-100 m
3	> 100 m
-1	No data

timezone	name	offset
-6	Central	-6
-5	Eastern	-5

taxa	code	common
1	AMTO	American Toad
2	BCFR	Northern (Blanchard's) Cricket Frog
3	BULL	Bullfrog
6	CGTR	Cope's Gray Treefrog
4	CHFR	Chorus Frog (Western/Boreal)
7	FOTO	Fowler's Toad
9	GRFR	Green Frog
8	GRTR	Gray Treefrog
10	MIFR	Mink Frog
11	NLFR	Northern Leopard Frog
12	PIFR	Pickerel Frog
14	SPPE	Spring Peeper
15	WOFR	Wood Frog

callcode	description
1	Calls not simultaneous; individuals can be accurately counted
2	Some calls simultaneous; individuals can be reliably estimated
3	Full chorus, calls continuous & overlapping; not reliably estimated

weather	description
1	Dry
2	Damp/Haze/Fog
3	Drizzle
4	Rain

wind	description
0	Calm; smoke rises vertically
1	Light air movement; smoke drifts; leaves barely move
2	Slight breeze; wind felt on face; small twigs move
3	Gentle breeze; leaves & small twigs in constant motion
4	Moderate breeze; small branches moving, raises dust & loose paper
5	Large branches & small trees sway

noise	description
0	No appreciable effect (owl calling)
1	Slightly affecting sampling (distant traffic, dog barking, car passing)
2	Moderately affecting sampling (distant traffic, 2-5 cars passing)
3	Seriously affecting sampling (continuous traffic nearby, 6-10 cars passing)
4	Profoundly affecting sampling (continuous traffic passing, construction noise)

A1424.1

AMPHIBIAN MONITORING
Field Data Sheet
2014

A1424.1.R1

Waypoint: ~~AB1424.1.1~~
Lat: N44.94897°
Lon: W087.37611°

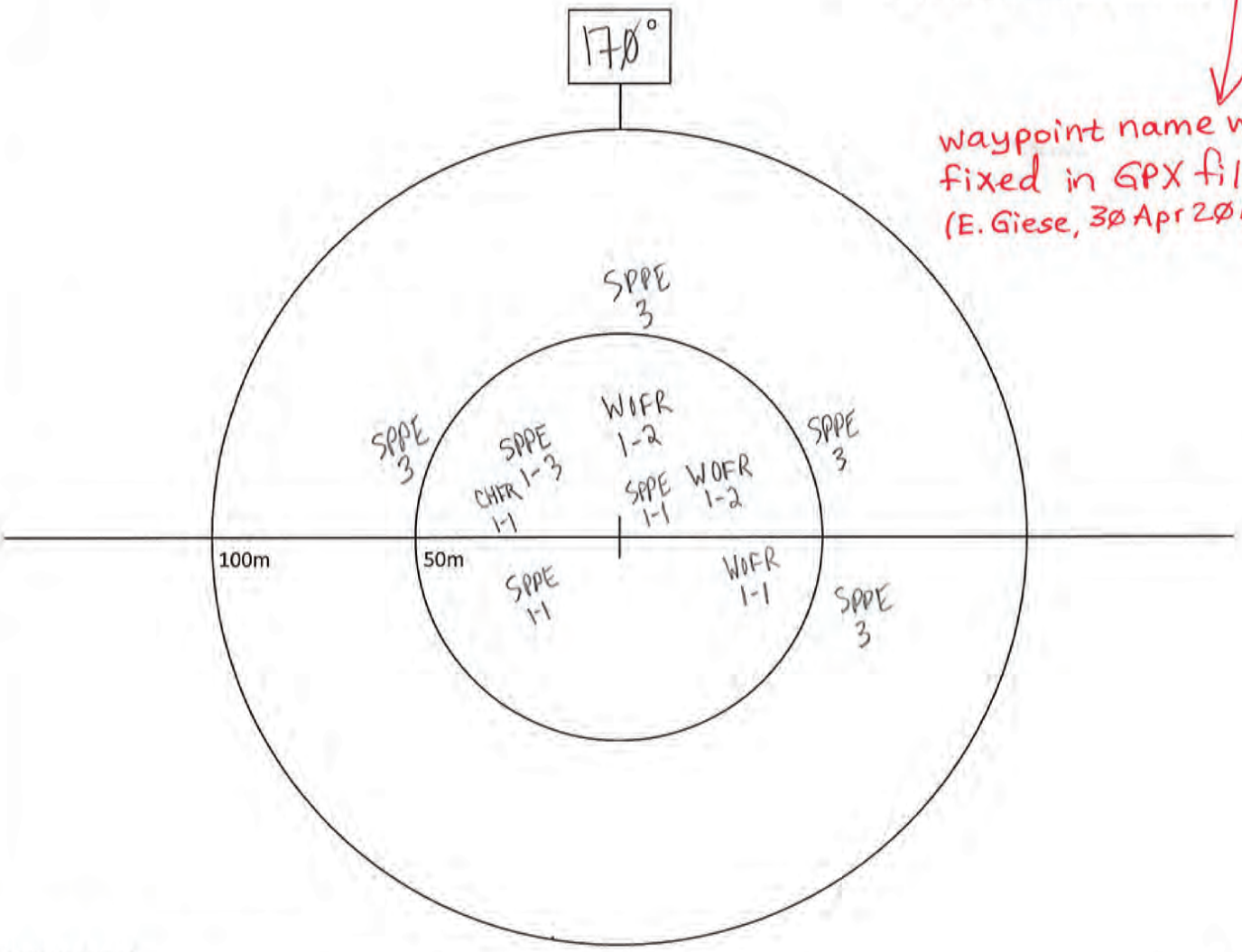
Point ID: ~~AB1424.1~~	
Sample: Round 1	
Date: 04 / 25 / 2014	
Start Time: 22:43 (CDT) EDT	
Observer: L. Bender	

Weather: (Dry) Damp/Haze/Fog Drizzle Rain	
% Cloud Cover: Ø	Wind: Ø
Air Temp: 3.5 °C	Water Temp: 8.6 °C
Noise: Ø	

Rec #: 2

Observations: CHFR x-y
x = calling code (1, 2 or 3)
y = number of individuals (1, or # > 1 if small group of the same species at the same location); leave blank for calling code 3

Calling Code	Description
1	Calls not simultaneous; individuals can be accurately counted
2	Some calls simultaneous; individuals can be reliably estimated
3	Full chorus, calls continuous & overlapping; not reliably estimated



waypoint name was fixed in GPX file. (E. Giese, 30 Apr 2014)

it data entry (signature): _____

id data entry (signature): _____

Comments:

2 Feb 2014

AMPHIBIAN MONITORING
Field Data Sheet
2014

Point ID: A1424.1	
Sample: Frogs R2	
Date: 05 / 27 / 2014	
Start Time: 22:07 (CDT / EDT)	
Observer: T. Prestby	

Waypoint: A1424.1.R2
Lat: 44.94900
Lon: 87.37606

Weather: (Dry) Damp/Haze/Fog Drizzle Rain	
% Cloud Cover: X	Wind: 1
Air Temp: 11.1 °C	Water Temp: °C
Noise: 3	

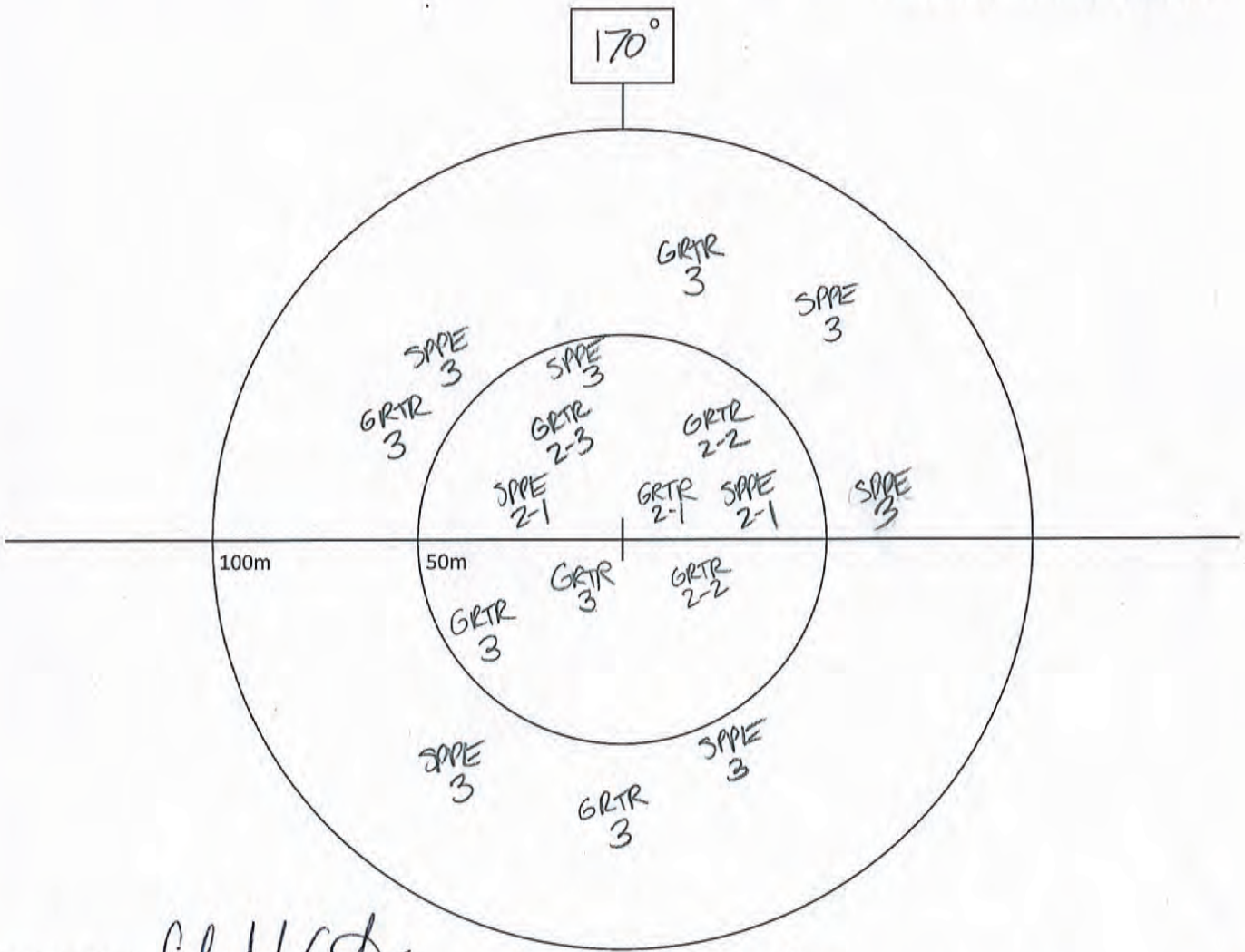
Rec #: 6

SPPE
GRTR

Observations: CHFR
x-y

x = calling code (1, 2 or 3)
y = number of individuals (1, or # > 1 if small group of the same species at the same location); leave blank for calling code 3

Calling Code	Description
1	Calls not simultaneous; individuals can be accurately counted
2	Some calls simultaneous; individuals can be reliably estimated
3	Full chorus, calls continuous & overlapping; not reliably estimated



:t data entry (signature): C L M Cotr

Comments: DEAFENING frogs
Very hard to count/estimate

:d data entry (signature): _____

2 Feb 2014

AMPHIBIAN MONITORING

Field Data Sheet
2014

Point ID:	A1424.1
Sample:	R3
Date:	06 / 19 / 2014
Start Time:	22:38 (CDT) EDT
Observer:	L. Bender

Waypoint: A1424.1, R3
Lat: N 44.94898°
Lon: W 87.37606°

Weather:	(Dry) Damp/Haze/Fog Drizzle Rain	
% Cloud Cover:	100%	Wind: 1
Air Temp:	15.9 °C	Water Temp: X °C
Noise:	1	

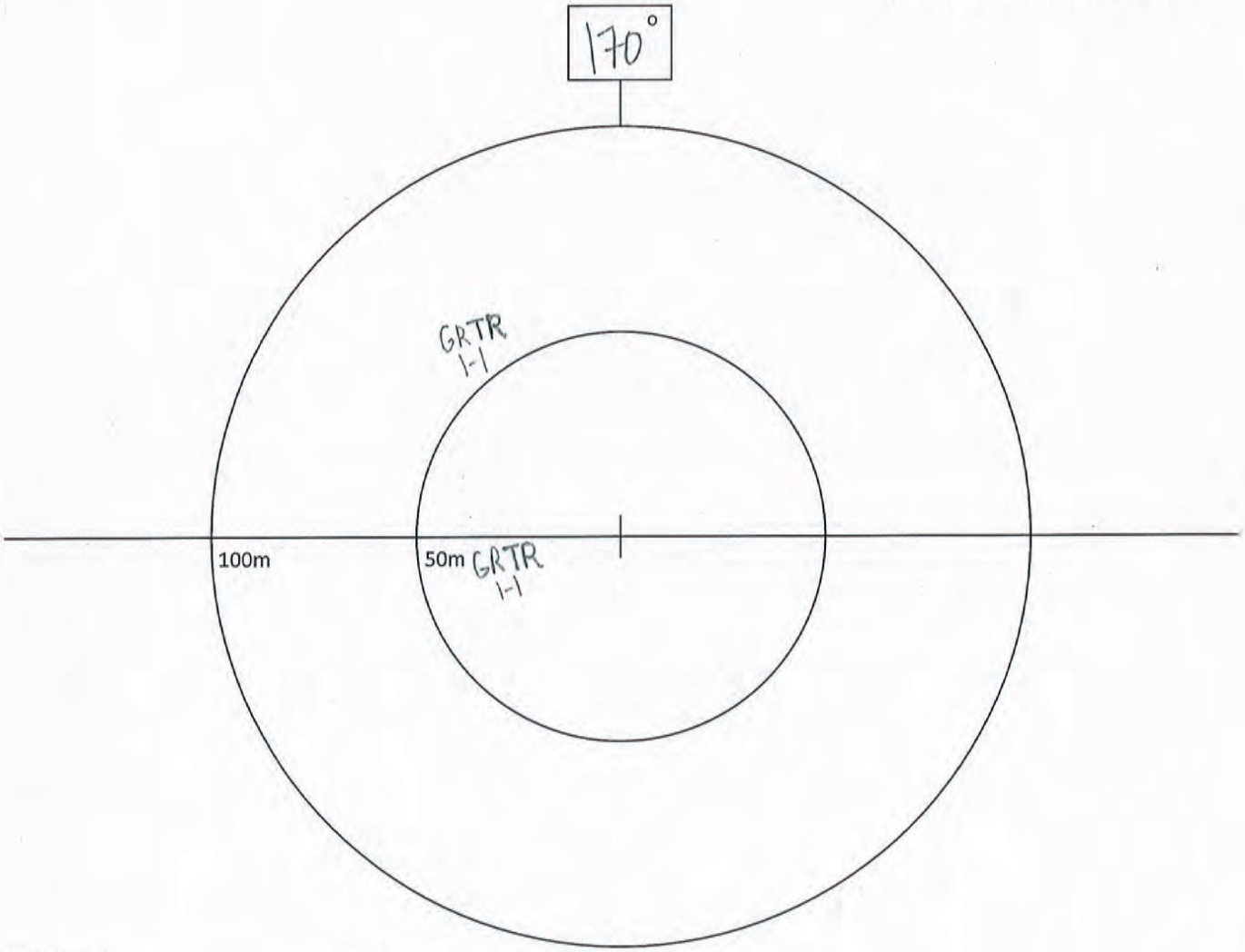
not safe from tall pier

Rec #: 2

Observations: CHFR
x-y

x = calling code (1, 2 or 3)
y = number of individuals (1, or # > 1 if small group of the same species at the same location); leave blank for calling code 3

Calling Code	Description
1	Calls not simultaneous; individuals can be accurately counted
2	Some calls simultaneous; individuals can be reliably estimated
3	Full chorus, calls continuous & overlapping; not reliably estimated



:t data entry (signature): _____

ıd data entry (signature): _____

Comments:

Bird Data Collected at Egg Harbor Township Wetland (#1424) from the Great Lakes Coastal Wetland Monitoring Program (2014)

This file contains breeding bird data collected during surveys conducted in the spring/summer of 2014 at Egg Harbor Township Wetland (1424), a.k.a. Bayshore Blufflands, for the Great Lakes Coastal Wetland Monitoring Program (GLCWMP). These data were collected by UW-Green Bay students under the supervision of Dr. Robert Howe to assist the Landscapes of Place, The Nature Conservancy, and Door County Land Trust in acquiring biological information about this wetland for writing a long-term land management plan.

These data were double entered by UW-Green Bay students and subsequently compared by Erin Giese in July 2014. The final product are the contents of this file. Protocols, reference sheets, and paper data sheets were provided separately to the Landscapes of Place (Nancy Aten and Dan Collins), The Nature Conservancy (Mike Grimm), and Door County Land Trust (Jodi Milske).

Bird data were collected using a full circle, unlimited-distance 15-minute point count method by certified expert observers. The first 5-minutes of a bird point count consisted of passive listening by the observer. During the middle 5-minutes of a bird count, a broadcast of secretive, marsh-nesting bird species calls (e.g., Pied-billed Grebe) was played to elicit responses of birds in the wetland. Then, the last 5-minutes of a count consisted of passive listening by the observer. Two counts (field "sample"), once in the morning and once in the evening, were conducted between the late spring and early summer and were separated by at least 15 days.

Bird data were collected at sampling point count location, B1424.2 (site=1424; point_id=2) at geospatial coordinates 44.947863°, -87.377717° (WGS 84).
Waypoints were collected at each of the two samples (B1424.2.BM = morning bird survey and B1424.2.BE = evening bird survey), confirming that point counts were conducted at the correct location.

Tab "B_point" contains information about the point count itself (e.g., weather, time). Tab "B_aerial" contains data on aerial foragers detected during a point count. Tab "B_observation" contains bird point count data (i.e., bird observations). The rest of the tabs in this file are described in greater detail below from the GLCWMP online database and generally explain the different fields provided in tabs "B_point", "B_aerial", and "B_observation".

File prepared by Erin Giese on 9 July 2014.

Contact Information:
Erin Giese, UW-Green Bay's Cofrin Center for Biodiversity Research Specialist / Data Manager, giesee@uwgb.edu, (615) 403-6000.
Dr. Robert Howe, UW-Green Bay Professor and Director of the Cofrin Center for Biodiversity; GLCWMP Principal Investigator, hower@uwgb.edu, (920) 465-2272.

Coastal Monitoring Bird data dumped Thu Jul 3 01:51:53 2014

This is an *export* of data from the project's online database

Birds - Metadata

Data CAN NOT BE ENTERED into the project database using this spreadsheet

Table	Fields	Records	Description
B_point	18	4515	Bird point count
B_aerial	7	4340	Aerial foragers
B_observation	12	91271	Observations
B_taxa	3	298	NO COMMENT SUPPLIED
Ab_distance	2	4	NO COMMENT SUPPLIED
B_behavior	2	6	NO COMMENT SUPPLIED
B_breeding	4	21	NO COMMENT SUPPLIED
G_timezone	3	2	NO COMMENT SUPPLIED
Ab_weather	2	4	NO COMMENT SUPPLIED
Ab_wind	2	6	NO COMMENT SUPPLIED
Ab_noise	2	5	NO COMMENT SUPPLIED

Table details

The following table descriptions show the fields in the project data base, which are somewhat different from the fields in this export. Descriptions of fields containing observed values are consistent.

B_point: Bird point count

Field	Units	Type	Description
site	N/A	link	to lookup list Site
point_id	N/A	text	Point number, 1-6
waypoint	N/A	text	Waypoint label on GPS, eg. B1234.2, NA if missing.
sample		integer	Sample number, 1-3
date	N/A	date	M/D/Y, e.g. 4/15/2011
start_time	N/A	time	HHMM, 24hr format, eg. 2343 or 0013
timezone	N/A	link	to table G_timezone
observer	N/A	text	F.Lastname, e.g. J.Doe
weather	N/A	link	to table Ab_weather
cloud_pcnt		real numbe	Cloud percent, 0-100
wind	N/A	link	to table Ab_wind
air_c		real numbe	Air temperature in C
water_c		real numbe	Water temperature in C
noise	N/A	link	to table Ab_noise

bearing		real numbe	Bearing faced on point, 0-360
comments	N/A	text	

B_aerial: Aerial foragers

Field	Units	Type	Description
point	N/A	link	to table B_point
taxa	N/A	link	to table B_taxa
total		integer	

B_observation: Observations

Field	Units	Type	Description
point	N/A	link	to table B_point
taxa	N/A	link	to table B_taxa
distance	N/A	link	to table Ab_distance
time	N/A	text	
in_front	N/A	true/false	
behavior	N/A	link	to table B_behavior
breeding	N/A	link	to table B_breeding
individuals		integer	

B_taxa: NO COMMENT SUPPLIED

Field	Units	Type	Description
code	N/A	text	
common	N/A	text	

Ab_distance: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

B_behavior: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

B_breeding: NO COMMENT SUPPLIED

Field	Units	Type	Description
code	N/A	text	
description	N/A	text	
category	N/A	text	

G_timezone: NO COMMENT SUPPLIED

Field	Units	Type	Description
name	N/A	text	
offset		real number	

Ab_weather: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

Ab_wind: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

Ab_noise: NO COMMENT SUPPLIED

Field	Units	Type	Description
description	N/A	text	

site	point_id	date	sample	waypoint	start_time	observer	weather	cloud_pcnt	wind	air_c	water_c	noise	bearing	comments
1424	2	2014-05-27	1	B1424.2.BE	18:51	T.Prestby	Dry	95	Slight breeze; wind felt on face; small twigs move	13		Slightly affecting sampling (distant traffic, dog barking, car passing)	270	3 WODU flyby just after survey
1424	2	2014-06-24	2	B1424.2.BM	5:16	S.Beilke	Damp/ Haze/ Fog	90	Calm; smoke rises vertically	15		Slightly affecting sampling (distant traffic, dog barking, car passing)	270	dog barking

Aerial

site	point_id	date	sample	taxa	total
1424	2	2014-06-24	2	PUMA	1

site	point_id	date	sample	taxa	distance	time	in_front	behavior	breeding	individuals
1424	2	2014-05-27	1	AMGO	0-50 m	2	FALSE	flyover		1
1424	2	2014-05-27	1	AMRO	50-100 m	1	FALSE	singing		1
1424	2	2014-05-27	1	AMRO	0-50 m	7	FALSE	calling		1
1424	2	2014-05-27	1	BGGN	0-50 m	4	FALSE	observed		1
1424	2	2014-05-27	1	BGGN	0-50 m	6	FALSE	calling		1
1424	2	2014-05-27	1	NOCA	50-100 m	1	FALSE	singing		1
1424	2	2014-05-27	1	NOCA	50-100 m	10	FALSE	singing		1
1424	2	2014-05-27	1	RBGR	0-50 m	4	FALSE	simultaneous		1
1424	2	2014-05-27	1	AMCR	> 100 m	11	TRUE	calling		1
1424	2	2014-05-27	1	AMRO	0-50 m	1	TRUE	singing		1
1424	2	2014-05-27	1	BCCH	50-100 m	12	TRUE	calling		1
1424	2	2014-05-27	1	BLJA	50-100 m	0	TRUE	calling		1
1424	2	2014-05-27	1	COGR	0-50 m	1	TRUE	singing		1
1424	2	2014-05-27	1	COYE	0-50 m	3	TRUE	singing		1
1424	2	2014-05-27	1	EAPH	0-50 m	0	TRUE	observed		1
1424	2	2014-05-27	1	HERG	0-50 m	2	TRUE	flyover		3
1424	2	2014-05-27	1	HERG	0-50 m	7	TRUE	observed		2
1424	2	2014-05-27	1	MODO	50-100 m	3	TRUE	singing		1
1424	2	2014-05-27	1	NOFL	50-100 m	14	TRUE	calling		1
1424	2	2014-05-27	1	RBGR	0-50 m	2	TRUE	simultaneous		1
1424	2	2014-05-27	1	REVI	50-100 m	0	TRUE	singing		1
1424	2	2014-05-27	1	RWBL	0-50 m	0	TRUE	calling		1
1424	2	2014-05-27	1	RWBL	0-50 m	0	TRUE	singing		1
1424	2	2014-05-27	1	RWBL	50-100 m	1	TRUE	singing		1
1424	2	2014-05-27	1	RWBL	0-50 m	3	TRUE	flyover		1
1424	2	2014-05-27	1	RWBL	0-50 m	10	TRUE	calling		1
1424	2	2014-05-27	1	SOSP	0-50 m	3	TRUE	calling		1
1424	2	2014-05-27	1	SWSP	50-100 m	4	TRUE	singing		1
1424	2	2014-05-27	1	YEWA	0-50 m	3	TRUE	singing		1
1424	2	2014-06-24	2	AMCR	> 100 m	0	FALSE	calling		1
1424	2	2014-06-24	2	BAWW	0-50 m	11	FALSE	singing		1

site	point_id	date	sample	taxa	distance	time	in_front	behavior	breeding	individuals
1424	2	2014-06-24	2	BCCH	0-50 m	11	FALSE	calling		1
1424	2	2014-06-24	2	DOWO	0-50 m	12	FALSE	calling		1
1424	2	2014-06-24	2	EAPH	0-50 m	0	FALSE	singing		1
1424	2	2014-06-24	2	HAWO	0-50 m	14	FALSE	calling		1
1424	2	2014-06-24	2	REVI	50-100 m	0	FALSE	simultaneous		1
1424	2	2014-06-24	2	RWBL	0-50 m	11	FALSE	singing		1
1424	2	2014-06-24	2	AMCR	> 100 m	0	TRUE	calling		1
1424	2	2014-06-24	2	AMRO	50-100 m	8	TRUE	observed		1
1424	2	2014-06-24	2	BCCH	0-50 m	12	TRUE	calling		1
1424	2	2014-06-24	2	BGGN	0-50 m	0	TRUE	singing		1
1424	2	2014-06-24	2	CEDW	0-50 m	1	TRUE	flyover		1
1424	2	2014-06-24	2	CEDW	50-100 m	1	TRUE	calling		1
1424	2	2014-06-24	2	CEDW	50-100 m	4	TRUE	observed		1
1424	2	2014-06-24	2	CEDW	0-50 m	14	TRUE	calling		1
1424	2	2014-06-24	2	COGR	0-50 m	0	TRUE	calling		3
1424	2	2014-06-24	2	COYE	0-50 m	0	TRUE	singing		1
1424	2	2014-06-24	2	HAWO	50-100 m	14	TRUE	calling		1
1424	2	2014-06-24	2	HERG	0-50 m	11	TRUE	flyover		1
1424	2	2014-06-24	2	MODO	0-50 m	0	TRUE	simultaneous		1
1424	2	2014-06-24	2	MODO	0-50 m	0	TRUE	simultaneous		1
1424	2	2014-06-24	2	MODO	0-50 m	8	TRUE	simultaneous		1
1424	2	2014-06-24	2	NOFL	50-100 m	4	TRUE	observed		1
1424	2	2014-06-24	2	RBNU	50-100 m	4	TRUE	calling		1
1424	2	2014-06-24	2	REVI	0-50 m	0	TRUE	simultaneous		1
1424	2	2014-06-24	2	RWBL	0-50 m	9	TRUE	calling		1
1424	2	2014-06-24	2	RWBL	50-100 m	9	TRUE	singing		1
1424	2	2014-06-24	2	SWSP	50-100 m	13	TRUE	singing		1
1424	2	2014-06-24	2	UGUL	50-100 m	4	TRUE	flyover		1
1424	2	2014-06-24	2	WTSP	50-100 m	0	TRUE	singing		1
1424	2	2014-06-24	2	YEWA	0-50 m	9	TRUE	singing		1

taxa	code	common	taxa	code	common
22	ABDU	American Black Duck	166	LOSH	Loggerhead Shrike
120	ACFL	Acadian Flycatcher	198	LOWA	Louisiana Waterthrush
121	ALFL	Alder Flycatcher	308	LTDU	Long-tailed Duck
69	AMAV	American Avocet	18	LWFG	Lesser White-fronted Goose
8	AMBI	American Bittern	75	MAGO	Marbled Godwit
66	AMCO	American Coot	23	MALL	Mallard
138	AMCR	American Crow	182	MAWA	Magnolia Warbler
257	AMGO	American Goldfinch	149	MAWR	Marsh Wren
51	AMKE	American Kestrel	52	MERL	Merlin
194	AMRE	American Redstart	91	MODO	Mourning Dove
159	AMRO	American Robin	304	MOOT	Common Moorhen/American Coot
28	AMWI	American Wigeon	201	MOWA	Mourning Warbler
80	AMWO	American Woodcock	305	MUSW	Mute Swan
215	ATSP	American Tree Sparrow	185	MYWA	Myrtle Warbler
113	ATTW	Three-toed Woodpecker	178	NAWA	Nashville Warbler
6	AWPE	American White Pelican	96	NHOW	Northern Hawk-Owl
97	BADO	Barred Owl	62	NOBO	Northern Bobwhite
42	BAEA	Bald Eagle	209	NOCA	Northern Cardinal
222	BAIS	Baird's Sparrow	115	NOFL	Northern Flicker
132	BANS	Bank Swallow	46	NOGO	Northern Goshawk
248	BAOR	Baltimore Oriole	43	NOHA	Northern Harrier
134	BARS	Barn Swallow	161	NOMO	Northern Mockingbird
193	BAWW	Black-and-white Warbler	179	NOPA	Northern Parula
92	BBCU	Black-billed Cuckoo	24	NOPI	Northern Pintail
137	BBMA	Black-billed Magpie	197	NOWA	Northern Waterthrush
313	BBPL	Black-bellied Plover	131	NRWS	N. Rough-winged Swallow
78	BBSA	Buff-breasted Sandpiper	26	NSHO	Northern Shoveler
190	BBWA	Bay-breasted Warbler	165	NSHR	Northern Shrike
114	BBWO	Black-backed Woodpecker	102	NSWO	Northern Saw-whet Owl
140	BCCH	Black-capped Chickadee	177	OCWA	Orange-crowned Warbler
15	BCNH	Black-crowned Night Heron	247	ORIOR	Orchard Oriole

107	BEKI	Belted Kingfisher	117	OSFL	Olive-sided Flycatcher
168	BEVI	Bell's Vireo	41	OSPR	Osprey
152	BGGN	Blue-gray Gnatcatcher	196	OVEN	Ovenbird
246	BHCO	Brown-headed Cowbird	3	PBGR	Pied-billed Grebe
169	BHVI	Blue-headed Vireo	53	PEFA	Peregrine Falcon
187	BLBW	Blackburnian Warbler	77	PESA	Pectoral Sandpiper
211	BLGR	Blue Grosbeak	172	PHVI	Philadelphia Vireo
136	BLJA	Blue Jay	249	PIGR	Pine Grosbeak
191	BLPW	Blackpoll Warbler	256	PISI	Pine Siskin
300	BLRA	Black Rail	188	PIWA	Pine Warbler
88	BLTE	Black Tern	116	PIWO	Pileated Woodpecker
238	BOBO	Bobolink	195	PROW	Prothonotary Warbler
141	BOCH	Boreal Chickadee	250	PUFI	Purple Finch
310	BOGU	Bonaparte's Gull	129	PUMA	Purple Martin
101	BOOW	Boreal Owl	210	RBGR	Rose-breasted Grosbeak
163	BOWA	Bohemian Waxwing	83	RBGU	Ring-billed Gull
244	BRBL	Brewer's Blackbird	38	RBME	Red-breasted Merganser
145	BRCR	Brown Creeper	143	RBNU	Red-breasted Nuthatch
162	BRTH	Brown Thrasher	109	RBWO	Red-bellied Woodpecker
184	BTBW	Black-throated Blue Warbler	151	RCKI	Ruby-crowned Kinglet
186	BTNW	Black-throated Green Warbler	252	RECR	Red Crossbill
90	BTPI	Band-tailed Pigeon	30	REDH	Redhead
35	BUFF	Bufflehead	173	REVI	Red-eyed Vireo
48	BWHA	Broad-winged Hawk	108	RHWO	Red-headed Woodpecker
25	BWTE	Blue-winged Teal	31	RNDU	Ring-necked Duck
174	BWWA	Blue-winged Warbler	56	RNEP	Ring-necked Pheasant
19	CANG	Canada Goose	4	RNGR	Red-necked Grebe
29	CANV	Canvasback	89	ROPI	Rock Dove
307	CARW	Carolina Wren	47	RSHA	Red-shouldered Hawk
85	CATE	Caspian Tern	50	RTHA	Red-tailed Hawk
205	CAWA	Canada Warbler	106	RTHU	Ruby-throated Hummingbird
236	CCLO	Chestnut-colored Longspur	1	RTLO	Red-throated Loon

217	CCSP	Clay-colored Sparrow	243	RUBL	Rusty Blackbird
164	CEDW	Cedar Waxwing	39	RUDU	Ruddy Duck
192	CERW	Cerulean Warbler	58	RUGR	Ruffed Grouse
216	CHSP	Chipping Sparrow	239	RWBL	Red-winged Blackbird
105	CHSW	Chimney Swift	67	SACR	Sandhill Crane
133	CLSW	Cliff Swallow	76	SAND	Sanderling
183	CMWA	Cape May Warbler	221	SAVS	Savannah Sparrow
34	COGO	Common Goldeneye	208	SCTA	Scarlet Tanager
245	COGR	Common Grackle	100	SEOW	Short-eared Owl
45	COHA	Cooper's Hawk	312	SEPL	Semipalmated Plover
2	COLO	Common Loon	148	SEWR	Sedge Wren
37	COME	Common Merganser	237	SNBU	Snow Bunting
301	COMO	Common Moorhen	12	SNEG	Snowy Egret
103	CONI	Common Nighthawk	309	SNOW	Snowy Owl
200	CONW	Connecticut Warbler	65	SORA	Sora
139	CORA	Common Raven	72	SOSA	Solitary Sandpiper
254	CORE	Common Redpoll	228	SOSP	Song Sparrow
86	COTE	Common Tern	57	SPGR	Spruce Grouse
202	COYE	Common Yellowthroat	73	SPSA	Spotted Sandpiper
181	CSWA	Chestnut-sided Warbler	44	SSHA	Sharp-shinned Hawk
7	DCCO	Double-crested Cormorant	60	STGR	Sharp-tailed Grouse
234	DEJU	Dark-eyed Junco	226	STSP	Sharp-tailed Sparrow
213	DICK	Dickcissel	207	SUTA	Summer Tanager
111	DOWO	Downy Woodpecker	49	SWHA	Swainson's Hawk
311	DUNL	Dunlin	230	SWSP	Swamp Sparrow
153	EABL	Eastern Bluebird	156	SWTH	Swainson's Thrush
5	EAGR	Eared Grebe	176	TEWA	Tennessee Warbler
127	EAKI	Eastern Kingbird	130	TRES	Tree Swallow
240	EAME	Eastern Meadowlark	283	TRUS	Trumpeter Swan
124	EAPH	Eastern Phoebe	142	TUTI	Tufted Titmouse
94	EASO	Eastern Screech-Owl	40	TUVU	Turkey Vulture
214	EATO	Eastern Towhee	273	UBLB	Unidentified blackbird

118	EAWP	Eastern Wood-Pewee		267	UDUC	Unidentified duck
315	EUCD	Eurasian Collared-Dove		266	UFLY	Unidentified flycatcher
167	EUST	European Starling		275	UGOO	Unidentified goose
258	EVGR	Evening Grosbeak		274	UGUL	Unidentified gull
104	EWPW	Whip-poor-will		278	ULBD	Unidentified large bird
218	FISP	Field Sparrow		277	UMBD	Unidentified medium bird
227	FOSP	Fox Sparrow		268	UNPS	Unidentified non-passerine
87	FOTE	Forster's Tern		269	UOWL	Unidentified owl
82	FRGU	Franklin's Gull		260	UPBD	Unidentified passerine
27	GADW	Gadwall		74	UPSA	Upland Sandpiper
10	GBHE	Great Blue Heron		284	URAP	Unidentified Raptor
125	GCFL	Great Crested Flycatcher		276	USBD	Unidentified small bird
150	GCKI	Golden-crowned Kinglet		271	USHO	Unidentified shorebird
155	GCTH	Gray-cheeked Thrush		261	USPA	Unidentified sparrow
98	GGOW	Great Gray Owl		270	USWA	Unidentified swallow
95	GHOW	Great Horned Owl		314	USWN	Unknown swan
135	GRAJ	Gray Jay		306	UTER	Unidentified Tern
55	GRAP	Gray Partridge		262	UTHR	Unidentified thrush
160	GRCA	Gray Catbird		264	UVIR	Unidentified vireo
11	GREG	Great Egret		265	UWAR	Unidentified warbler
302	GRHE	Green Heron		263	UWPR	Unidentified woodpecker
59	GRPC	Greater Prairie Chicken		272	UYEL	Unidentified yellowlegs
32	GRSC	Greater Scaup		154	VEER	Veery
223	GRSP	Grasshopper Sparrow		219	VESP	Vesper Sparrow
70	GRYE	Greater Yellowlegs		64	VIRA	Virginia Rail
21	GWTE	Green-winged Teal		171	WAVI	Warbling Vireo
175	GWWA	Golden-winged Warbler		144	WBNU	White-breasted Nuthatch
54	GYRF	Gyrfalcon		232	WCSP	White-crowned Sparrow
233	HASP	Harris Sparrow		281	WEGR	Western Grebe
112	HAWO	Hairy Woodpecker		126	WEKI	Western Kingbird
84	HERG	Herring Gull		241	WEME	Western Meadowlark
224	HESP	Henslow's Sparrow		280	WEVI	White-eyed Vireo

157	HETH	Hermit Thrush	17	WHSW	Tundra Swan
251	HOFI	House Finch	122	WIFL	Willow Flycatcher
128	HOLA	Horned Lark	81	WIPH	Wilson's Phalarope
36	HOME	Hooded Merganser	79	WISN	Wilson's Snipe
255	HORE	Hoary Redpoll	61	WITU	Wild Turkey
259	HOSP	House Sparrow	204	WIWA	Wilson's Warbler
203	HOWA	Hooded Warbler	147	WIWR	Winter Wren
146	HOWR	House Wren	20	WODU	Wood Duck
212	INBU	Indigo Bunting	158	WOTH	Wood Thrush
199	KEWA	Kentucky Warbler	189	WPWA	Palm Warbler
68	KILL	Killdeer	231	WTSP	White-throated Sparrow
303	KIRA	King Rail	253	WWCR	White-winged Crossbill
235	LALO	Lapland Longspur	206	YBCH	Yellow-breasted Chat
220	LASP	Lark Sparrow	93	YBCU	Yellow-billed Cuckoo
13	LBHE	Little Blue Heron	119	YBFL	Yellow-bellied Flycatcher
225	LCSP	Le Conte's Sparrow	110	YBSA	Yellow-bellied Sapsucker
9	LEBI	Least Bittern	16	YCNH	Yellow-crowned Night Heron
123	LEFL	Least Flycatcher	63	YERA	Yellow Rail
99	LEOW	Long-eared Owl	180	YEWA	Yellow Warbler
33	LESC	Lesser Scaup	242	YHBL	Yellow-headed Blackbird
71	LEYE	Lesser Yellowlegs	170	YTVI	Yellow-throated Vireo
229	LISP	Lincoln's Sparrow	282	YTWA	Yellow-throated Warbler

distance	description
1	0-50 m
2	50-100 m
3	> 100 m
-1	No data

behavior	description
1	singing
2	calling
3	flyover
4	observed
5	simultaneous
6	drumming

breeding	code	description	category
30	O	O	Observed
31	X	X	Possible
32	M	M	Probable
33	S	S	Probable
34	P	P	Probable
35	T	T	Probable
36	C	C	Probable
37	N	N	Probable
38	A	A	Probable
39	PE	PE	Confirmed
40	CN	CN	Confirmed
41	NB	NB	Confirmed
42	DD	DD	Confirmed
43	UN	UN	Confirmed
44	ON	ON	Confirmed
45	FY	FY	Confirmed
46	FL	FL	Confirmed
47	FS	FS	Confirmed
48	NE	NE	Confirmed
49	NY	NY	Confirmed
50	null	null	null

timezone	name	offset
-6	Central	-6
-5	Eastern	-5

weather	description
1	Dry
2	Damp/Haze/Fog
3	Drizzle
4	Rain

wind	description
0	Calm; smoke rises vertically
1	Light air movement; smoke drifts; leaves barely move
2	Slight breeze; wind felt on face; small twigs move
3	Gentle breeze; leaves & small twigs in constant motion
4	Moderate breeze; small branches moving, raises dust & loose paper
5	Large branches & small trees sway

noise	description
0	No appreciable effect (owl calling)
1	Slightly affecting sampling (distant traffic, dog barking, car passing)
2	Moderately affecting sampling (distant traffic, 2-5 cars passing)
3	Seriously affecting sampling (continuous traffic nearby, 6-10 cars passing)
4	Profoundly affecting sampling (continuous traffic passing, construction noise)

BIRD MONITORING
Field Data Sheet
2014

☒ broadcast volume at 80dB, checked toda

Point ID: B1424.2	
Sample: Birds 1	
Date: 05/27/2014	
Start Time: 18:51 (CDT / EDT)	
Observer: T. Prestby	

Weather: (Dry) Damp/Haze/Fog Drizzle Rain	
% Cloud Cover: 95	Wind: 2
Air Temp: 13.2 °C	Water Temp: °C
Noise: 1	

Waypt: B1424.2.BE
Lat: 44.94786
Lon: 87.37773

Rec #: 6

Behavior: (NAWA) singing; NAWA calling; —NAWA→ flyover; NAWA observed; (NAWA) + (NAWA) 2 males simultaneous singing; $DOWO_D$ woodpecker drumming

Time Codes (superscript): 0-1 minutes^0 1-2 minutes^1 2-3 minutes^2 ... 14-15 minutes^{14}

Breeding Evidence Codes (subscript): $NAWA_{ON}$ occupied nest; $NAWA_{CN}$ carrying nest material; $NAWA_{NB}$ nest building; $NAWA_{DD}$ distraction display; $NAWA_{FY}$ feeding young

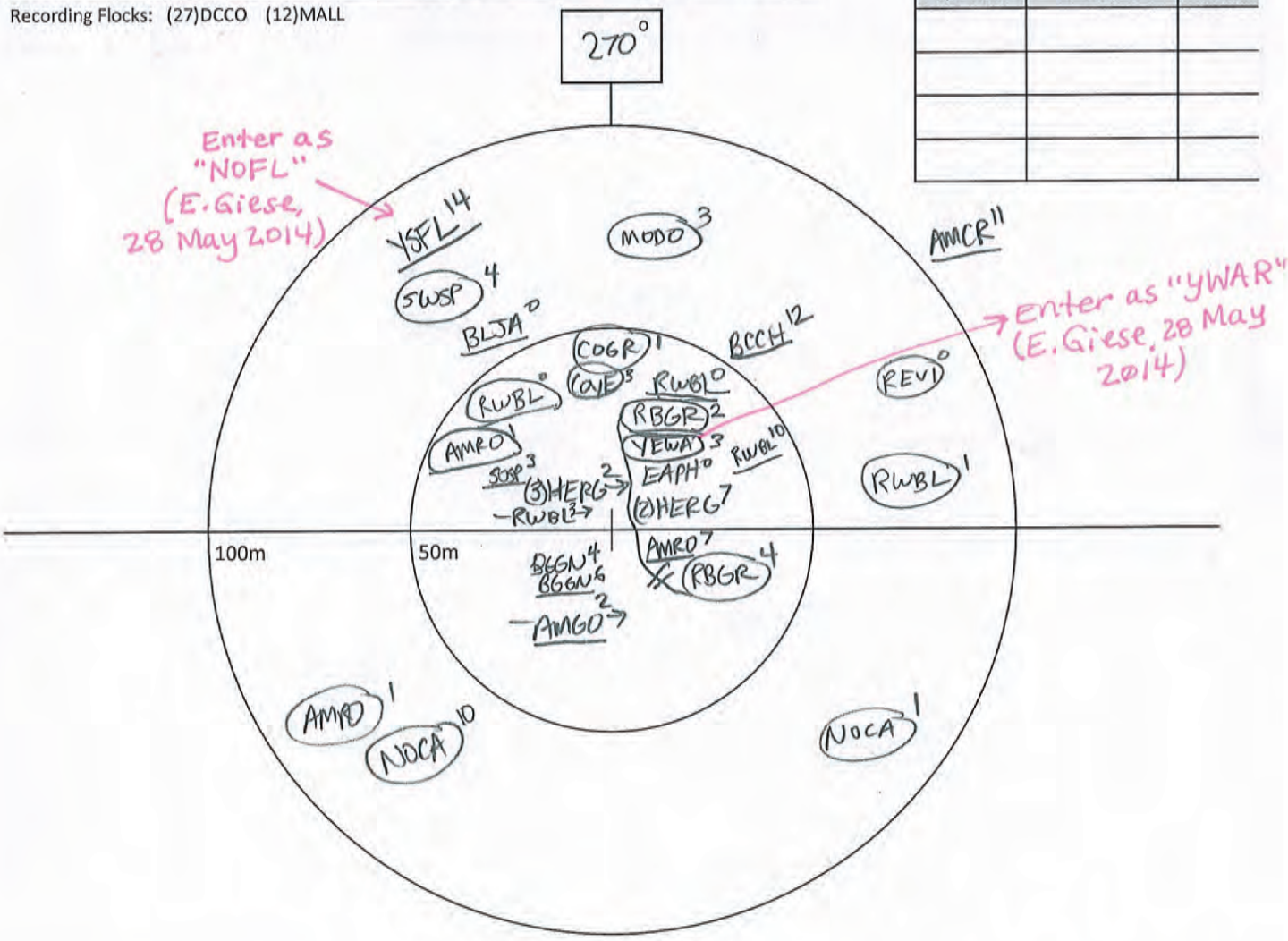
Recording Flocks: (27)DCCO (12)MALL

Focal Species
record ALL time periods

AMBI	KIRA	PBGR	COMO	VIRA
AMCO	LEBI	SORA	BLRA	YERA

Aerial Foragers (inside & outside 100m) NONE

species	tally	total



Comments: 3 WODU flyby just after survey

:t data entry (signature): _____

ıd data entry (signature): _____

2 Feb 2014

BIRD MONITORING
Field Data Sheet
2014

☑ broadcast volume at 80dB, checked toda

Point ID: B1424.2	
Sample: AM	
Date: 06/24/2014	
Start Time: 0516 (CDT) EDT	
Observer: S. Beilke	

Weather:	Dry (Damp/Haze/Fog) Drizzle Rain	
% Cloud Cover: 90	Wind: 0	
Air Temp: 15.0 °C	Water Temp: NA °C	
Noise: 1		

Waypt: B1424.2.BM
Lat: 44.94787°
Lon: -87.37775°

Rec #: 4

Behavior: (NAWA) singing; NAWA calling; —NAWA→ flyover; NAWA observed; (NAWA) + (NAWA) 2 males simultaneous singing; $DOWO_D$ woodpecker drumming

Time Codes (superscript): 0-1 minutes^0 1-2 minutes^1 2-3 minutes^2 ... 14-15 minutes^{14}

Breeding Evidence Codes (subscript): $NAWA_{ON}$ occupied nest; $NAWA_{CN}$ carrying nest material; $NAWA_{NB}$ nest building; $NAWA_{DD}$ distraction display; $NAWA_{FY}$ feeding young

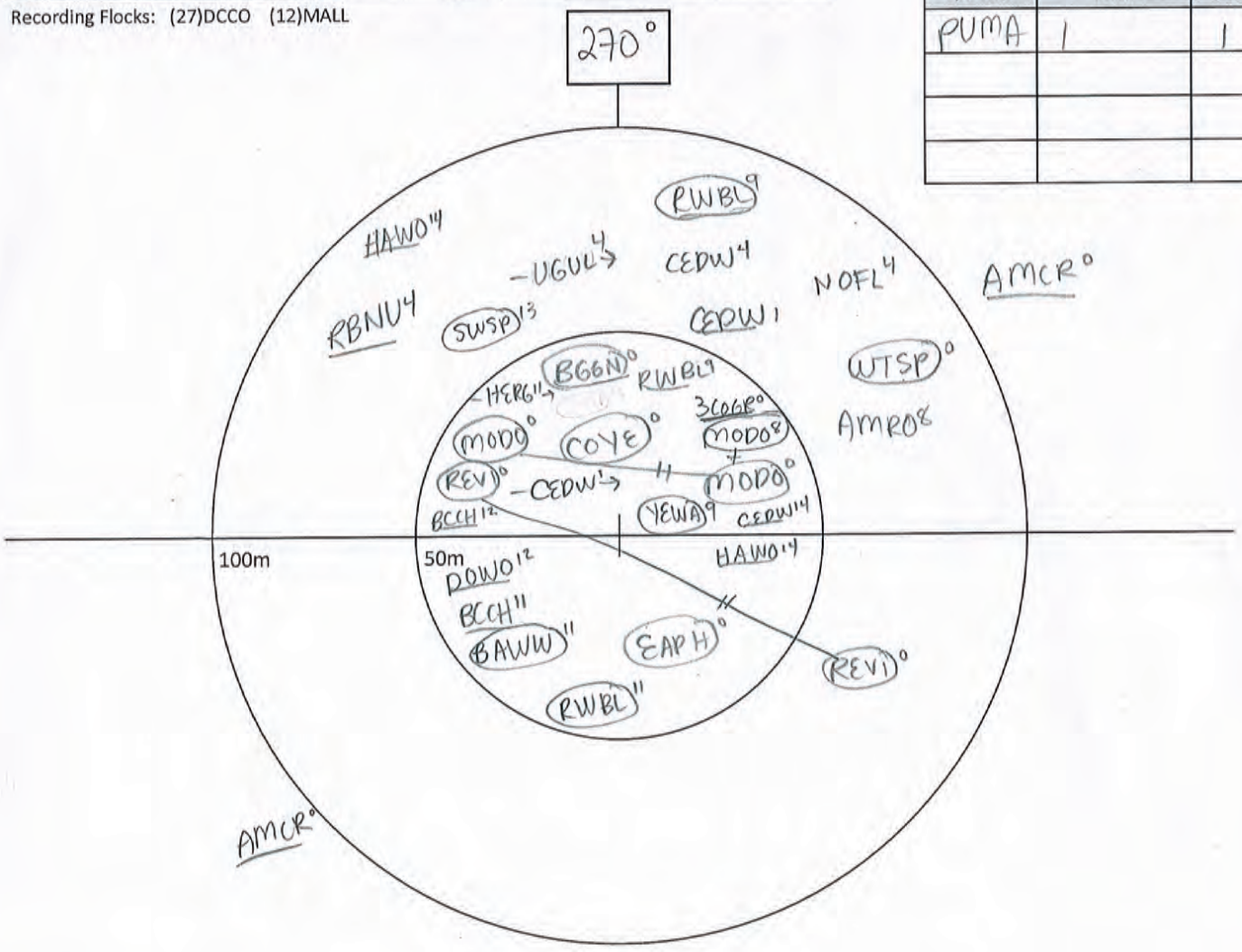
Recording Flocks: (27)DCCO (12)MALL

Focal Species
record ALL time periods

AMBI	KIRA	PBGR	COMO	VIRA
AMCO	LEBI	SORA	BLRA	YERA

Aerial Foragers
(inside & outside 100m)

species	tally	total
PUMA	1	1



:t data entry (signature): _____

id data entry (signature): _____

Comments: dog barking

2 Feb 2014

site	date	zone	rep	taxa	life stage	total
1424	6/29/14	SAV	1	Caecidotea	Immature	13
1424	6/29/14	SAV	1	Callibaetis	Immature	1
1424	6/29/14	SAV	1	Chironomidae	Pupae	3
1424	6/29/14	SAV	1	Chironomini/Pseudochironomini	Immature	6
1424	6/29/14	SAV	1	Coenagrionidae	Immature	1
1424	6/29/14	SAV	1	Crangonyx	Immature	8
1424	6/29/14	SAV	1	Gyraulus	Immature	22
1424	6/29/14	SAV	1	Haliplus	Adult	1
1424	6/29/14	SAV	1	Haliplus	Immature	3
1424	6/29/14	SAV	1	Helophorus	Adult	1
1424	6/29/14	SAV	1	Hydroporus	Adult	1
1424	6/29/14	SAV	1	Orthocladiinae	Immature	3
1424	6/29/14	SAV	1	Physella or Physa	Immature	8
1424	6/29/14	SAV	1	Planorbidae	Immature	20
1424	6/29/14	SAV	2	Bezzia/Palpomyia	Immature	12
1424	6/29/14	SAV	2	Caecidotea	Immature	29
1424	6/29/14	SAV	2	Chironomidae	Pupae	2
1424	6/29/14	SAV	2	Chironomini/Pseudochironomini	Immature	2
1424	6/29/14	SAV	2	Coenagrionidae	Immature	2
1424	6/29/14	SAV	2	Crangonyx	Immature	14
1424	6/29/14	SAV	2	Gyraulus	Immature	6
1424	6/29/14	SAV	2	Haliplus	Adult	2
1424	6/29/14	SAV	2	Hygrotus	Adult	1
1424	6/29/14	SAV	2	Lepidoptera	Immature	1
1424	6/29/14	SAV	2	Lymnaeidae	Immature	1
1424	6/29/14	SAV	2	Odontomyia/Hedriodiscus	Immature	1
1424	6/29/14	SAV	2	Oligochaeta	Immature	4
1424	6/29/14	SAV	2	Orthocladiinae	Immature	9
1424	6/29/14	SAV	2	Physella or Physa	Immature	14
1424	6/29/14	SAV	3	Bezzia/Palpomyia	Immature	5
1424	6/29/14	SAV	3	Caecidotea	Immature	20

1424	6/29/14	SAV	3	Ceratopogonidae	Immature	1
1424	6/29/14	SAV	3	Chironomidae	Pupae	1
1424	6/29/14	SAV	3	Chironomini/Pseudochironomini	Immature	9
1424	6/29/14	SAV	3	Crangonyx	Immature	48
1424	6/29/14	SAV	3	Gyraulus	Immature	6
1424	6/29/14	SAV	3	Haliplus	Adult	1
1424	6/29/14	SAV	3	Haliplus	Immature	2
1424	6/29/14	SAV	3	Helophorus	Immature	1
1424	6/29/14	SAV	3	Ischnura	Immature	1
1424	6/29/14	SAV	3	Oligochaeta	Immature	1
1424	6/29/14	SAV	3	Physella or Physa	Immature	8
1424	6/29/14	SAV	3	Planorbidae	Immature	2
1424	6/29/14	TYPHA	1	Aeshna	Immature	1
1424	6/29/14	TYPHA	1	Anabolia	Immature	3
1424	6/29/14	TYPHA	1	Aplexa	Immature	3
1424	6/29/14	TYPHA	1	Caecidotea	Immature	10
1424	6/29/14	TYPHA	1	Chrysops	Immature	1
1424	6/29/14	TYPHA	1	Crangonyx	Immature	49
1424	6/29/14	TYPHA	1	Haliplus	Immature	1
1424	6/29/14	TYPHA	1	Helophorus	Adult	2
1424	6/29/14	TYPHA	1	Hydrophilidae	Immature	1
1424	6/29/14	TYPHA	1	Ischnura	Immature	3
1424	6/29/14	TYPHA	1	Limnephilus	Immature	1
1424	6/29/14	TYPHA	1	Odontomyia	Immature	1
1424	6/29/14	TYPHA	1	Odontomyia/Hedriodiscus	Immature	5
1424	6/29/14	TYPHA	1	Orthocladiinae	Immature	2
1424	6/29/14	TYPHA	1	Paraleptophlebia	Immature	3
1424	6/29/14	TYPHA	1	Physella or Physa	Immature	17
1424	6/29/14	TYPHA	1	Planorbidae	Immature	2
1424	6/29/14	TYPHA	1	Planorbula	Immature	7
1424	6/29/14	TYPHA	1	Stagnicola	Immature	34
1424	6/29/14	TYPHA	1	Stratiomyidae	Immature	1

1424	6/29/14	TYPHA	1	Tanytarsini	Immature	1
1424	6/29/14	TYPHA	2	Alluaudomyia	Immature	2
1424	6/29/14	TYPHA	2	Amphipoda	Immature	8
1424	6/29/14	TYPHA	2	Anabolia	Immature	2
1424	6/29/14	TYPHA	2	Aplexa	Immature	1
1424	6/29/14	TYPHA	2	Bezzia/Palpomyia	Immature	1
1424	6/29/14	TYPHA	2	Caecidotea	Immature	11
1424	6/29/14	TYPHA	2	Chironominae	Immature	1
1424	6/29/14	TYPHA	2	Chironomini/Pseudochironomini	Immature	7
1424	6/29/14	TYPHA	2	Coenagrion/Enallagma	Immature	2
1424	6/29/14	TYPHA	2	Crangonyx	Immature	43
1424	6/29/14	TYPHA	2	Dytiscinae	Immature	1
1424	6/29/14	TYPHA	2	Gyraulus	Immature	7
1424	6/29/14	TYPHA	2	Ischnura	Immature	1
1424	6/29/14	TYPHA	2	Lymnaeidae	Immature	4
1424	6/29/14	TYPHA	2	Odontomyia	Immature	1
1424	6/29/14	TYPHA	2	Odontomyia/Hedriodiscus	Immature	2
1424	6/29/14	TYPHA	2	Oligochaeta	Immature	2
1424	6/29/14	TYPHA	2	Orthocladiinae	Immature	3
1424	6/29/14	TYPHA	2	Physella or Physa	Immature	7
1424	6/29/14	TYPHA	2	Pisidiidae	Immature	2
1424	6/29/14	TYPHA	2	Planorbula	Immature	3
1424	6/29/14	TYPHA	2	Stagnicola	Immature	44
1424	6/29/14	TYPHA	2	Tabanus	Immature	1
1424	6/29/14	TYPHA	2	Tanypodinae	Immature	1
1424	6/29/14	TYPHA	2	Tanytarsini	Immature	3
1424	6/29/14	TYPHA	3	Amphipoda	Immature	15
1424	6/29/14	TYPHA	3	Caecidotea	Immature	13
1424	6/29/14	TYPHA	3	Chironomidae	Immature	1
1424	6/29/14	TYPHA	3	Chironominae	Immature	1
1424	6/29/14	TYPHA	3	Chironomini/Pseudochironomini	Immature	9
1424	6/29/14	TYPHA	3	Chrysomelidae	Adult	1

1424	6/29/14	TYPHA	3	Coenagrionidae	Immature	1
1424	6/29/14	TYPHA	3	Collembola	Immature	1
1424	6/29/14	TYPHA	3	Crangonyx	Immature	57
1424	6/29/14	TYPHA	3	Gyraulus	Immature	6
1424	6/29/14	TYPHA	3	Helophorus	Adult	7
1424	6/29/14	TYPHA	3	Hydra	Immature	2
1424	6/29/14	TYPHA	3	Limnephilus	Immature	2
1424	6/29/14	TYPHA	3	Lymnaeidae	Immature	2
1424	6/29/14	TYPHA	3	Neoporus	Adult	1
1424	6/29/14	TYPHA	3	Odontomyia	Immature	4
1424	6/29/14	TYPHA	3	Odontomyia/Hedriodiscus	Immature	4
1424	6/29/14	TYPHA	3	Oligochaeta	Immature	6
1424	6/29/14	TYPHA	3	Orthocladiinae	Immature	3
1424	6/29/14	TYPHA	3	Physella or Physa	Immature	8
1424	6/29/14	TYPHA	3	Pisidiidae	Immature	1
1424	6/29/14	TYPHA	3	Planorbidae	Immature	3
1424	6/29/14	TYPHA	3	Planorbula	Immature	4
1424	6/29/14	TYPHA	3	Stagnicola	Immature	24
1424	6/29/14	TYPHA	3	Tanytarsini	Immature	3

Site	Date	Zone	Ttube	Actual or tube max	T Alk	chl	phaeo	tp	srp	tn	nh4n	no2/ no3	color	turb	cl		Ttube	Transparency Tube (cm)
1424	6/29/14	SAV	100	max	326.4	--	--	--	0.004	15.15	0.0164	4.868	25.2	--	19.8		T Alk	Total alkalinity CaCO3 (mg/ L)
1424	6/29/14	Typha	11	actual	337.7	28.6	45.6	0.162	0.003	7.778	0.0401	4.587	36.6	77	17.3		chl	Chlorophyll a (ug/L)
																	phaeo	Phaeophytin (ug/L)
																	tp	Total P (mg/L)
																	srp	Soluble reactive P (mg/L)
																	tn	Total N (mg/L)
																	nh4n	Ammonia-N (mg/L)
																	no2/no3	N02/N03-N (mg/L)
																	color	color pt units
																	turb	Turbidity (NTU)
																	cl	Chloride (mg/L)
																	--	value below limit of detection

site	site_date	zone	rep	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Temperature (°C)	pH	Specific Conductivity (µS/cm)
1424	6/29/14	typha	1	6.58	83.6	26.71	7.2	589.8
1424	6/29/14	typha	2	9.17	103.3	19.99	7.4	650.4
1424	6/29/14	typha	3	9.06	102.1	19.54	7.5	654.2
1424	6/29/14	sav	1	16.83	163.1	13.35	7.1	630.2
1424	6/29/14	sav	2	18.02	175.9	12.74	7.3	613.3
1424	6/29/14	sav	3	14.63	139.8	12.11	7.3	639.4

Name	Dumke, Joshua D.			
Affiliation	University of Minnesota Duluth-Natural Resources Research Institute			
Address	5013 Miller Trunk Hwy			
City, State, Zip	Duluth, MN 55811			
Year	2014			
Permit issued	SCP-NER-126			
Renewal?	No (new site list not established yet)			
Telephone	218-428-4234			
Email	jddumke@d.umn.edu			

Vegetation Transects

Site ID	Date	Observers	Transect ID	Start Waypoint ID	End Waypoint ID	Bearing (degrees)	Zone	Zone Width (m)
1424	1-Jul	N. Dahlberg; J. Nooker	1	023	022	10	Emergent	51
1424	1-Jul	N. Dahlberg; J. Nooker	2	030	029	5	Emergent	46
1424	1-Jul	N. Dahlberg; J. Nooker	3	038	037	202	Emergent	63

Vegetation Transects - Point Level Data

Wetland Site ID	Transect ID	Waypoint ID	Substrate Type	Organic Depth (cm)	Unvegetated (%)	Total Vegatative Cover (%)	Standing Dead veg (%)	Detritus (%)	Water Depth (cm)	Bottom Visibility
1424	1	024	Sand	0	85	15	2	92	35	Visible
1424	1	025	Sand	0	85	15	2	60	25	Visible
1424	1	026	Sand	0	80	20	2	50	26	Visible
1424	1	027	Sand	0	80	20	2	60	23	Visible
1424	1	028	Sand	0	85	15	1	40	39	Visible
1424	2	031	Bedrock	87	30	70	25	80	18	Visible
1424	2	032	Bedrock	66	50	50	0	5	35	Visible
1424	2	033	Bedrock	77	60	40	1	3	25	Visible
1424	2	034	Bedrock	56	75	25	30	35	26	Visible
1424	2	035	Bedrock	54	30	70	10	3	32	Visible
1424	3	039	Bedrock	21	75	25	25	50	21	Visible
1424	3	040	Bedrock	21	40	60	5	60	15	Visible
1424	3	041	Bedrock	30	15	85	25	25	12	Visible
1424	3	042	Bedrock	38	35	65	10	70	15	Visible
1424	3	043	Bedrock	37	50	50	5	70	8	Visible

Vegetation Transects - Species Level Data

Wetland Site ID	Transect ID	Waypoint ID	Species Name	Percent Cover (%)
1424	1	024	Schoenoplectus acutus	2
1424	1	024	Phragmites australis	2
1424	1	024	Fraxinus pennsylvanica	7
1424	1	024	Calamagrostis canadensis	3
1424	1	024	Carex lasiocarpa	2
1424	1	024	Phalaris arundinacea	2
1424	1	024	Lycopus uniflorus	1
1424	1	024	Mentha canadensis	1
1424	1	025	Equisetum fluviatile	1
1424	1	025	Schoenoplectus acutus	3
1424	1	025	Phragmites australis	3
1424	1	025	Fraxinus pennsylvanica	5
1424	1	025	Carex lasiocarpa	7
1424	1	025	Phalaris arundinacea	3
1424	1	025	Mentha canadensis	1
1424	1	025	Equisetum fluviatile	1
1424	1	026	Phragmites australis	3
1424	1	026	Fraxinus pennsylvanica	2
1424	1	026	Calamagrostis canadensis	13
1424	1	026	Carex lasiocarpa	2
1424	1	026	Phalaris arundinacea	2
1424	1	026	Mentha canadensis	2
1424	1	026	Equisetum fluviatile	1
1424	1	026	Eupatorium perfoliatum	1
1424	1	027	Phragmites australis	3
1424	1	027	Calamagrostis canadensis	10
1424	1	027	Carex lasiocarpa	3
1424	1	027	Phalaris arundinacea	3
1424	1	027	Mentha canadensis	2
1424	1	027	Eupatorium perfoliatum	1
1424	1	027	Persicaria amphibia	2

Vegetation Transects - Species Level Data

Wetland Site ID	Transect ID	Waypoint ID	Species Name	Percent Cover (%)
1424	1	028	Phragmites australis	1
1424	1	028	Calamagrostis canadensis	10
1424	1	028	Carex lasiocarpa	1
1424	1	028	Phalaris arundinacea	3
1424	1	028	Mentha canadensis	1
1424	1	028	Equisetum fluviatile	2
1424	1	028	Eleocharis palustris	1
1424	1	028	Iris versicolor	2
1424	2	031	Phalaris arundinacea	3
1424	2	031	Carex utriculata	40
1424	2	031	Caltha palustris	5
1424	2	031	Typha latifolia	1
1424	2	031	Lysimachia thyrsiflora	1
1424	2	031	Typha X glauca	1
1424	2	031	Lemna minor	1
1424	2	031	Salix candida	1
1424	2	032	Caltha palustris	1
1424	2	032	Equisetum fluviatile	1
1424	2	032	Hippuris vulgaris	50
1424	2	032	Carex sp.	5
1424	2	033	Phalaris arundinacea	30
1424	2	033	Caltha palustris	10
1424	2	033	Typha latifolia	5
1424	2	033	Lysimachia thyrsiflora	1
1424	2	033	Lemna minor	1
1424	2	033	Hippuris vulgaris	10
1424	2	034	Phalaris arundinacea	1
1424	2	034	Carex utriculata	2
1424	2	034	Caltha palustris	1
1424	2	034	Typha latifolia	2
1424	2	034	Typha X glauca	1

Vegetation Transects - Species Level Data

Wetland Site ID	Transect ID	Waypoint ID	Species Name	Percent Cover (%)
1424	2	034	Calamagrostis canadensis	7
1424	2	034	Lycopus uniflorus	2
1424	2	034	Impatiens capensis	2
1424	2	034	Eutrochium maculatum	3
1424	2	034	Solanum dulcamara	10
1424	2	034	Moss sp.	3
1424	2	035	Phalaris arundinacea	3
1424	2	035	Hippuris vulgaris	20
1424	2	035	Calamagrostis canadensis	55
1424	2	035	Carex stricta	7
1424	3	039	Carex stricta	10
1424	3	039	Phalaris arundinacea	15
1424	3	039	Calamagrostis canadensis	1
1424	3	039	Cicuta bulbifera	1
1424	3	039	Carex lacustris	1
1424	3	040	Carex stricta	3
1424	3	040	Phalaris arundinacea	30
1424	3	040	Calamagrostis canadensis	20
1424	3	040	Algea	45
1424	3	040	Lycopus uniflorus	1
1424	3	040	Solanum dulcamara	1
1424	3	041	Carex stricta	15
1424	3	041	Phalaris arundinacea	5
1424	3	041	Calamagrostis canadensis	40
1424	3	041	Cicuta bulbifera	1
1424	3	041	Carex lacustris	1
1424	3	041	Solanum dulcamara	10
1424	3	041	Lysimachia thyrsiflora	2
1424	3	041	Campanula aparinoides	1
1424	3	042	Carex stricta	25
1424	3	042	Phalaris arundinacea	7

Vegetation Transects - Species Level Data

Wetland Site ID	Transect ID	Waypoint ID	Species Name	Percent Cover (%)
1424	3	042	Calamagrostis canadensis	35
1424	3	042	Algea	45
1424	3	042	Solanum dulcamara	5
1424	3	042	Campanula aparinoides	1
1424	3	043	Carex stricta	40
1424	3	043	Phalaris arundinacea	5
1424	3	043	Algea	35
1424	3	043	Lysimachia thyrsiflora	1
1424	3	043	Typha latifolia	2
1424	3	043	Typha X glauca	2
1424	3	043	Galium sp.	1

Vegetation Transects - Spatial Data

Waypoint	Latitude	Longitude		
022	44°56'55.98"N	87°22'32.16"W		
023	44°56'54.42"N	87°22'32.88"W		
024	44°56'54.72"N	87°22'32.57"W		
025	44°56'54.83"N	87°22'32.53"W		
026	44°56'55.12"N	87°22'32.31"W		
027	44°56'55.22"N	87°22'32.09"W		
028	44°56'55.57"N	87°22'32.08"W		
029	44°56'50.94"N	87°22'42.41"W		
030	44°56'49.59"N	87°22'41.64"W		
031	44°56'49.84"N	87°22'41.87"W		
032	44°56'50.11"N	87°22'42.10"W		
033	44°56'50.32"N	87°22'42.06"W		
034	44°56'50.45"N	87°22'42.27"W		
035	44°56'50.69"N	87°22'42.34"W		
036	44°56'52.76"N	87°22'44.01"W		
037	44°56'53.66"N	87°22'44.33"W		
038	44°56'55.47"N	87°22'42.91"W		
039	44°56'55.18"N	87°22'43.26"W		
040	44°56'54.80"N	87°22'43.42"W		
041	44°56'54.57"N	87°22'43.67"W		
042	44°56'54.20"N	87°22'43.97"W		
043	44°56'53.94"N	87°22'44.24"W		

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Breeding Bird Survey

June - July 2014, Paul Regnier

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

Bay Shore Blufflands Natural Area
Bird Survey Project
June – July 2014

Submitted by Paul Regnier
Door County Nature and Travel LLC
P. O. Box 136
Baileys Harbor, WI 54202-0136

Summary:

A breeding bird survey was conducted in the greater Bay Shore Blufflands area of Door County using a series of 20 bird survey points. Surveying began in early June and concluded in early July of 2014. Each site was visited twice during the course of the survey.

The goal of this project was to begin a breeding bird survey of the Bay Shore Blufflands Natural Area and the surrounding habitats.

A total of 56 species of birds were recorded during the surveys of this project. The species found on the most counts was the Red-eyed vireos with 23 counts. The American Robin came in second and was found at 19 of the survey points. Point #10 had the greatest diversity of bird species, with 15 species on the first count. Eleven species of birds observed are listed as Species of Greatest Conservation Need (SGCN), Special Concern (SC) or Threatened (THR).

Weather played a significant role in surveying Points, with cool spring temperatures, rain, and wind effecting when counts could be taken.

With this report are the following:

1. **Bird Survey Summary** spreadsheet; Listing all Bird Species observed, Code, Wisconsin Conservation Status, WI Breeding Status, Species observed by Point, # Points /Species were Observed and # Species/Point.
2. **Habitat Descriptions:** For each Point, a general vegetative description of the area is included. A photo was taken near each Point. Photos were taken in September.

The following is the key for data used on "Bird Survey Summary" spreadsheet.

Bird Species: common bird species by alpha order.

Code: Standard alphabetic codes for common species of western Great Lakes region. Codes are derived from North American Bird Banding Manual.

Wisconsin Conservation Status:

E = endangered
THR = threatened
SC = special concern
SGCN = species of greatest conservation concern

Wisconsin Breeding Status:

* = breeds in Wisconsin
*PR = permanent resident
Abundance Codes – used with breeding Status
a = abundant; very easy to find
c = common; easy to find in appropriate habitat and season
uc = uncommon; requires additional effort to find

Methods:

This Survey used a standard method for sampling birds in an unlimited-radius, 10-minute point count, a method described by Howe et al. (Howe, R.W., G.J. Niemi, S.J. Lewis, and D.A. Welsh. 1997. A standard method for monitoring songbird populations in the Great Lakes Region. *Passenger Pigeon* 59(3):183-194.). All birds seen and heard from a single point site are recorded during a 10-minute period. Flyovers are counted and noted as such. When possible, sex and age (adult or juvenile) was included. Additional information like time of day, weather conditions and location are recorded. A standardized bird point form is used to record the data at each point site. Twenty point sites were surveyed throughout the project area. The road surveys, which included 2 points, are listed with one numeric value (i.e.7 and 7a). Locations of points surveyed were selected by Mike Grimm (The Nature Conservancy) and Paul Regnier (Door County Nature and Travel) and represent the variety of habitats throughout this part of the County. GPS coordinates mark point site locations. Each point's habitat was described. Bird Surveys were conducted in the early morning hours between 5:00a.m. -9:00a.m. Counts were not conducted in rain, heavy fog or high winds. Bird species were identified based on confirmed sightings and/or vocalizations. The discretionary use of recorded bird songs and calls were used to confirm species.

The order in which bird survey points were taken was reversed for the second survey to allow for possible species visiting/vocalizing on the site at different times. This probably had little effect due to the rain that stopped several counts. Counts were resumed as soon as possible, but rainy weather was unfortunately a factor in scheduling counts. For a list of the order in which the survey points were taken, see Bird Survey Summary spreadsheet.

Observations and Considerations:

The 2014 greater Bay Shore Blufflands Natural Area Bird Survey is a snap shot in time of a population of birds found in the variety of habitats sampled. A multi-year or a long-term study would prove to be much more valuable in determining the true picture of a bird population in any given habitat. Many factors, human and environmental, play an influential role in the life of our wildlife species.

This year's cool and wet spring delayed early survey efforts and could have had an influence on the behavior of birds. Weather can play an important role in bird surveys and may influence the results of the survey. A longer-term survey would help to lessen the effect of weather influenced survey years.

Non-native honeysuckle and common buckthorn were found growing in several points. Both these species can spread aggressively through the native landscape and degrade habitats and therefore reduce the biodiversity of the natural landscape. Due to past invasive species control efforts, one could argue that there is a trend toward habitat improvement. Improving the quality of habitats can lead to greater number of birds and species using these habitats. This could be an underlining theme in a long-range bird survey progam.

Habitat Descriptions:

The project area is characterized by a diverse set of habitats found on the Green Bay side of the County. Natural and built influenced environments (through road surveys) were included. The majority of the survey sites are located on the upper part of the Niagara Escarpment, the edge of the escarpment and below the escarpment near the shore of Green Bay. Bird Survey Points were placed in areas throughout the greater Bay Shore Blufflands to sample the variety of habitats.

Dominant and understory tree species along with shrub species were identified where appropriate at each Point.

ATC Point 1: Habitat Description

Habitat: Open field and young successionary forest. Major tree species are white ash with sparse white pine. Ground cover is a mix of grasses with common milkweed, honeysuckle species and poison ivy.
Notes: A few common buckthorn shrubs are dispersed throughout this area, but due to invasive species control over the past 5 years the number of stems are sparse.
GPS: N44 56.236 W87 23.134

Point 2: Habitat Description

Habitat: Mix of agricultural field (some activity in 2014), old-field and lowland shrub. Majority of shrub species in the low wet area are a mix of dogwood and willow species. Drier field area includes common juniper, goldenrod species, aster species, grasses, poison ivy and sweet clover. Several cottonwood trees are in the low areas.
Notes: Common buckthorn is in the adjacent wooded area.
GPS: N44 56.654 W87 22.763

Point 3: Habitat Description

Habitat: Hawthorne species dominates this upland habitat. Wild black cherry, white ash and small groves of trembling aspen are scattered throughout this site. Dogbane, sweet clover, common buckthorn and miscellaneous grasses make up the ground cover between shrubs and trees.
Notes: The Blue-winged Warbler is a special concern breeding species and is found on this site. It probably nests in this area. Much work has been done to control invasive species on this site and improvements are showing results with native species reclaiming this site.
GPS: N44 56.270 W87 22.218

Point 4: Habitat Description

Habitat: Dominant tree species: Mix of white and red pines, white ash, white birch and red oak. Understory: dogwoods with few ironwood and young white ash.
Notes: This point is on the upland edge of the Niagara escarpment near the intersection of Reynolds Road and Carlsville Road.
GPS: N44 58.065 W87 21.491

Point 5: Habitat Description

Habitat: Dominant tree species: red pine, sugar maple, and red oak. Understory: young white pine and balsam fir with dogwoods, Canada buffalo berry and some witch hazel.
Notes: Point includes an abandoned roadbed put in place in the 1990s.
GPS: N44 57.168 W87 22.224

Point 7: Habitat Description (Road Survey 7 Top, 7a Bottom)

Habitat: Point 7: Dominant tree species: red pine, white birch, balsam fir, with few white ash. Understory: dogwoods, and young balsam fir.
Point 7a: Dominant tree species: balsam fir, white ash, and aspen. Understory: dominated with dogwoods.
Notes: This is a road survey on Lady-slipper Road near the Bay of Green Bay.
GPS: Pt. 7: N44 57.668 W87 22.179 Pt7a: N44 57.867 W87 22.202

Point 8: Habitat Description (Road Survey 8 Top, 8a Bottom)

Habitat: Road Survey in Governor Woods.
#8: Dominant trees species: white pine, trembling aspen, and sugar maple. Understory: Canada buffalo berry, some witch hazel, young eastern hemlock and balsam fir.
#8a: Dominant tree species: sugar maple, red oak, with aspen and white birch. Understory: sugar maple, ironwood, white ash and dogwood.
Notes: This is a road survey consisting of 2 points.
GPS: Pt 8: N44 57.742 W87 20.977 Pt8a: N44 58.066 W87 21.492

Point 9: Habitat Description

Habitat: Dominant tree species: mix of large toothed aspen, white ash, and white birch, some sugar maple, eastern hemlock and red oak. Understory: sugar maple, ironwood and American beech.
Notes: This point is located at the end of Autumn Lane and off Monument Point Road.
GPS: N44 58.324 W87 21.002

Point 10: Habitat Description

Habitat: Open Field habitat with early successionary species. Dominant vegetation: mix of cool season grasses, white sweet clover, common milkweed and goldenrod species. Edge trees include sugar maple, black cherry, white pine and white ash. Field is dotted with sparse wild apple trees and shrubs of common juniper and honeysuckle species.
Notes: This point is located off County Road G.
GPS: N45 00.127 W87 19.628

Point 11: Habitat Description

Habitat: Dominant tree species: Eastern hemlock, sugar maple, and red oak. Understory: Sugar maple, American beech, and eastern hemlock.
Notes: This heavily wooded point is located in Lautenbach Woods on the trail and near the escarpment.
GPS: N45 59.841 W87 20.035

Point 12: Habitat Description

Habitat: Dominant tree species: trembling aspen, northern white cedar, and balsam poplar. Understory: white spruce, common buckthorn, common juniper and willow species.
Notes: This point is on Spring Road. Ditches were wet and holding standing water.
GPS: **Pt. 12** N45 00.345 W87 20.240 **Pt. 12a** N45 00.345 W87 20.437

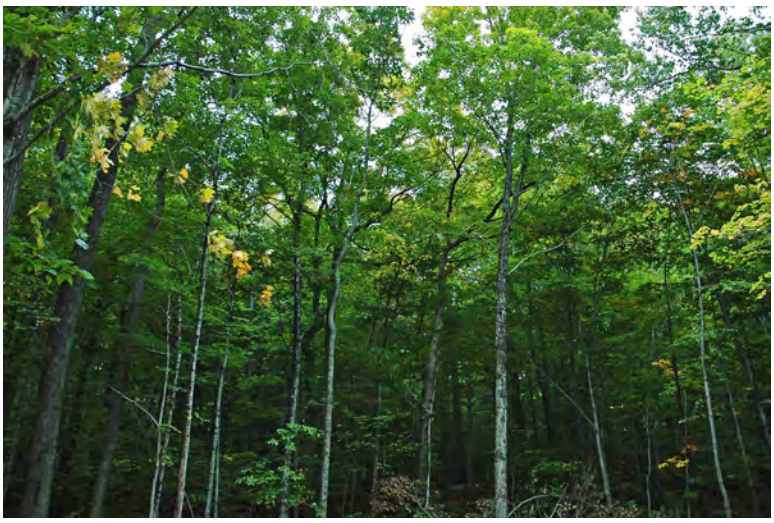
Point 13: Habitat Description

Habitat: Dominant tree species: black ash, with some white oak. Understory: few northern white cedars and black ash. Edge species include: American beech, sugar maple, basswood and eastern hemlock.
Notes: This point is located below the Niagara escarpment and near the end of Spring Lane.
GPS: N44 59.990 W87 20.149

Point 14: Habitat Description (Road Survey 14 Top, 14a Bottom)

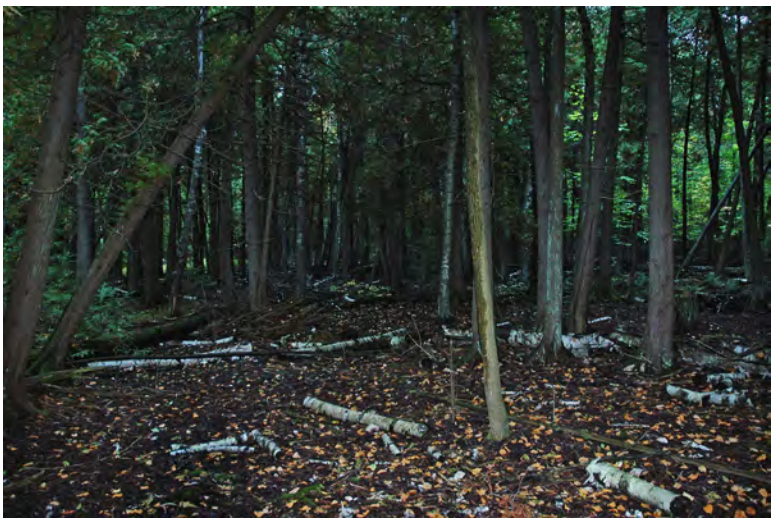
Habitat: Road survey on Monument Point road.
Point 14: Dominant tree species: Northern white cedar and aspen species. Understory: northern white cedar, balsam fir and dogwoods.
Point 14a: Dominant tree species: White birch, sugar maples and aspen species. Understory: northern white cedar and dogwoods.
Notes: This is a road survey on Monument Point Road near the Bay of Green Bay.
GPS: Pt.14 N44 59.146 W87 21.548 **Pt. 14a** N44 59.253 W87 21.519

Point 15: Habitat Description (Road Survey 15 Top, 15a Bottom)



Habitat: Road survey on Monument Bluff Pass
Point 15: Dominant tree species: Sugar maple, red oak and American beech. Understory: American beech and sugar maple.
Point 15a: Dominant tree species: Red oak, and sugar maple. Understory: American beech and sugar maple.
Notes: This is a road survey on Monument Bluff Pass located on the escarpment. Logging from this summer is evident on point 15.
GPS: Pt. 15 N44 58.897 W87 21.305 **Pt. 15a** N44 59.370 W87 20.959

Point 16: Habitat Description



Habitat: Dominant tree species: northern white cedar, some white birch and few large toothed aspen. Understory; sparse balsam fir and in forest gaps white ash and balsam fir.
Notes: This point is located near County highway B.
GPS: N44 59.299 W87 21.370

	Bird Species	Code*	WI Conserv. Status*	WI Breeding Status*	Pt1-1	Pt1-2	Pt2-1	Pt2-2	Pt3-1	Pt3-2	Pt4-1	Pt4-2	Pt5-1	Pt5-2	Pt7-1	Pt7-2	Pt7a-1	Pt7a-2	Pt8-1	Pt8-2	Pt8a-1	Pt8a-2	Pt9-1	Pt9-2	Pt10-1	Pt10-2	Pt11-1	Pt11-2	Pt12-1	Pt12-2	Pt12a-1	Pt12a-2	Pt13-1	Pt13-2	Pt14-1	Pt14-2	Pt14a-1	Pt14a-2	Pt15-1	Pt15-2	Pt15a-1	Pt15a-2	Pt16-1	Pt16-2	# of Pts for species	Notes First (1) Survey	Notes Second (2) Survey
1	Alder Flycatcher	ALFL		c*			1		1																																		2		
2	American Crow	AMCR		c*	1						1						1			1		1	1	1	1			1		1		1		1									13		
3	American Goldfinch	AMGO		a*				1		1														1	1			1															5		
4	American Redstart	AMRE		c*		1											1															1											3		
5	American Robin	AMRO		a*	1		1	1	1		1		1	1				1					1		1		1			1		1	1				1	1	1	1	1		19		
6	American White Pelican	AWPE	SC	uc*																														1									1		
7	Baltimore Oriole	BAOR		c*	1					1																																	2		
8	Black and White Warbler	BAWW		c*						1					1														1	1												4		
9	Black-capped Chickadee	BCCH		a*	1			1	1				1		1	1												1		1		1			1	1				1	1	13		
10	Black-throated green Warbler	BTNW		c*									1						1		1				1	1					1										1	7		
11	Blue-gray Gnatcatcher	BGGN		c*																											1											1		
12	Blue Jay	BLJA		a*	1			1		1																					1				1					1	1	7		
13	Blue-winged Warbler	BWWA		uc*					1																																	1		
14	Brown-headed Cowbird	BHCO	SC;SGCN	c*			1																																			1		
15	Brown Thrasher	BRTH	SC;SGCN	c*			1																																			1		
16	Canada Goose	CAGO		a*							1																1																2		
17	Cedar Waxwing	CEDW		a*				1		1								1					1			1				1		1		1								8		Pt2 with nesting material
18	Chipping Sparrow	CHSP		c*										1				1	1							1																4		
19	Clay-colored Sparrow	CCSP		c*																					1	1																	2		
20	Common Grackle	COGR		a*																					1																		1		
21	Common Raven	CORA		uc*																																				1			1		
22	Common Yellowthroat	COYE		a*			1																		1																		2		
23	Downy Woodpecker	DOWO		c*																							1							1		1						3		
24	Eastern Meadowlark	EAME		c*																					1	1																	2		
25	Eastern Towhee	EATO		c/uc*		1			1	1															1																		4		
26	Eastern Wood-Pewee	EAWP		c*		1															1		1	1			1	1			1	1							1				9		
27	Field Sparrow	FISP	SC;SGCN	uc*	1				1																1	1																	4		
28	Grasshopper Sparrow	GRSP	SC;SGCN	uc*																					1	1																	2		
29	Gray Catbird	GRCA		c*			1																																			1		
30	Great-crested Flycatcher	GCFL		c*	1							1	1	1	1						1				1								1	1							1	10		
31	Hairy Woodpecker	HAWO		c*							1						1																										2		
32	Hermit Thrush	HETH		c*									1							1		1																					3		
33	House Wren	HOWR		a/c*				1	1																																1		3		
34	Indigo Bunting	INBU		c*					1	1																																	2		
35	Mallard	MALL		a*																					1						1												2		
36	Mourning Dove	MODO		a*																						1																		1		
37	Mourning Warbler	MOWA	THR;SGCN	c*			1																																			1		
38	Nashville Warbler	NAWA	SC	c*									1															1		1													3		
39	Northern Cardinal	NOCA		a*						1										1									1		1												4		
40	Ovenbird	OVEN	SC;SGCN	c*					1		1	1	1	1			1		1	1	1	1		1	1		1	1		1									1			1	17		
41	Pine Warbler	PIWA		c*															1	1																1							3		
42	Red-bellied Woodpecker	RBWO		c*			1		1		1						1				1		1		1																		7		
43	Red-eyed Vireo	REVI		a*	1	1	1						1	1	1		1		1	1	1	1	1			1	1				1	1		1		1		1	1		1	1	23		
44	Red-tailed Hawk	RTHA		c*																																				1			1		
45	Ring-billed Gull	RBGU		c*	1	1		1								1	1	1							1	1			1			1	1			1			1				13		
46	Rose-breasted Grosbeak	RBGR		c*						1																							1										2		
47	Ruby-crowned Kinglet	RCKI	SC	uc*																						1																		1		
48	Ruby-throated Hummingbird	RTHU		c*																																			1	1				2	Pt15a nest	
49	Savannah Sparrow	SAVS		c*																					1																			1		
50	Scarlet Tanager	SCTA		*																			1			1	1				1	1					1						6		
51	Song Sparrow	SOSP		a*PR		1	1																																				2		
52	White-breasted Nuthatch	WBNU		*																																					1			1		
53	Wild Turkey	WITU		a*PR	1																																						1		
54	Willow Flycatcher	WIFL	SC;SGCN	c*			1																																				1		
55	Wood Thrush	WOTH	SC;SGCN	c*															1		1																				1			3		
56	Yellow Warbler	YWAR		c*																						1																		1		
	# Species /Point				10	6	11	7	10	9	6	2	8	5	4	2	7	4	6	6	5	6	6	4	15	13	7	5	5	3	5	6	10	7	5	1	5	3	3	4	5	5	6	4			
	Dates of Survey				6/6	7/1	6/6	7/1	6/6	7/1	6/6	7/1	6/6	7/1	6/6	7/1	6/6	7/1	6/8	6/23	6/8	6/23	6/7	6/23	6/8	6/26	6/7	6/26	6/6	6/26	6/6	6/26	6/6	6/26	6/6	7/1	6/6	7/1	6/8	6/26	6/8	6/26	6/6	7/1			

Order of Survey Points	First Survey	Second Survey
1	3	8
2	4	9
3	1	15,15a
4	2	10
5	5	11
6	7,7a	12,12a
7	14,14a	13
8	16	16
9	13	14,14a
10	12,12a	7,7a
11	11	5
12	10	2
13	15,15a	1
14	9	4
15	8	3

Bay Shore Blufflands Breeding Bird Summary Data

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Migratory Bird Survey

2014, Michael Grimm

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

2014 Migratory Bird Survey
Bayshore Blufflands Landscape
Door County, WI

Submitted by:
Michael Grimm
30 North 7th Avenue
Sturgeon Bay, WI 54235
September 28, 2014

Introduction

A migratory bird survey was undertaken to gather information on one aspect of avian usage in the Bayshore Blufflands landscape. Migratory stop-over habitat for many species, including birds, bats, and insects, is now recognized as a critical component in the life history of these animals. Being situated on the Door Peninsula, near the shoreline of Green Bay positions the Bayshore Blufflands landscape to be an important migratory habitat setting for birds. It should be expected that the variety of habitats in this landscape, from open old fields through early successional habitats to young or semi-mature forest tracts would provide good stop-over conditions for many species. The adjacency to the shoreline of Green Bay is another important feature of the Bayshore Blufflands area. Recent research and the models based on that research indicate that forested lands within ¼ mile of open water is especially important for migrating land birds (see Great Lakes Migratory Bird Stopover Portal **http://glmigratorybirds.org/map.html#).**

Methods

Surveys for migratory birds were conducted on 10 days with suitable weather conditions throughout the month of May at several locations across the Bayshore Blufflands landscape. The surveys were conducted in the mornings, generally between 0700 and 100. Surveys were conducted by walking slowly through an area, stopping occasionally, trying to access all the habitat types present, and recording all species seen or heard during the walk. Notes were made on abundance and behavior on occasion, though more time was devoted to identifying species. Notes were also occasionally made on conservation issues noted on the tracts.

All surveys were conducted the author. He was accompanied by Shirley Griffin on 17 May on the survey off Autumn Lane. He was accompanied by Mary Standish on 28 May during survey of the "Hutter fields" on the south side of Carlsville Road.

This report contains daily tallies for the locations and a summary of all species recorded in the appendix. The appendices also contain, information on the habitats surveyed, past bird records from the area, and maps of the areas walked with a few accompanying notes.

Results

Date: 4 May 2014

Time: 0730 – 0924**.** Clear sky, 39 F. Moderately strong wind from the west.

Location: Hawthorn field off Reynold's Road and west into field below escarpment bluff.

GPS approximate center: Lat: 44.9380, Long: -87.3763

Habitat: 1, 9 (See Appendix 1 Habitat Types referenced in migratory bird survey)

- **(1) *Pinus resinoa / Populus grandidentata / Quercus rubra* dry-mesic forest**
- **(9) Old field – includes the hawthorn meadow**

Map: See Appendix 5 Maps

Results:

Canada goose
Broad-winged Hawk
Ruffed Grouse
Wild Turkey
Ring-billed Gull
Herring Gull
Mourning Dove
Red-bellied Woodpecker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Eastern Phoebe
Blue Jay
Common Raven
Black-capped Chickadee
White-breasted Nuthatch
Brown Creeper
House Wren
Ruby-crowned kinglet
Eastern Bluebird
Hermit Thrush
American Robin
Brown Thrasher
Yellow-rump Warbler
Eastern Towhee
Field Sparrow
Song Sparrow
White-crowned sparrow
White-throated Sparrow
Northern Cardinal
Red-winged Blackbird
Brown-headed Cowbird
Purple Finch
American Goldfinch

Comments:

This diverse habitat of open and early successional abandoned agricultural fields surrounded by young pole stands of upland hardwoods provides migratory habitat for a diverse set of birds. Both open field and woodland species were encountered on the survey. On 4 May, the field sparrows were conspicuous by their singing in the upper open field and in the lower elevation 'Hutter" fields to the west. Small groups of yellow-rump warblers were also conspicuous, seen in small groups gleaning in the pole stands of hardwoods along the south side of the fields. Important species noted include brown thrasher and field sparrows both listed as "species of greatest conservation need (SGCN)" in Wisconsin's Wildlife Action Plan.

Date: 8 May 2014

Time: 0700 - 0800

Location: Lautenbach Woods Preserve

GPS approximate center: Lat: 44.9968; Long -87.3336

Route walked: Starting at the parking lot on County G, followed the northern route of the walking trail west to the western edge of the preserve returning on the southern route to the parking lot.

Habitat:

- **(2) *Acer saccharum / Fagus / Quercus rubra / Pinus strobus / Tsuga* forest**
- **(5) *Acer saccharinum / Fraxinus pennsylvanica* swamp forest**

Map: See Appendix 5 Maps

Results:

Wood Duck
American Kestrel
Ruffed Grouse
Red-bellied Woodpecker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Blue Jay
Black-capped Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
Brown Creeper
Winter Wren
Ruby-crowned kinglet
Hermit Thrush
Wood Thrush
American Robin
Nashville Warbler
Yellow-rumped Warbler
Black-throated Green Warbler
Ovenbird
Common Yellowthroat
Field Sparrow
White-throated Sparrow
Rose-breasted Grosbeak
Red-winged Blackbird
Brown-headed Cowbird
American Goldfinch

Comments:

The high quality of this forest patch is evident by the large number of seedling and sapling eastern hemlocks (Tsuga occidentalis) present in throughout the woods. Typical forest birds such as black-throated green warblers, wood thrush, ovenbirds and rose-breasted grosbeaks were noted regularly during the survey. On this day trout lily (*Eurythronium spp*) leaves are up, and *Hepatica acutiloba* and *Carex pedunculata* were in bloom. Trilliums (*Trillium grandiflorum*) were near bloom. Important species noted were wood thrush and rose-breasted grosbeak, both listed as SGCN in Wisconsin. The field associated species noted on the above list (field sparrow, American goldfinch, kestrel) were noted from the parking area on County G and were seen or singing from the open fields along the road. The wood duck was flushed up from the flooded hardwood swamp at the west end of the route walked.

A significant amount of filamentous algae (*Chladophora*?) was seen flowing in the current below the main spring to the hardwood swamp at the west end of the Lautenbach Woods Preserve.. This may be a signature of high nutrient loading to the aquifer which discharges at these springs.

Date: 9 May 2014

Time: 0745 - 0900

Location: DCLT tracts at the west end of Monument Point Road

GPS approximate center: Lat: 44.9849, Long: -87.3571

Route walked: The first portion of the day's survey was walked on the south side of Monument Point Road into DCLT property. The second section of the survey walked north of Monument Point Road into land purchased by The Nature Conservancy and subsequently transferred to the Land Trust.

Habitat:

- **(2)** ***Acer saccharum / Fagus / Quercus rubra / Pinus strobus / Tsuga*** **forest**
- **(3)** ***Thuja / Tsuga / Pinus sp. / Betula papyrifera*** **forest**
- **(4)** ***Thuja / Fraxinus pennsylvanica / Populus balsamifera*** **wet-mesic forest**

Map: See Appendix 5 Maps

Results:

Mourning Dove
Red-bellied Woodpecker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Blue Jay
Black-capped Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
Brown Creeper
Ruby-crowned kinglet
Wood Thrush
Yellow-rumped Warbler
Black-throated Green Warbler
Ovenbird
Northern Cardinal
American Goldfinch

Comments: Poor weather conditions are thought to have contributed to the low number of species encountered during this survey. As the habitat covered was wooded with both upland hardwoods and mesic to wet-mesic conifers forest associated species were to be expected. The proximity to the shore of Green Bay (< ¼ mile) and the high percentage of forest cover in this area has been modeled by the Great Lakes Migratory Bird Stopover Portal http://glmigratorybirds.org/map.html# (and incorporated into maps for the Door County Greenprint – see Figure 1 below), to be highly significant for migratory land birds. Despite the low numbers recorded on this survey one SGCN was noted (wood thrush). This area undoubtedly has higher numbers of migrants that indicated by this survey.

As a side note a significant flow of surface water originating in the eastern portion of the area walked north of Monument Point Road flows south and west into and through the mesic white cedar stand at the northeast corner of the intersection of Monument Point Road and Bayshore Drive. On the date of the survey none of the surface water was found flowing under Bayshore Drive to the west (i.e., all the water was soaking into the forest floor on that tract. This flow appears to originate as overflow out of a linear north/south depression bordering the east side of the access road which borders the DCLT lands to the east. It appears to be ground water discharging from the base of the escarpment. As this land is in non-DCLT ownership it was not walked to investigate the origin of this water. However, observing the area from a distance it appeared that the linear depression was quite deep and may form a significant. Likely ephemeral wetland habitat. Flora in bloom included: *Sheperdia, Dirca, Carex pedunculata, C. pennsylvanica,* and *Hepatica acutiloba*.

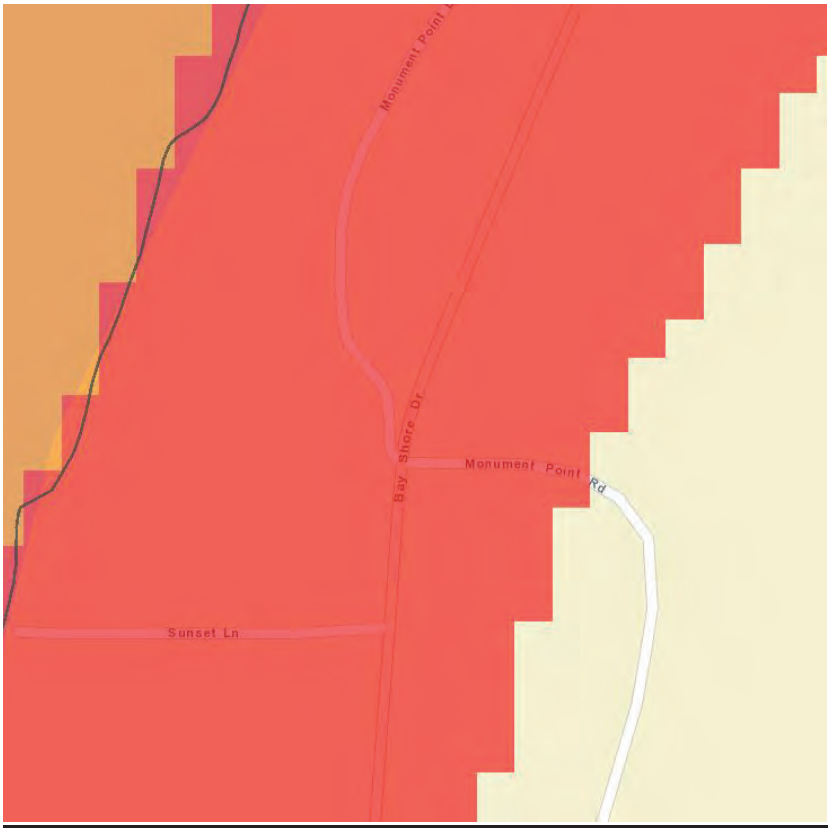


Figure 1. Map of surrounding area surveyed on 9 May, 2014, showing modeled ranking of landscape for migratory land birds. Red area indicates high significance for migratory birds. From Door County Greenprint. (http://tplgis.org/DoorCounty_GreenprintMap/), accessed September 27, 2014.

Date: 10 May 2014

Time: 0730 - 0830

Location: South off White Cedar Lane

GPS approximate center: Lat: 44.9527, Long: -87.3702

Route walked: Walked into area south off White Cedar Lane following the old gravel drive. Returned on same path.

Habitat:

- ***Pinus resinoa / Populus grandidentata / Quercus rubra*** **dry-mesic forest**
- **(4)** ***Thuja / Fraxinus pennsylvanica / Populus balsamifera*** **wet-mesic forest**

Map: See Appendix 5 Maps

Results:

Turkey Vulture
Broad-winged Hawk
Red-bellied Woodpecker
Yellow-bellied Sapsucker
Downy Woodpecker
Northern Flicker
Blue-headed vireo
Blue Jay
Common Raven
Black-capped Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
Golden-crowned Kinglet
Ruby-crowned kinglet
Swainson's thrush
Wood Thrush
American Robin
Nashville Warbler
Yellow-rumped Warbler
Ovenbird
White-throated Sparrow
Brown-headed Cowbird
Purple Finch
American Goldfinch

Comments:
Two forest types characterize this site. Notable species encountered included both kinglet species, Swainson's and wood thrush, and purple finch.

Date: 11 May 2014

Time: 0700 - 0830

Location: South off White Cedar Lane.

GPS approximate center: Lat: 44.9505, Long: -87.3694

Route walked: Walked south off White Cedar Lane on the gravel drive, returning by the same route.

Habitat:

- ***Pinus resinoa / Populus grandidentata / Quercus rubra*** **dry-mesic forest**
- ***Acer saccharum / Fagus / Quercus rubra / Pinus strobus / Tsuga*** **forest**
- ***Thuja / Tsuga / Pinus sp. / Betula papyrifera*** **forest**

Map: See Appendix 5 Maps

Results:

Ruffed Grouse
Wild Turkey
Killdeer
Ring-billed Gull
Mourning Dove
Yellow-bellied Sapsucker
Downy Woodpecker
Hairy Woodpecker
Northern Flicker
Pileated Woodpecker
Great Crested Flycatcher
Blue Jay
Black-capped Chickadee
Blue-gray Gnatcatcher
Eastern Bluebird
Swainson's thrush
Wood Thrush
American Robin
Nashville Warbler
Yellow-rumped Warbler
Black-throated Green Warbler
Ovenbird
Northern Cardinal
Common Grackle
Brown-headed Cowbird
Baltimore oriole
Purple Finch
American Goldfinch

Comments:
The mix of pole to semi-mature upland forest types provides good habitat for a number of forest associated migratory birds. Important or charismatic species encountered this day included wood and Swainson's thrush, blue-grey gnatcatcher and Baltimore oriole. As with other tracts on other days during this survey, records of earlier bird surveys taken in this area (see Appendix 2) indicate that it is likely a considerably larger number of species utilize these wooded areas during migration than have been recorded during this survey.

As a side note, two tree deer stands were found just east of the loop road cut on the tract under easement to the Land Trust, with a trail camera, and bait. Red oval on the map indicates the approximate area of the deer stands.

Date: 17 May 2014

Time: 0800 - 0900

Location: Autumn Lane woods

GPS approximate center: Lat: 44.9705, Long: -87.3519

Route walked: Walked off the south-west end of Autumn Lane and looped through the upland forest skirting the lowland conifer stand on the east.

Habitat:

- **(2)** ***Acer saccharum / Fagus / Quercus rubra / Pinus strobus / Tsuga*** **forest**

Map: See Appendix 5 Maps

Results:

Sharp-shinned hawk
Hairy Woodpecker
Great Crested Flycatcher
Blue-headed vireo
Red-eyed Vireo
Blue Jay
Black-capped Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
American Robin
Black-throated Green Warbler
Ovenbird
Song Sparrow
White-throated Sparrow
Rose-breasted Grosbeak
American Goldfinch

Comments:
This high quality semi-mature upland forest had few species on the date surveyed, although notable species included the sharp-shinned hawk, blue-headed vireo and rose-breasted grosbeak.

Date: 17 May 2014

Time: 0915 - 1030

Location: Aten's Collin's spring pond.

GPS approximate center: Lat: 44.9477, Long: -87.3775

Route walked: Walked to driveway to the tract to the spring pond and to wetland south of the pond.

Habitat:

- **(4) *Thuja / Fraxinus pennsylvanica / Populus balsamifera* wet-mesic forest**
- **(6) *Larix laricina* / *Carex* fen**

Map: See Appendix 5 Maps

Results:

Wild Turkey
Northern Parula
Nashville Warbler
Red-breasted Nuthatch
Gray catbird
Northern Flicker
American Crow
American Robin
Blue-headed vireo
Red-bellied woodpecker
Blue Jay
Black and white warbler
Red wing blackbird
Northern Cardinal
Pileated woodpecker
Blue-gray Gnatcatcher
Swamp Sparrow
Mourning dove
Black-capped chickadee

Comments:
A rich diversity of forest and wetland structure characterizes this site. It undoubtedly provides habitat for more species than noted on this day.

Date: 22 May 2014

Time: 0715 - 0830

Location: Hawthorn field off Reynold's Road and west open field with surrounding woods

GPS approximate center: Lat: 44.9378, Long: -87.3729

Route walked: Started at the parking Land Trust parking lot on Reynolds Road walked west into the hawthorn grove, continued into the upper open field to the west, then returned on the north side of the hawthorn field.

Habitat:

- ***Pinus resinoa / Populus grandidentata / Quercus rubra*** **dry-mesic forest**
- **(9) Old field – includes the hawthorn meadow**

Map: See Appendix 5 Maps

Results:

Red-tailed Hawk
Ruffed Grouse
Wild Turkey
Mourning Dove
Downy Woodpecker
Northern Flicker
Least Flycatcher
Eastern Phoebe
Great Crested Flycatcher
Blue Jay
American Crow
Black-capped Chickadee
Red-breasted Nuthatch
White-breasted Nuthatch
House Wren
Wood Thrush
American Robin
Gray Catbird
European Starling
Blue-winged Warbler
Nashville Warbler
Northern Parula
Chestnut-sided Warbler
Magnolia Warbler
Black-throated Green Warbler
Black-and-white Warbler
American Redstart
Ovenbird
Eastern Towhee
Chipping Sparrow
Clay-colored Sparrow
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Brown-headed Cowbird
Baltimore oriole
American Goldfinch

Comments:
The varied habitat of this tract attracts a diverse suite of species. Several warbler species and many open field or edge species were encountered. Notable species included wood thrush, clay-colored sparrow and rose-breasted grosbeak.

Date: 26 May 2014

Time: 0700 - 0800

Location: Aten and Collin's tract

GPS approximate center: Lat: 44.9483, Long: -87.3768

Route walked: Walked north into tract along the driveway, stopping at the spring pond then proceeding north along the woods trail. Retraced the route on the way out.

Habitat:

- **(3) *Thuja / Tsuga / Pinus sp. / Betula papyrifera* forest**
- **(4) *Thuja / Fraxinus pennsylvanica / Populus balsamifera* wet-mesic forest**
- **(6) *Larix laricina* / *Carex* fen**

Map: See Appendix 5 Maps

Results:

Ruffed Grouse
Mourning Dove
Eastern Wood-Pewee
Great Crested Flycatcher
Red-eyed Vireo
Blue Jay
American Crow
Common Raven
Black-capped Chickadee
White-breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Blue-gray Gnatcatcher
Cedar Waxwing
Nashville Warbler
Chestnut-sided Warbler
Black-and-white Warbler
American Redstart
Ovenbird
Common Yellowthroat
Eastern Towhee
Song Sparrow
Swamp Sparrow
White-throated Sparrow
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Red-winged Blackbird
Common Grackle
Brown-headed Cowbird
Baltimore oriole
American Goldfinch

Comments:

The lack of warbler species from this survey date should be considered uncharacteristic of such a complex setting of forest and wetland. The density of forest cover obscuring small species may explain the low number warblers and vireos. Definitely worth further surveys at this site.

Date: 28 May 2014

Time: 0715 - 0830

Location: Aten/Collin's tract and the "Hutter" fields south of Carlsville Road across from Aten/Collin driveway.

GPS approximate center: Lat: 44.9455, Long: -87.3769

Route walked: Walked north on the driveway of the Aten/Collin's tract to the spring pond area, then crossed Carlsville Road south into the Land Trust property across from the Aten/Collin's driveway. Made a loop walk generally to the south and east of the entry point.

Habitat:

- **(3) *Thuja / Tsuga / Pinus sp. / Betula papyrifera* forest**
- **(4) *Thuja / Fraxinus pennsylvanica / Populus balsamifera* wet-mesic forest**
- **(6) *Larix laricina* / *Carex* fen**
- **(7) *Salix / Cornus* shrub-carr**
- **(9) Old field – includes the hawthorn meadow**

Map: See Appendix 5 Maps

Results:

Wild Turkey
Mourning Dove
Northern Flicker
Alder Flycatcher
Great Crested Flycatcher
Red-eyed Vireo
Blue Jay
Black-capped Chickadee
Red-breasted Nuthatch
House Wren
Blue-gray Gnatcatcher
Gray Catbird
Blue-winged Warbler
Nashville Warbler
Yellow Warbler
Chestnut-sided Warbler
American Redstart
Mourning Warbler
Common Yellowthroat
Eastern Towhee
Field Sparrow
Song Sparrow
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
Common Grackle
Brown-headed Cowbird
American Goldfinch

Comments:

Date: 29 May 2014

Time: 0700 - 0830

Location: Spring Lane lowland hardwoods and associated upland to the east.

GPS approximate center: Lat: 44.9983, Long: -87.3361

Route walked: The route started at the south end of Spring Lane and went south into the upland hardwoods following the east side of the lowland hardwood swamp. The route looped to the east and then back to Spring Lane.

Habitat:

- **(2)** ***Acer saccharum / Fagus / Quercus rubra / Pinus strobus / Tsuga*** **forest**
- **(5)** ***Acer saccharinum / Fraxinus pennsylvanica*** **swamp forest**

Map: See Appendix 5 Maps

Results:
Wood Duck
Ruffed Grouse
Red-bellied Woodpecker
Hairy Woodpecker
Eastern Wood-Pewee
Great Crested Flycatcher
Red-eyed Vireo
Blue Jay
American Crow
Black-capped Chickadee
White-breasted Nuthatch
Brown Creeper
Blue-gray Gnatcatcher
Wood Thrush
American Robin
Black-throated Green Warbler
American Redstart
Ovenbird
Scarlet Tanager
Rose-breasted Grosbeak
Brown-headed Cowbird

Comments:
At this late date in the season likely many of the early and mid-season transitory migrants have left the area, and the species noted are likely those that will breed in at this site.

Discussion

This survey was a rapid and brief look at the birds that use the Bayshore Blufflands landscape during the migratory period of their life cycle. It was conducted in primarily forested setting in the early mornings of the month of May, usually considered a prime period to capture the majority of migratory species. However, given the design of this survey, many migratory species would be missed. Species that may have passed through earlier (e.g., fox sparrow) would be missed and surveying in the morning would necessarily miss many of the evening or night species (e.g., owls, woodcock, whip-poor-will). As this survey focused on primarily forested settings grassland or open field species (e.g., eastern meadow lark, grasshopper and savannah sparrows) were also perhaps missed in the survey. Focusing on forested habitats also meant it would be unlikely to encounter waterfowl and shorebirds in the survey and thus were not cataloged. These species undoubtedly occur off shore or along the shoreline of Green Bay. Lastly given the timing of the survey species over-wintering in this landscape (e.g., juncos, crossbills, northern shrike, rough-legged hawk, pine grosbeak), but moving north before the beginning of May were also missed. These limitations of this survey noted here are mentioned with the purpose of addressing these gaps in future migratory bird surveys for the area.

However, despite these limitations of the survey, several important species were recorded from the landscape. 17 species which have a "Partners-in-Flight" score of greater than 14 were recorded (Appendix 2). These species are considered in need of conservation consideration by the Partners in Flight program (http://www.partnersinflight.org/). The score of 14 is an arbitrary cut off, but species with scores above that number are generally considered priority species for several grant programs administered by the U.S. Fish and Wildlife Service.

Five species recorded during the survey are identified as "Species of Greatest Conservation Need" in the Wisconsin Wildlife Action Plan. These species are generally considered in some risk for population decline in Wisconsin and their presence on this landscape during migration (and some species likely breed here) should be noted when applying for land conservation or management grants for this landscape.

Appendix 1. Bird tally tor the 2014 migratory bird survey listed by date.

Species	5-May	8-May	9-May	10-May	11-May	17-May	22-May	26-May	28-May	29-May
Turkey Vulture				x						
Canada Goose	x									
Wood Duck		x								x
Sharp-shinned hawk						x				
Broad-winged Hawk	x			x						
Red-tailed Hawk							x			
American Kestrel		x								
Ruffed Grouse	x	x			x		x	x		x
Wild Turkey	x				x	x	x		x	
Killdeer					x					
Ring-billed Gull	x				x					
Herring Gull	x									
Mourning Dove	x		x		x	x	x	x	x	
Red-bellied Woodpecker	x	x	x	x		x				x
Yellow-bellied Sapsucker				x	x					
Downy Woodpecker	x	x	x	x	x		x			
Hairy Woodpecker	x	x	x		x	x				x
Northern Flicker	x	x	x	x	x	x	x		x	
Pileated Woodpecker	x				x	x				
Eastern Wood-Pewee								x		x
Alder Flycatcher									x	
Least Flycatcher							x			
Eastern Phoebe	x						x			
Great Crested Flycatcher					x	x	x	x	x	x
Blue-headed vireo				x		x				
Red-eyed Vireo						x		x	x	x
Blue Jay	x	x	x	x	x	x	x	x	x	x
American Crow						x	x	x		x
Common Raven	x			x				x		
Black-capped Chickadee	x	x	x	x	x	x	x	x	x	x
Red-breasted Nuthatch		x	x	x		x	x		x	
White-breasted Nuthatch	x	x	x	x		x	x	x		x
Brown Creeper	x	x	x					x		x
House Wren	x						x	x	x	

Winter Wren		x						x		
Golden-crowned Kinglet				x						
Ruby-crowned kinglet	x	x	x	x						
Blue-gray Gnatcatcher					x	x		x	x	x
Eastern Bluebird	x				x					
Hermit Thrush	x	x								
Swainson's thrush				x	x					
Wood Thrush		x	x	x	x		x			x
American Robin	x	x		x	x	x	x		x	x
Gray Catbird						x	x		x	
Brown Thrasher	x									
European Starling							x			
Cedar Waxwing								x		
Blue-winged Warbler							x		x	
Nashville Warbler		x		x	x	x	x	x	x	
Northern Parula						x	x			
Yellow Warbler									x	
Chestnut-sided Warbler							x	x	x	
Magnolia Warbler							x			
Yellow-rumped Warbler	x	x	x	x	x					
Black-throated Green Warbler		x	x		x	x	x			x
Black-and-white Warbler						x	x	x	x	
American Redstart							x	x	x	x
Ovenbird		x	x	x	x	x	x	x		x
Mourning Warbler									x	
Common Yellowthroat		x						x	x	
Scarlet Tanager										x
Eastern Towhee	x						x	x	x	
Chipping Sparrow							x			
Clay-colored Sparrow							x			
Field Sparrow	x	x							x	
Song Sparrow	x					x		x	x	
White-crowned sparrow	x									
Swamp Sparrow						x		x		
White-throated Sparrow	x	x		x		x		x	x	

Northern Cardinal	x		x		x	x	x	x	x	
Rose-breasted Grosbeak		x				x	x	x	x	x
Indigo Bunting							x	x	x	
Red-winged Blackbird	x	x				x		x	x	
Common Grackle					x			x	x	
Brown-headed Cowbird	x	x		x	x		x	x	x	x
Baltimore Oriole					x		x	x		
Purple Finch	x			x	x				x	
American Goldfinch	x	x	x	x	x	x	x	x	x	

Total 77 species

Appendix 2. Species encountered in 2014 migratory survey listed as Species of Greatest Conservation Need in Wisconsin or having a "Partner's In Flight" regional breeding score of 14 or greater.

Species	WI SGCN*	PIF Score**
Broad-winged Hawk		14
Ruffed Grouse		14
Northern Flicker		15
Least Flycatcher	x	15
Winter Wren		14
Wood Thrush	x	15
Brown Thrasher	x	15
Blue-winged Warbler	x	13
Nashville Warbler		14
Chestnut-sided Warbler		15
Black-throated Green Warbler		14
Black-and-white Warbler		14
American Redstart		14
Mourning Warbler		15
Scarlet Tanager		15
Field Sparrow	x	15
Rose-breasted Grosbeak		16

*Wisconsin Species of greatest conservation need
http://dnr.wi.gov/topic/WildlifeHabitat/profiles.asp

**Partners-in-Flight regional breeding conservation score for land birds of Bird Conservation Region 12
http://rmbo.org/pifassessment/Database.aspx#

Appendix 3. Habitat Types referenced in migratory bird survey

HABITAT TYPE			
Species occupying high estimated percentage of canopy	**Common or distinguishing understory or shrub layer species (est. by number of individuals)**	**Commonly encountered ground cover species in habitat type**	**Other significant species**
(1) *Pinus resinoa / Populus grandidentata / Quercus rubra* dry-mesic forest			
Pinus resinosa	*Abies balsamea*	*Aster macrophyllus*	*Plantanthera Hookeri*
Betula papyrifera	*Cornus rugosa*	*Trilium grandiflorum*	*Cypripedium arietinum*
Populus grandidentata	*Acer saccharum*	*Maianthemum canadense*	
Acer saccharum	*Pinus strobus*	*Pedicularis canadensis*	
Quercus rubra	*Quercus rubra*	*Aralia nudicaulis*	
Acer rubrum	*Sheperdia canadensis*	*Carex eburnea*	
Pinus strobus		*Pteridium aquilinum*	
(2) *Acer saccharum / Fagus / Quercus rubra / Pinus strobus / Tsuga* forest			
Acer saccharum	*Tsuga canadensis*	*Dicentra canadensis*	*Carya cordiformis*
Fagus grandifolia	*Acer saccharum*	*Viola pubescens*	*Hydrophyllum appendiculatum*
Quercus rubra	*Pinus strobus*	*Viola canadensis*	*Staphylea trifolia*
Pinus strobus	*Abies balsamea*	*Galium aparine*	*Juglans cinerea*
Tsuga canadensis		*Galium triflorum*	*Viola rostrata*
Betula papyrifera		*Erythronium americanum*	*Carex platyphylla*
Fraxinus americana		*Anemone quinquefolia*	*Aplectrum hyemale*
Populus grandidentata		*Claytonia virgininica*	
		Uvularia grandiflora	
		Carex pensylvanica	
		Caulophyllum thalictroides	
		Allium tricoccum	
		Osmorhiza claytonii	
(3) *Thuja / Tsuga / Pinus sp. / Betula papyrifera* forest			
Thuja occidentalis	*Sheperdia canadensis*	*Equisetum scripoides*	*Iris lacustris*
Tsuga canadensis	*Amelanchier canadensis*	*Maianthemum canadense*	*Lillium philadelphicum*
Betula papyrifera	*Juniper communis*	*Trientalis borealis*	
Pinus strobus	*Lonicera hirsuta*	*Aralia nudicaulis*	
Picea glauca		*Clintonia borealis*	
Pinus resinosa		*Lonicera dioica*	
		Danthonia spicata	
		Polygala paucifolia	
		Linnaea borealis	
		Smilacina stellata	
		Carex eburnea	

Species characteristic of Habitat types of Carlsville Bluff Continued

Species occupying high estimated percentage of canopy	Common or distinguishing understory or shrub layer species (est. by number of individuals)	Commonly encountered ground cover species in habitat type	Other significant species
(4) *Thuja / Fraxinus pennsylvanica / Populus balsamifera* wet-mesic forest			
Thuja occidentalis	*Cornus sericea*	*Petasites frigidus*	*Cypripedium reginae*
Fraxinus pennsylvanica	*Fraxinus nigra*	*Aralia nudicaulis*	
Populus balsamifera	*Fraxinus pennsylvanica*	*Maianthemum Canadensis*	
Populus deltoides	*Thuja occidentalis*	*Lonicera canadensis*	
Populus tremuloides	*Rhamnus alnifolia*	*Botrychium virginianum*	
Fraxinus nigra	*Acer spicatum*	*Streptopus spp.*	
Acer rubrum	*Ilex verticillata*	*Arisaema triphyllum*	
Tsuga canadensis	*Abies balsamea*	*Rubus pubescens*	
		Mitella nuda	
(5) *Acer saccharinum / Fraxinus pennsylvanica* swamp forest			
Acer saccharinum	Fraxinus nigra	*Menispermum canadense*	*Quercus bicolor*
Fraxinus pennsylvanica	*Tilia americana*	*Smilax ecirrata*	
Ulmus americana	*Ulmus americana*		
Populus deltoides	*Prunus virginiana*		
Acer rubrum	*Cornus sericea*		
	Viburnum opulus		
(6) *Larix laricina* / *Carex* fen			
Larix laricina	*Alnus incana*	*Carex eburnea*	
Thuja occidentalis	*Fraxinus nigra*	*Gymnocarpum dryopteris*	
Abies balsamea	*Vibrunum opulus*	*Carex disperma*	
Populus balsamifera	*Vaccinium myrtiloides*	*Carex paupercula*	
		Calamogrostis canadensis	
		Rubus pubescens	
		Typha spp	
		Thelyptris palustris	
		Cystopteris bulbifera	

Species characteristic of Habitat types of Carlsville Bluff Continued

Species occupying high estimated percentage of canopy	Common or distinguishing understory or shrub layer species (est. by number of individuals)	Commonly encountered ground cover species in habitat type	Other significant species
(7) *Salix / Cornus* shrub-carr			
Cornus sericea		*Eupatorium perfoliatum*	*Liparis loeselii*
Salix spp.		*Eupatorium maculatum*	
Fraxinus pennsylvanica		*Impatiens capensis*	
		Lysimachia thyrisifolia	
		Juncus tenuis	
		Carex pellita	
		Thelypteris palustris	
		Caltha palustris	
		Cypripedium calceolus var.parviflorum	
(8) Escarpment free face and talus slope			
Thuja occidentalis	*Acer spicatum*	*Cystopteris bulbifera*	*Asplenium rhizophyllum*
Fraxinus pennsylvanica	*Corylus Americana*	*Streptopus spp.*	*Adlumia fungosa*
Betula papyrifera	*Ribes lacustris*	*Solidago flexicaulis*	
Tilia americana	*Cornus rugosa*	*Osmorhiza claytonii*	
Ostrya virginiana		*Maianthemum canadensis*	
		Galium triflorum	
		Epipactis helleborine	
		Polypodium virginianum	
		Dryopteris marginalis	
		Aquilegia canadensis	
(9) Old field – includes the hawthorn meadow			
Crataegusspp.	*Lonicera spp*	*Bromus inermis*	*Aster lateriflorus*
Populus tremuloides	*Amelanchier spp.*	*Phleum pretense*	*Aster lowrieanus*
Prunus serotina	*Viburnum lentago*	*Daucus carota*	*Aster ericoides*
Fraxinus pennsylvanica	*Rhus typhina*	*Trifolium agraium*	*Monarda fistulosa*
		Trifolium pratense	
		Asclepias syriaca	

Nomemclature follows Manual of Vascular Plants of Northeastern United States and Adjacent Canada, 2nd Edition; H. Gleason and A. Cronquist, 1991.

Appendix 4. 1995 – 2000 record of bird usage; Bayshore Blufflands landscape; compiled by author.

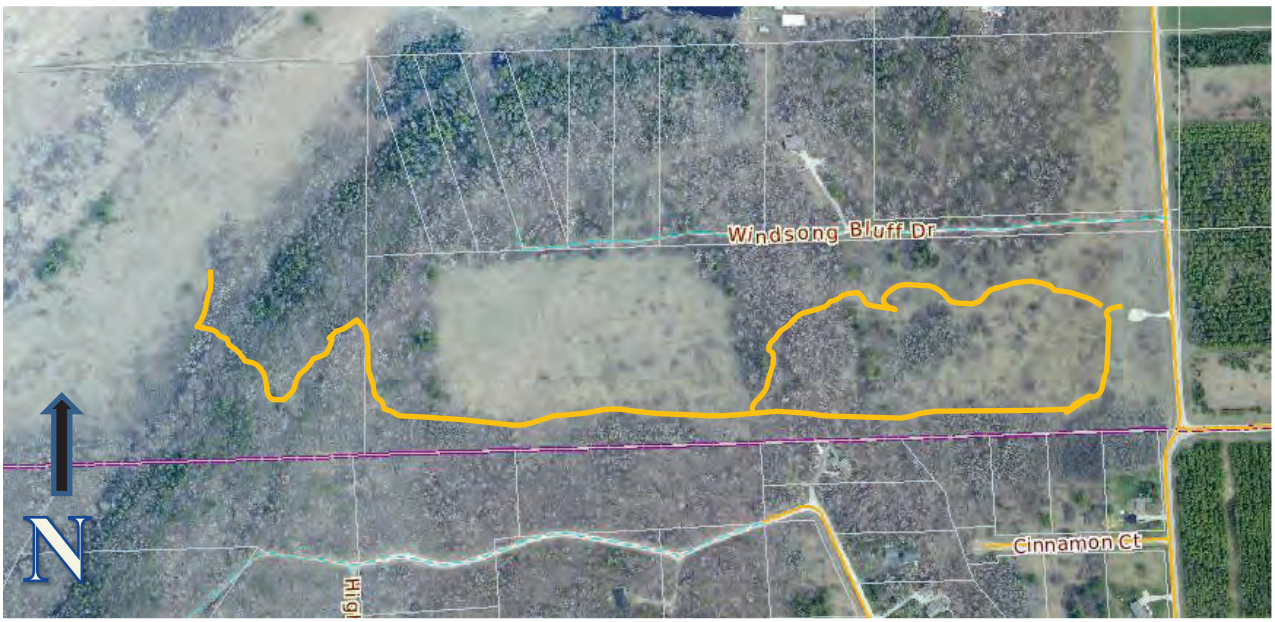
Species	Estimated Abundance	Suspected Site Usage
Wood duck	o	b,m
Mallard	c	b,m
Turkey vulture	o (May nest on outcrops)	b,m
Red-shouldered hawk	o (2 Nests, 1998)	b,m
Woodcock	o	b,m
Whip-poor-will	r	b,m
Ruby-throated humingbird	o	b,m
Red-headed woodpecker	r	b,m
Northern flicker	c	b,m
Eastern kingbird	o	b,m
Wood pewee	c	b,m
Least flycatcher	c	b,m
Phoebe	c	b,m
Crested flycatcher	c	b,m
Tree swallow	c	b,m
Barn swallow	c	b,m
Brown creeper	o	b,m
House wren	o	b,m
Winter wren	c	b,m
Veery	c	b,m
Wood thrush	c	b,m
Hermit thrush	o	b,m
American robin	a	b,m
Gray catbird	c	b,m
Warbling vireo	c	b,m
Red-eyed vireo	a	b,m
Nashville warbler	r	b,m
Yellow warbler	c	b,m
Chestnut-sided warbler	o	b,m
Magnolia warbler	r	b,m
Black-throated green warbler	c	b,m
Blackburnian warbler	r	b,m
Pine warbler	o	b,m
Black & white warbler	c	b,m
American redstart	o	b,m
Ovenbird	a	b,m
Northern waterthrush	o	b,m
Mourning warbler	c	b,m
Common yellowthroat	c	b,m
Canada warbler	o	b,m
Scarlet tanager	o	b,m
Rose-breated grosbeak	c	b,m
Indigo bunting	c	b,m
Chipping sparrow	c	b,m
Song sparrow	c	b,m
White-throated sparrow	c	b,m

Red-winged blackbird	c	b,m
Common grackle	c	b,m
Brown-headed cowbird	c	b,m
Northern oriole	r	b,m
Orchard oriole	r	b,m
Purple finch	r	b,m
American goldfinch	c	b,m
Goshawk	r (1? Nest, 1998)	b,r
Red-tailed hawk	o	b,r
Kestrel	c	b,r
Wild turkey	c	b,r
Ruffed grouse	c	b,r
Great horned owl	o	b,r
Barred owl	o	b,r
Rock dove	c	b,r
Mourning dove	c	b,r
Red-bellied woodpecker	c	b,r
Downy woodpecker	c	b,r
Hairy woodpecker	c	b,r
Pileated woodpecker	c	b,r
Blue jay	a	b,r
Northern raven	c	b,r
American crow	a	b,r
Black-capped chickadee	a	b,r
Red-breasted nuthatch	o	b,r
White-breated nuthatch	o	b,r
Cedar waxwing	c	b,r
Starling	c	b,r
Cardinal	c	b,r
Willow flycatcher	o	b.m
Yellow-throated vireo	r	b?,m
Peregrine	r (1 for 1 day, 1998, Aten/Collin's tract)	m
Sharp-shinned hawk	r	m
Night hawk	r	m
Wison's warbler	r	m
Palm warbler	c	m
White-crowned sparrow	c	m
Ring necked pheasant	r	r
Rough-legged hawk	o	w
Snowy owl	r (1 in April, 2000)	w
Dark-eyed junco	c	w
Pine siskin	o	w

a=abundant	b=breeding
c=common	m=migratory
o=occasional	r=resident
r=rare	w=winter

Appendix 5. Maps of areas surveyed in May 2014 for migratory birds

Map 1. Migratory Bird Survey Route 1. May 4, 2014



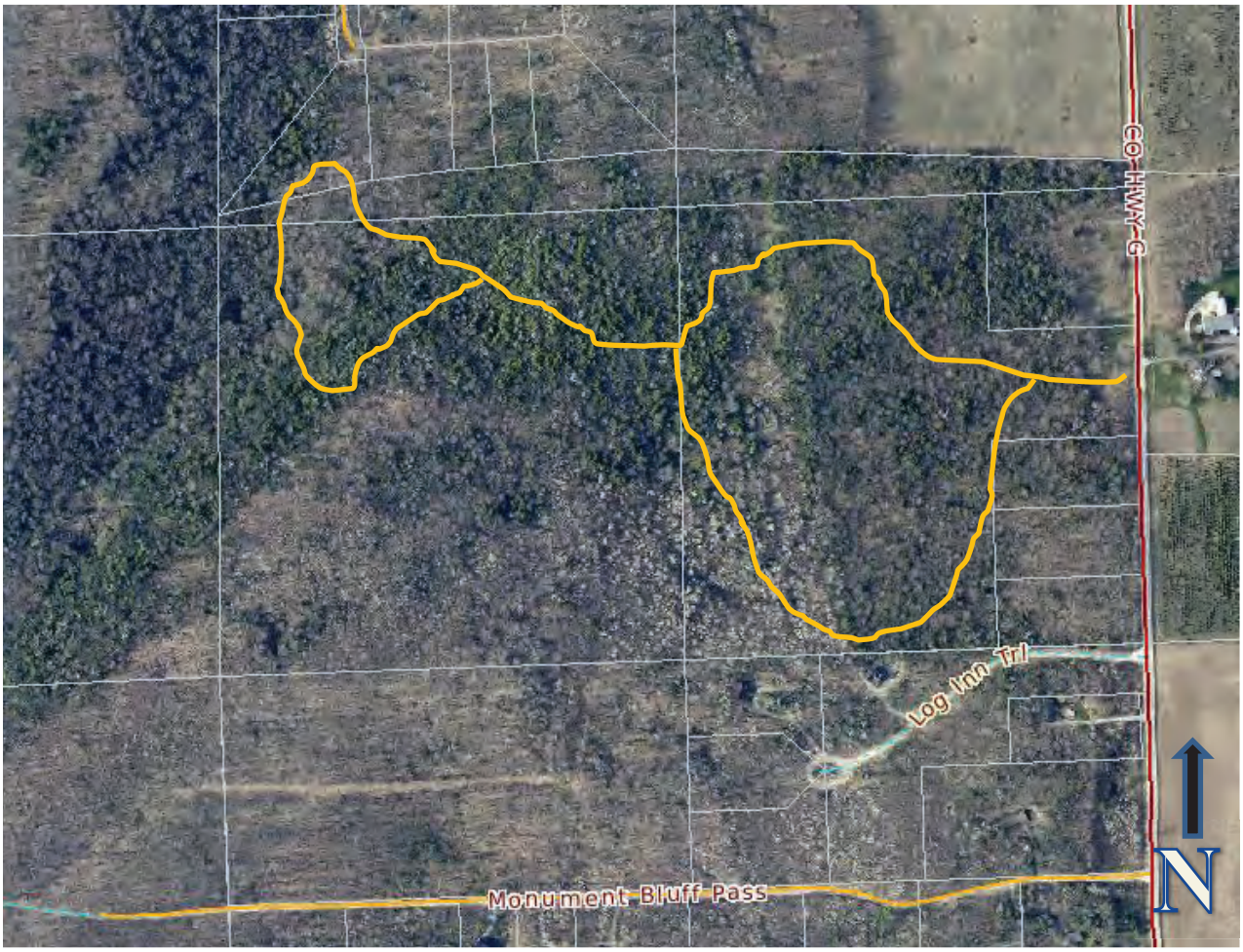
Time: 0730 – 0930

Approximate center of route: 44.9378; -87.3729

Clear sky, 39 F. Moderately strong wind from the west.

Habitats covered: 1, 9 (See Appendix 1. Habitat Types referenced in migratory bird survey)

Map 2. Migratory Bird Survey Route 2. May 8, 2014



0700 – 0800. 45 F. Solid overcast, with light to moderate winds from west.

Approximate center of route: 44.9968; -87.3336

Habitats covered: 2, 5

Map 3. Migratory Bird Survey Route 3. May 9, 2014

0745 – 0900. 55 F. Solid to moderate overcast with a moderate to strong wind from the west.

Approximate center of route: 44.9849; -87.3571

Habitats covered: 2, 3, 4

Map 4. Migratory Bird Survey Route 4. May 10, 2014

0730-0830. 55 F. Clear, light wind from S.

Approximate center of route: 44.9527; -87.3702

Habitats covered: 1, 4

Map 5. Migratory Bird Survey Route 5. May 11, 2014

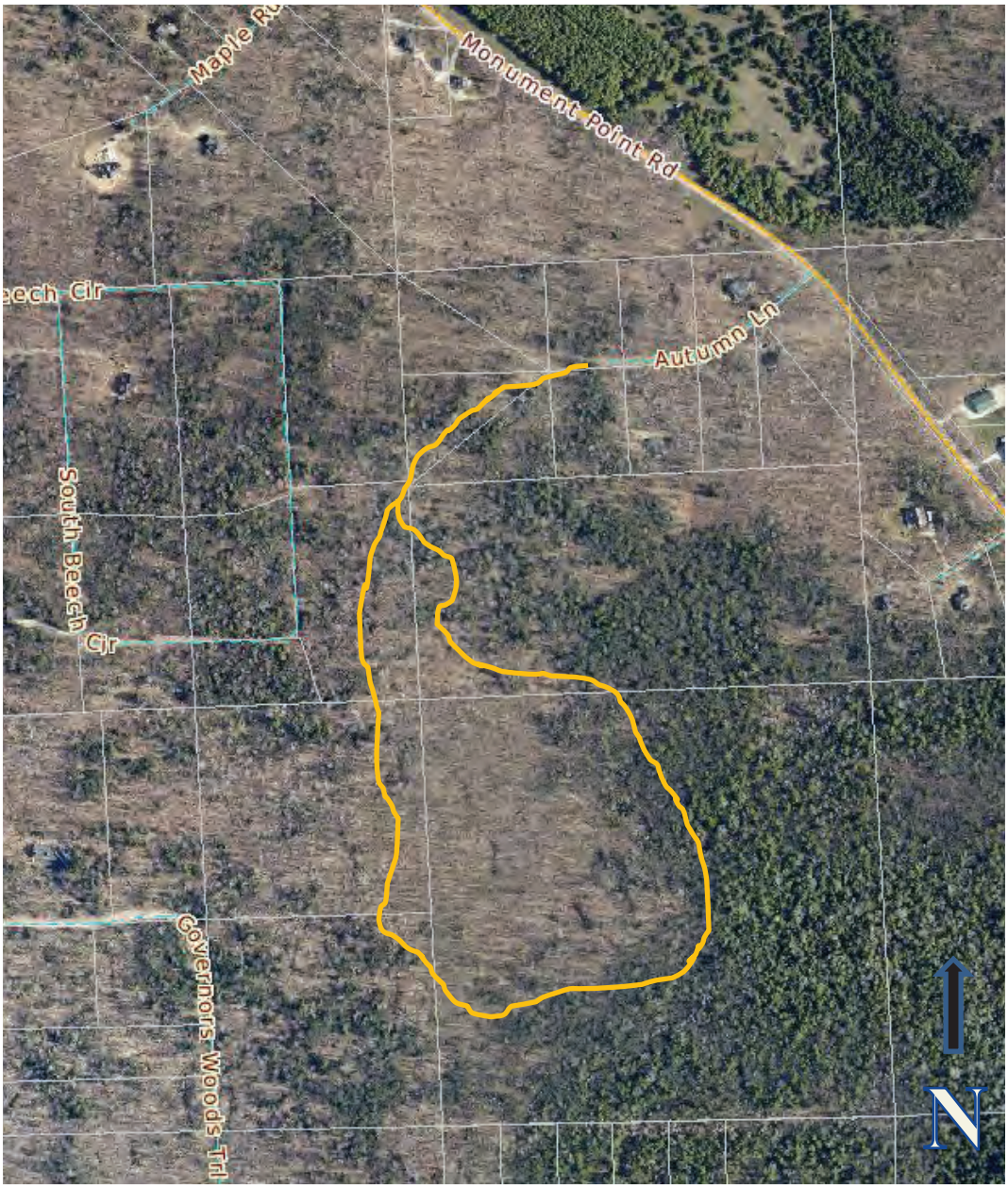
0700 – 0830. 60 F. Partly cloudy, moderate SW winds.

Approximate center of route: 44.9505; -87.3694

Notes: 2 tree deer stands were found just east of the loop road cut, with a trail camera, and bait. Red oval indicates approximate area of the deer stands.

Habitats covered: 1, 2, 3

Map 6. Migratory Bird Survey Route 6. May 17, 2014



0800 – 0900. 55 F. Clear, light to moderate winds from the west.

Approximate center of route: 44.9705; -87.3519

Habitats covered: 2

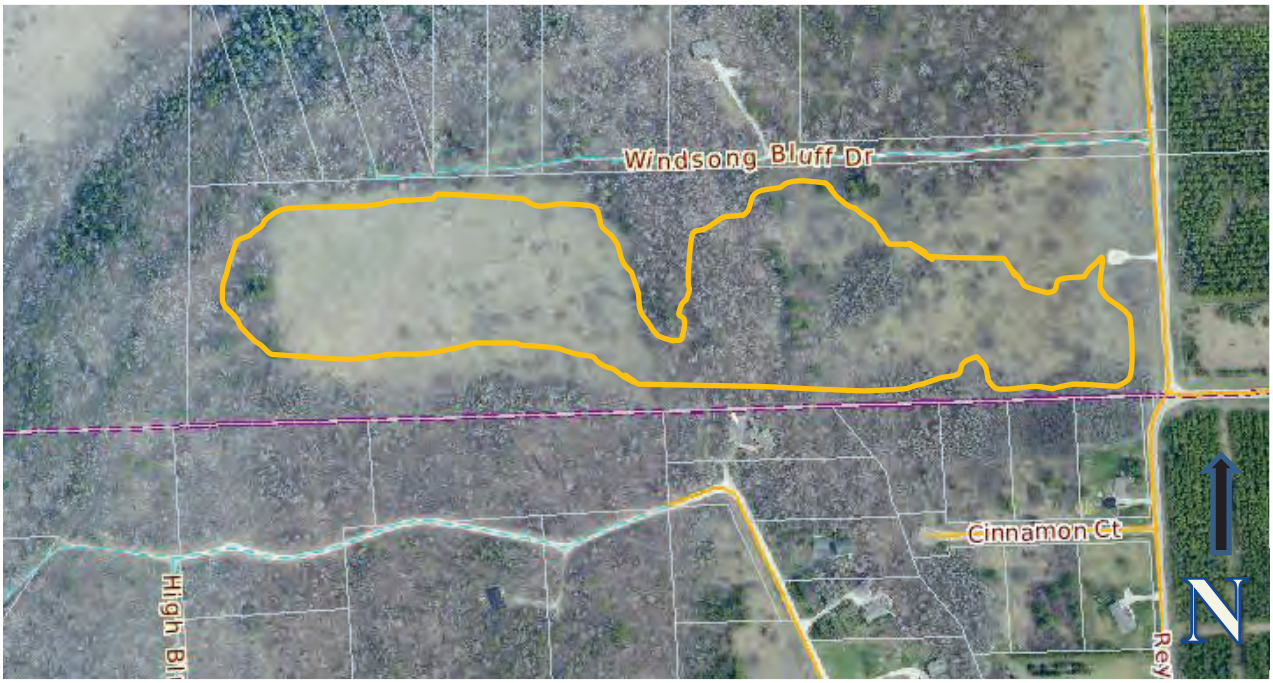
Map 7. Migratory Bird Survey Route 7. May 17, 2014

0915 – 1030. 60 F. Partly cloudy, light to moderate winds.

Approximate center of route: 44.9477; -87.3775

Habitats covered: 4, 6,

Map 8. Migratory Bird Survey Route 8. May 22, 2014



O715 – 0830. 60 F. Scattered clouds, light winds from west.

Approximate center of route: 44.9378; -87.3729

Habitats covered: 1, 9

Map 9. Migratory Bird Survey Route 9. May 26, 2014

0700- 0900. 60 F. Light overcast, with light winds.

Approximate center of route: 44.9483; -87.3768

Habitats covered: 3, 4, 6,

Map 10. Migratory Bird Survey Route 10. May 28, 2014

0700 – 0830. 60 F. Clear sky, light winds.

Approximate center of route: 44.9455; -87.3769

Habitats covered: 3, 4, 6, 7, 9,

Map 11. Migratory Bird Survey Route 11. May 29, 2014

0700 – 0830. 65 F. Partly cloudy, moderate winds from west.

Habitats covered: 2, 5

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Small Mammal Survey & Recommendations

2014, Reis, Callaghan, Loedding and Vargo

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043





Wisconsin Coastal Management Program
Coastal Resource and Community Planning
Door County Land Trust
Small Mammal Monitoring Survey & Recommendations
(non-chiropteran)

Urban Ecology Center
Research & Citizen Science Team

Anne Reis, GIS & Field Data Management Coordinator
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URBAN ECOLOGY CENTER®

DOOR COUNTY LAND TRUST

WISCONSIN COASTAL MANAGEMENT PROGRAM

The Urban Ecology Center fosters ecological understanding as inspiration for change, neighborhood by neighborhood.

Our Environmental Community Centers:

- Provide outdoor science education for urban youth
- Protect and use public natural areas, making them safe, accessible and vibrant
- Preserve and enhance these natural areas and their surrounding waters
- Promote community by offering resources that support learning, volunteerism, stewardship, recreation and camaraderie
- Practice and model environmentally responsible behaviors

The Urban Ecology Center's Citizen Science Program serves as a meaningful bridge between academic research and the community-at-large, enabling collaboration, and creating a more engaged, knowledgeable and ecologically literate citizenry. The Center maintains a network of urban field stations in which all research is accessible to and advised by volunteers. With careful training, volunteers conduct cutting-edge research, from studying the physiology of migrating birds to discovering the winter quarters of threatened snakes. Citizen Science volunteers work with bats, bugs, plants, snakes, turtles, mice and a host of other critters!

Executive Summary

As a part of a 2013-2014 Wisconsin Coastal Management Program grant (Coastal Resource and Community Planning) awarded to the Door County Land Trust (DCLT), the Urban Ecology Center's Research & Citizen Science Team conducted small mammal surveys in four of the land trust's natural areas between the towns of Carlsville and Egg Harbor (Township 29, Range 26) in Door County. These natural areas are situated within the Northern Lake Michigan Coastal (NLMC) Ecological Landscape (WDNR, 2014). There are no known current formal mammal surveys for the Door County Land Trust natural areas aside from casual observations. This report offers a brief analysis of small mammal surveys performed from August 9th through August 11th, 2014 (and an extended wildlife camera session until August 21st) as well as monitoring recommendations for the Door County Land Trust Natural Areas. We observed 11 total mammal species (out of 40 theoretical). The final section of the report summarizes additional observations and probabilities of occurrences of the remaining 29 species.

Background

The Northern Lake Michigan Coastal (NLMC) Ecological Landscape encompasses 2,000 square miles of which 24% (488 square miles) is found in the Door Peninsula. Peninsula soils are calcareous, shallow and mostly stony loam to loam. The majority of the Door Peninsula land cover is agriculture, grassland, wetland (spring-fed ephemeral ponds, shrub swamps and sedge meadows) and forested upland (dry-mesic, mesic, wet-mesic) (WDNR, 2014). The Niagara Escarpment, a globally important resource and a conservation priority, runs through the Peninsula and consists of rock outcrops, cliffs and talus slopes.

The Door County Land Trust protects over 6,500 acres of land in 13 public and 12 private natural areas throughout the Door Peninsula. Habitat and vegetation types include open wetlands (tussock sedge wet meadow), forested wetlands (White Cedar-Boreal Conifer, Mesic, Maple-Ash-Elm Swamp), old fields, and mixed hardwood and conifer upland forests (Hemlock-Beech).

Kurta (1995) identifies 40 mammal species whose ranges cover part of the Door Peninsula. Two previous mammal surveys were conducted throughout the Peninsula by Johnson (1978) and Long (1990). There are nine mammalian Species of Greatest Conservation Need (SGCN) (WDNR, 2012) identified as important to the NLMC, four of which are bats that are not discussed in this report. Of the remaining five, only two species are found in the Door Peninsula (White-tailed Jackrabbit and Northern Flying Squirrel) and only one (Northern Flying Squirrel) is strongly associated with the NLMC communities in this report.

Small mammals are an important prey base for larger avian and mammalian predators, are primary and secondary consumers of vegetation and invertebrates, and play a crucial role as seed dispersers, thus serving an important ecological role in natural communities (Stephens and Anderson, 2014). Abundance and composition of small mammal communities also affect the structure, species composition, and successional trends of plant communities. Because small mammals are directly and indirectly impacted by changes to vegetation and because populations can change over relatively short periods of time, regular mammal surveys are ideal for measuring the impacts of restoration (Manley et al., 2006 and Sieg 1987).

The Urban Ecology Center's Research & Citizen Science Team was asked to conduct preliminary surveys for several of the land trust's natural areas. Table 1 indicates the natural areas, abbreviations used throughout the report, and includes habitat and vegetation cover type.

Table 1. Door County Natural Area Name Abbreviations, Habitat and Vegetation Cover Type.

Natural Area	Habitat	Abbreviation	Veg Cover Type
Lautenbach Woods	Upland Woods	LW_UW	Hemlock-Beech & Sugar Maple Aspen
	Lowland Woods	LW_LW	Silver Maple Swamp
Monument Point	Monument Point	MP	Hemlock-Birch-Maple
Bayshore Blufflands	Old Fields	BB_OF	Grain Grass & Hawthorne
Atens-Collins Property	Wetlands	BB_Wet	Conifer Swamp Or Ash-Sedge Meadow
	Niagara Escarpment	BB_NE	Cedar-Hemlock

Methods

Urban Ecology Center staff conducted small mammal surveys using three different capture methods.

Sherman Folding traps target small mammals that are attracted to bait, such as mice, voles and moles.

From August 8th through August 11th (three consecutive nights) we set out traps using a combination of bird seed (nuts, oats, seeds, mealworms) and a peanut butter/oats mixture as bait as follows:

Lautenbach Woods: 60 traps per night (30 each at both sites) for a total of 180 trap-nights^.

Monument Point: 25 traps per night for a total of 75 trap-nights.

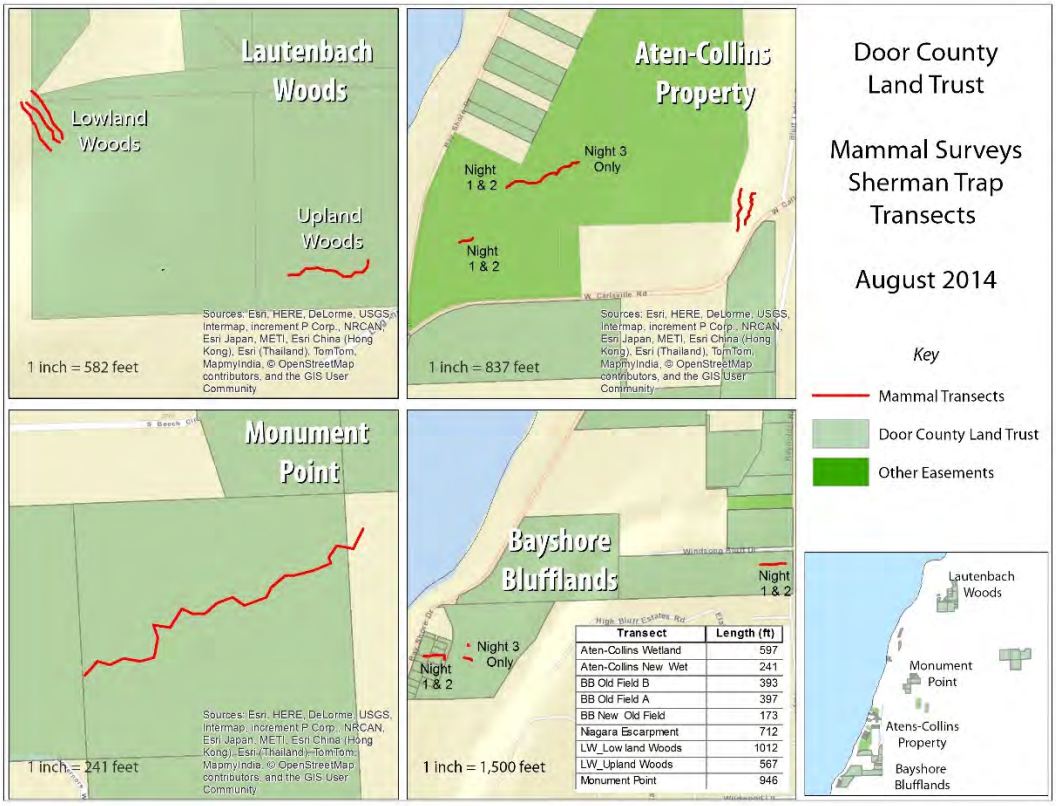
Bayshore Blufflands: Old Fields: 26 traps (nights 1 and 2) and 16 traps on night 3 for a total of 68 trap-nights.

Aten-Collins Property: 26 traps per night at Niagara Escarpment; 18 traps (night 1 and 2) and 16 traps (night 3) for a total of 198 trap-nights at the Aten-Collins Wetlands.

^ A trap night is the product of the number of traps and the number of nights.

Transect orientations and lengths are shown in Figure 1 below and Appendix A.

Figure 1. Map of Sherman Trap Transects at four DCLT Natural Areas.



We checked traps each morning and recorded the condition of the trap. A trap that was closed with bait (CWB) either had an animal inside (successful capture), or was triggered by a visitation but the animal was not captured. A trap that was closed and had no bait (CNB) likely had a visitation but the animal escaped. A trap that was open with bait (OWB) likely did not receive a visitation, and a trap that was open with no bait (ONB) was the result of a visitation with a successful escape, or a malfunctioning trap. We also noted whether the trap had been knocked over or moved (molestation) likely by a larger animal (raccoon, porcupine).

For successful captures, we took a photo of the animal and recorded species, sex, breeding status (if female), picture number and weight, ear and tail length. On mornings 1 and 2 we marked animals (nail polish on the ear) using a different color each time. On mornings 2 and 3 we recorded whether the animal had previously been captured and on which night it was initially captured.

Pitfall traps target many of the same species as Sherman Folding Traps but also capture foraging animals that may not necessarily be attracted to bait. We installed 2 Pitfall Traps at Monument Point and 2 Pitfall Traps on the Aten-Collins property on Night 3 (both sites). All traps were baited with the same bait combinations used in the Sherman Folding Traps.

Wildlife Cameras target the widest variety of mammals, particularly larger mammals that don't fit in Sherman Folding Traps or Pitfall Traps, arboreal mammals (flying squirrels) and carnivores. We installed wildlife cameras in a variety of locations (Appendix A) and were able to leave them up for a period of time after completion of the other surveys.

All small mammal transects, pitfalls and wildlife cameras were geo-referenced using a handheld Topcon GMS-2 GPS using the State Plane NAD 1927 Wisconsin Central coordinate system and subsequently mapped using ESRI ArcGIS 10.2. Appendix A shows a map of Door County Land Trust natural areas, small mammal transects, pitfall traps and wildlife camera locations.

Data Analysis & Results

Sherman & Pitfall Trap Capture Rate

Over all four sites during the 3-day trapping sessions, 43 individuals were captured in the Sherman Folding Traps (42 Peromyscus mice and 1 shrew); 9 at BB, 13 at MP and 21 at LW. An additional shrew was captured in a pitfall trap. There were 0 recaptures at Bayshore Blufflands, 6 recaptures at Monument Point and 5 at Lautenbach Woods. Table 2 shows trapping success per location.

Table 2. Sherman Trap Capture rates per night per location for Door County Land Trust Natural Areas.

		Capture Rate			
Location		Day 1	Day 2	Day 3	Total
Lautenbach Woods					
	LW_UW (30/night)	10%	10%	10%	10%
	LW_LW (30/night)	23%	17%	0%	13%
Monument Point					
	MP (25/night)	16%	20%	16%	17%
	Pitfall Traps (3 set)			33%	
Bayshore Blufflands					
	BB_OF (26/night)	0%	0%	13%*	
Atens-Collins Property	BB_NE (26/night)	19%	0%	0%	6%
	BB_Wet (18/night)	11%	0%	0%^	6%
	Pitfall Traps (2 set)			0%	

* New old field location 3rd night with 16 traps set. ^New wetland location 3rd night with 16 traps set.

Trap Tampering

During the first night of trapping none of the traps were molested by mesopredators. During the second night of trapping, three out of six locations experienced obvious tampering, particularly the Niagara Escarpment and the Atens-Collins Wetlands where tampering was severe. During the third night, five of the six locations experienced obvious tampering, with the exception of the relocated Old Field location in Bayshore Blufflands. Table 3 shows the extent of tampering, which affects population modeling and other analyses.

Table 3. Trap Tampering per night per DCLT Natural Area.

	Day 1	Day 2	Day 3
LW_UW	0	3/30	30/30
LW_LW	0	0	18/30
MP	0	0	14/25
BB_OF	0	0	0*
BB_NE	0	26/26	21/26
BB_Wet	0	16/18	12/18*

* Indicates different location 3rd night of trapping.

Mark-Recapture Population Estimate Model

We used the Lincoln-Petersen Index to estimate population (Equation 1) based on two nights of mark-recapture trapping. This is a basic closed model estimate that doesn't account for immigration/ emigration and births/deaths and assumes all members of community are equally likely to be captured and are normally distributed (Gotelli and Ellison, 2004).

Equation 1. $N=[(m1+1)(n+1)/(m2+1)]-1$

N = estimate of total population size
m1 = number of animals marked and released in the first session
n = number of animals captured on the second night
m2 = number of animals recaptured in the second night

Equation 2. $$\text{St. dev.} = \text{SQRT}\frac{(n1 + 1)(n2 + 1)(n1 - m2)(n2 - m2)}{(m2 + 1)2\,(m2 + 2)}$$

A population estimate (Equation 1) with a 95% confidence interval (Equation 2) was calculated for each site for Peromyscus (White-footed Mouse/Deer Mouse) populations as seen in Table 4. Note that the Lautenbach Lowland Woods, according to these estimates had by far the highest density of mice.

Table 4. Lincoln-Petersen Mark-Recapture White-footed/Deer Mouse Population Estimate for DCLT.

	n1	n2	m2	N	SD	95% Lower CI	95% Upper CI
LW_UW	2	3	1	5	1.41	3.59	6.41
LW_LW	5	5	1	17	6.93	10.07	23.93
MP	4	5	3	6.5	0.87	5.63	7.37
BB_OF				no captures			
*BB_NE	4	0	0	4	0	4	4
*BB_Wet	2	0	0	2	0	2	2

* High tampering rate makes this calculation unsuitable.

Species Identification

Deer mice and White-footed mice are difficult to distinguish in the field. Therefore, measurements such as ear length, tail length, hind leg length and weight are recorded to help determine species (Stephens et al., 2014). We recorded all of these parameters except for hind leg length. We were not able to distinguish between the two species for four individuals at Lautenbach Woods, five individuals for Monument Point and three individuals for Bayshore Blufflands. Table 5 shows the range of values for tail length, ear length and weight for White-footed Mice and Deer Mice.

Table 5. Range of three measurements distinguishing features for White-footed Mouse and Deer Mouse

	Tail Length	Ear Length	Weight (g)
White-footed Mouse	56-92	12-17	9-33
Deer Mouse	66-103	16-20	7-27

Wildlife Camera Results

Five wildlife cameras were strategically placed at eight locations in the DCLT natural areas: two locations in Monument Point, five locations on the Aten-Collins property, and one location in the old fields of Bayshore Blufflands (Appendix A). Seven species were captured on camera as shown in Table 6.

Table 6. Wildlife Camera Image Captures

	Eastern Gray Squirrel	Thirteen-lined Ground Squirrel	Raccoon	Porcupine	White-tailed Deer	Opossum	Rodent spp.
Monument Point_WC1*	x						
Monument Point_WC2^	x		x				x
Aten-Collins Easement North			x		x	x	
Aten-Collins Easement South			x	x	x		
Aten-Collins Spring			x				
Aten-Collins Wetland			x		x		
Aten-Collins Trail	x		x		x		
Bayshore Blufflands Old Field		x					

Monument Point WC1 was aimed toward a beech tree shelf baited with bird seed and peanuts. Monument Point WC2 was aimed at a topped tree baited with carnivore pellets and bird seed. Aten-Collins Easement North and South were baited with blood meal and carnivore pellets. Aten-Collins Spring, Wetlands and Trail were not baited. Bayshore Blufflands Old Field was pointed at a small

mammal burrow and baited with mealworms. Wild turkeys (Meleagris gallopavo) at the Aten-Collins Easement) and a Great Blue Heron (Ardea Herodias) at the Aten-Collins Wetland were also captured on camera.

Data Results Summary

Of the 40 potential mammal species in the Door Peninsula (Kurta, 1995), we observed 11 (28%) during this 3-day survey period (Table 7). All mice and shrews were captured in the Sherman Folding Traps and a Pitfall Trap. The Thirteen-lined Ground Squirrel was observed on a wildlife camera baited with mealworms. Muskrat (Aten-Collins pond), Cottontail Rabbit (road right-of-way) and Striped Skunk (road kill) were casual observations during the course of the survey. Eastern Gray Squirrel, Common Porcupine, Common Raccoon, White-tailed Deer and Virginia Opossum were all observed on wildlife camera.

Table 7. Species Observed during DCLT small mammal surveys (August 8th-11th, 2014)

	Bayshore Blufflands	Monument Point	Lautenbach Woods
White-footed Mouse/Deer Mouse (Peromyscus leucopus/maniculatus)	X	X	X
Short-tailed Shrew (Blarina brevicauda)	X	X	
Thirteen-lined Ground Squirrel (Spermophilis tridecemlineatus)	X (OF)*		
Eastern Gray Squirrel (Sciurus carolinensis)	X	X*	X
Porcupine (Erythizon dorsatum)	X (NE)*		
Common Raccoon (Procyon lotor)	X (NE, Wet)*		X
Eastern Cottontail (Sylvilagus floridanus)	X (Wet)		
White-tailed Deer (Odocoileus virginianus)	X (Wet)*		
Virginia Opossum (Didelphis virginiana)	X (A-C Easement)*		
Striped Skunk (Mephitis mephitis)	X (road kill)		
Muskrat (Ondatra zibethicus)	X (Wet)		

Bayshore Blufflands communities: Old Field (OF); Niagara Escarpment (NE); and, wetlands on Aten-Collins property (Wet). * Seen on wildlife cameras.

Discussion & Monitoring Recommendations

The recommendations listed here represent a combination of personal experience of the authors and references of the US Forest Service Multi-species Inventory & Monitoring (MSIM) Technical Guide (Manley et al., 2006) and Mammals of the Great Lakes Region (Kurta, 1995).

The main objective of this survey was to provide preliminary presence/absence data to begin to inform land management practices. Considering the importance of long-term data sets and the powerful analyses that could be gleaned from such, we recommend the following:

1) Conduct repeated surveys of the areas included in this report to begin a long-term data set to look for population trends. This could start as early as late-June of 2015 (when it is consistently warm enough to safely trap small mammals). Factors such as seasonality, weather, trap bias, bait preference, etc. affects capture rates so multiple surveys at different times of years will help to build a more complete list. Long-term data sets of mammal abundance can help measure the success of changes in the landscaped, particularly species indicative of desired habitats.

2) Expand preliminary presence/absence surveys to include additional micro-habitat communities in each of the natural areas as well as additional Land Trust holdings. The highest potential for new species occurs during the first three nights of trapping and a minimum of a three-night trapping period should be conducted in each of these areas to reach an 84% chance of documenting all species present in an area. A fourth night of trapping increases the potential by 2% and is recommended if recording abundance (Manley et al. 2002). These sessions should be run on consecutive nights. If weather or other unforeseen circumstances prevent consecutive trapping nights, surveys should continue on the next available evening. A minimum of 20 Sherman traps (or other small live trap), placed a minimum of 10 meters apart, should be set within each micro-habitat, paired with a minimum of 2 pitfall traps. For future surveys we recommend recording breeding status of males and measuring hind leg length to better differentiate Peromyscus species. Larger live traps such as Tomahawk or Havahart could be used in conjunction with the others as certain species (Northern Flying Squirrels) are more inclined to be captured in them.

3) We recommend increasing efforts to document areas used by the Northern Flying Squirrel, a Species of Greatest Conservation Need that may be declining due to the aggressiveness of the encroaching Southern Flying Squirrel. Wildlife cameras aimed at nest boxes with feeding platforms (baited with peanuts) could increase the likelihood of detecting flying squirrels. Nest boxes are labor intensive to monitor and construct, but their erection could document a new species and become an extraordinarily popular project with the public. The aggressiveness of the Southern Flying Squirrel is being studied in Wisconsin and a flying squirrel project might also prove popular with scientists.

4) For this report we used a variety of small mammal transect types, such as a grid formation (Lautenbach Woods Lowland Woods location and Niagara Escarpment), meandering (Lautenbach Woods Upland Woods, Aten-Collins Wetlands), and straight line (Monument Point and Bayshore Bluffland Old Fields). A 50 m hexagonal transect is recommended by the Iowa

Multi Species Inventory and Monitoring guide for standardizing among protocols (Forest Service, Iowa and California) and covering a larger area (Kinkead, 2006) and should be used in future monitoring if space permits.

5) Wildlife cameras provide an excellent way of surveying remotely with minimal effort and can document the widest variety of mammal species. Primary efforts should focus on areas with obvious signs of wildlife (dens, volunteer trails). Carnivore pellets, blood meal, cat food, rabbit and poultry can be used as bait for larger predators (mustelids, canines) and seed and peanuts can be used to attract arboreal rodents (mice, flying squirrels).

6) Given the high trap molestation rate in many of these areas, likely by mesopredators (raccoons, skunks), future trapping using Sherman Folding Traps should include a mesopredator exclosure. The Urban Ecology Center has successfully deterred trap molestation for years using a modified plastic shoebox turned upside down and staked to the ground with sturdy stakes to protect the trap. A hole is cut on one end to allow animal entry. Preliminary analyses have found that molestation rates decrease with this method while capture rate is not affected. Additionally, we recommend using less aromatic bait such as good quality bird seed with grain, seed, fruit and nuts mixed with quick oats and freeze-dried mealworms. Peanut butter is less desirable for long-term studies because its aroma is a strong attractant for mesopredators.

7) When conducting live-trapping, bait should always be used. Small mammals have very fast metabolisms and need to eat constantly. Some small mammals have to consume their body weight in food every night and a depletion of food can quickly cause stress and hypothermia. Also, bedding should always be provided in traps to provide warmth (and prevent hypothermia). Natural bedding materials are the best option, but cosmetic cotton squares or pads work well as long they are placed in the traps in such a way so as not to hinder trap functionality.

8) Pitfall traps are a great way to document a wider variety of small mammals and we recommend installing a minimum of two per habitat, ideally one or two dozen. Shrews, for example, avoid Sherman traps by using echolocation. When installing pitfall traps, we recommend using screw-on lids, particularly in areas with heavy leaf litter and fallen debris, to allow for easy closure between monitoring sessions. These traps should be buried level with the ground and as close to logs as possible (which act as a natural funnel to the trap). All gaps around the edge of the pit traps should be filled with dirt to ensure no diminutive-sized mammals fall through. A sturdy cover should be erected over the traps during trapping sessions to prevent rain from entering the trap and to deter mesopredators from disturbing captured animals. These traps should be baited with a protein source such as live waxworms or mealworms. Shrews are particularly sensitive, stress out easily, and have extremely high metabolisms, so caution should be taken to mimimize handling of these mammals if possible.

9) Increasing trapping sessions to two per day will allow for captures of both diurnal and nocturnal mammals. If this is done, extreme care should be taken to keep traps out of direct sunlight and to check traps at least every 12 hours.

10) Traps should be cleaned with soap and water after every survey session. This prevents the spread of disease between individuals and species and minimizes the spread of zoonotic diseases to humans. Also, urine and dirty traps increase the likelihood of capturing the same species (biasing effort). Many mammalogists also recommend cleaning traps with bleach and a soap solution after every three-day trapping period in areas where Peromyscus maniculatus is present to eliminate any possibility of spreading Hantavirus. A combination of diluted bleach and soap should ALWAYS be used to clean traps at the end of the field season. Hantavirus is a very serious and life-threatening pulmonary disease. Any volunteers helping with future surveys should be informed of the seriousness of the disease and be provided with appropriate materials regarding Hantavirus in the field and the likelihood of contracting the disease. Anyone working with small mammals and/or traps should be provided protective gloves and hand sanitizer. Precautionary measures such as minimizing the amount of time spent in close proximity to traps and being wary of wind direction in the field will minimize risk of contraction. Traps should always be handled in well-ventilated areas and hands should always be washed with soap and hot water post-surveys or before ingesting food or drink.

11) We strongly recommend engaging community volunteers in sampling efforts, particularly in collaboration with professional researchers. Larger survey crews allow for increased efforts in shorter time periods. Bioblitzes are good ways to attract new volunteers while still gathering important data.

12) Regular mammal walks around sunrise and/or sunset will increase the potential for detecting trap-shy and/or crepuscular mammals. This could be a pre-determined route “owned” by volunteers and documented with photographic evidence.

13) A database of mammal species can be augmented with Road kill surveys, particularly for species too large or too wary of traps. Identification of road kill “hotspots” serves dual purposes of identifying problem areas and providing background data for future management plans.

14) We recommend encouraging local residents and experts to submit their sightings to a shared database, encouraging photographic evidence when possible. If photographic evidence is not possible, we encourage live trapping or strategically placing wildlife cameras.

15) If access to a lab is available, hair traps placed in dens or Sherman Traps can increase species detection.

16) We included a very basic population estimate for the Peromyscus and it should be noted that this covers only one trapping session during one season. If population estimates are desired for any of the species in this report, we recommend regular surveys over a period of several years. The Jolly-Seber population estimate is a type of open capture-recapture model that accounts for survival, capture probability, population size and immigration and it requires at least three samples to estimate population size. Another more robust model is the Pollock model that combines attributes of both open and closed population models (Gotelli and Ellison, 2004). Other options include site occupancy models (Stephens and Anderson, 2014). Additionally, we recommend contracting with a population biologist and/or an ecological statistician.

Probability of Occurrence in Door County Land Trust Natural Areas

Below we provide information on the potential for the 40 species identified by Kurta (1995) to be observed in the DCLT natural areas. A brief analysis of Stephens & Anderson (2014) provides the probability of occurrence for species in different habitats. We use probabilities of >= 40% for twelve small mammal species: Arctic Shrew, Masked Shrew, Pygmy Shrew, Short-tailed Shrew, Eastern Chipmunk, Thirteen-lined Ground Squirrel, Meadow Vole, Meadow Jumping Mouse, Southern Red-backed Vole, White-footed Mouse, Deer Mouse and Southern Bog Lemming. We indicate the Stephens and Anderson (2014) natural areas and provide the equivalent Door County Land Trust habitat. An x indicates a >=40% probability of occurring in that habitat. N/A indicates the animal would have <=40% probability of occurring in that habitat or would not be associated with the habitat. All other species habitat potential is based on Kurta (1995).

Each species falls in one of four categories and is denoted with the following superscript symbols: *Species documented for this report during the 3-day survey period (Aug 9-11). ^Species most likely present, based on previous sightings, commonality and historical records. ®Species that are probable based on historical records and current habitat. ¤Species with historical records that likely have been extirpated.

Table 8. Shrews and Moles

S&A, 2014 Natural Habitat	Equivalent DCLT NA	^Arctic Shrew	^Masked Shrew	¤Pygmy Shrew	*Short-tailed Shrew
Sedge Wetlands	BB_Wet	x	x	n/a	n/a
Shrub Wetlands	BB_Wet	x	x	n/a	n/a
Cedar Swamp	BB_Wet	n/a	x	x	x
Floodplain Forest	LW_LW	n/a	x	x	x
Northern Mesic Forest	LW_UW, MP	n/a	n/a	n/a	x
Dry Prairie	BB_Old Fields	n/a	x	x	n/a

Based on >=40% probability of occupancy from Stephens & Anderson (2014)

The ¤star-nosed mole is likely extirpated from Door County, but prefers the borders of swamps, lakes, streams, and isolated areas of poor drainage.

Table 9a. Squirrels, Beavers, Mice, Porcupines

S&A, 2014 Natural Habitat	Equivalent DCLT NA	^Eastern Chipmunk	*Thirteen-lined Ground Squirrel
Sedge Wetlands	BB_Wet	n/a	n/a
Shrub Wetlands	BB_Wet	n/a	n/a
Cedar Swamp	BB_Wet	n/a	n/a
Floodplain Forest	LW_LW	n/a	n/a
Northern Mesic Forest	LW_UW, MP	n/a	n/a
Dry Prairie	BB_Old Fields	n/a	x

Based on >=40% probability of occupancy from Stephens & Anderson (2014)

Table 9b. Squirrels, Beavers, Mice, Porcupines

DCLT NA	^Wood-chuck	*Eastern Gray Squirrel	^Eastern Fox Squirrel	^Red Squirrel	^Northern Flying Squirrel
LW_UW	n/a	x	n/a	x	x
LW_LW	n/a	x	n/a	n/a	n/a
MP	n/a	x	n/a	n/a	x
BB_OF	x	n/a	n/a	n/a	n/a
BB_NE	n/a	x	n/a	x	x
BB_Wet	n/a	n/a	n/a	n/a	n/a

The Eastern Fox Squirrel prefers edge habitats and urban areas.

Door County Residents of the area have reported observations of Northern Flying Squirrels at residential bird feeders (Joe Henry personal communication). Johnson (1978) also reports observations of this species at Toft Point, near Bailey's Harbor. WDNR species guidance indicates northern flying squirrels prefer old growth conifer forests; sites such as Lautenbach Woods, Monument Point and portions of the Niagara Escarpment would be ideal places for monitoring. Conservation of the mature conifer forests and cultivation of younger conifers would increase the likelihood of a successful Northern Flying Squirrel population. Live trapping for monitoring purposes requires state licensing and an Endangered Resources review must be completed to verify protocols and personnel qualifications. Tomahawk or Havahart traps are superior to Sherman folding traps due to this species' size.

Table 9c. Squirrels, Beavers, Mice, Porcupines

Natural Habitat	Equivalent DCLT NA	^Meadow Vole	®Meadow Jumping Mouse	®Southern Red-backed Vole	*White-footed Mouse	*Deer Mouse	®Southern Bog Lemming
Sedge Wetlands	BB_Wet	x	n/a	n/a	n/a	n/a	n/a
Shrub Wetlands	BB_Wet	x	x	n/a	x	n/a	n/a
Cedar Swamp	BB_Wet	n/a	x	x	x	x	x
Floodplain Forest	LW_LW	x	x	x	x	n/a	n/a
Northern Mesic Forest	LW_UW, MP	n/a	x	n/a	x	x	n/a
Dry Prairie	BB_Old Fields	n/a	x	n/a	x	x	n/a

Based on >=40% probability of occupancy from Stephens & Anderson (2014)

Southern bog lemming was historically found on Washington and Rock Islands, but in general this species is fairly uncommon in Wisconsin (Long, 1990).

Table 9d. Squirrels, Beavers, Mice, Porcupines

	^American Beaver	*Muskrat	*Common Porcupine
LW_UW	n/a	n/a	x
LW_LW	n/a	n/a	n/a
MP	n/a	n/a	n/a
BB_OF	n/a	n/a	n/a
BB_NE	n/a	n/a	x
BB_Wet	x	x	n/a

The House Mouse prefers residential areas and actively cultivated areas.

Table 10. Rabbits, Hares & Opossum

	*Opossum	*Eastern Cottontail	^Snowshoe Hare	®White-tailed Jackrabbit
LW_UW	n/a	n/a	x	n/a
LW_LW	n/a	n/a	n/a	n/a
MP	n/a	n/a	x	n/a
BB_OF	x	x (with lot brushy cover)	n/a	x grasslands
BB_NE	n/a	n/a	x	n/a
BB_Wet	x	n/a	x (Cedar Bogs)	n/a

Based on >=40% probability of occupancy from Stephens & Anderson (2014)

Table 11. Carnivores

	*Common Raccoon	^Ermine	®Long-tailed Weasel	^Least Weasel	^Mink	^American Badger	*Striped Skunk	^Northern River Otter
LW_UW	x	n/a	n/a	n/a	n/a	n/a	x	n/a
LW_LW	x	n/a	n/a	n/a	n/a	n/a	n/a	n/a
MP	x	n/a	n/a	n/a	n/a	n/a	x	n/a
BB_OF	x	n/a	x	x	n/a	x	x	n/a
BB_NE	x	n/a	n/a	n/a	n/a	n/a	x	n/a
BB_Wet	x	n/a	n/a	n/a	x	n/a	n/a	n/a

Based on >=40% probability of occupancy from Stephens & Anderson (2014)

Ermine prefer riparian woodlands. Long-tailed weasels prefer forest-field edges and places with brushy cover. The least weasel is a habitat generalist. Minks prefer streams, ponds, and lakes with brushy cover. The northern river otter requires moderately deep water of ponds, lakes and streams.

We did not cover fox, larger cats, wolves, black bear or deer in this report, though their ranges cover Door County.

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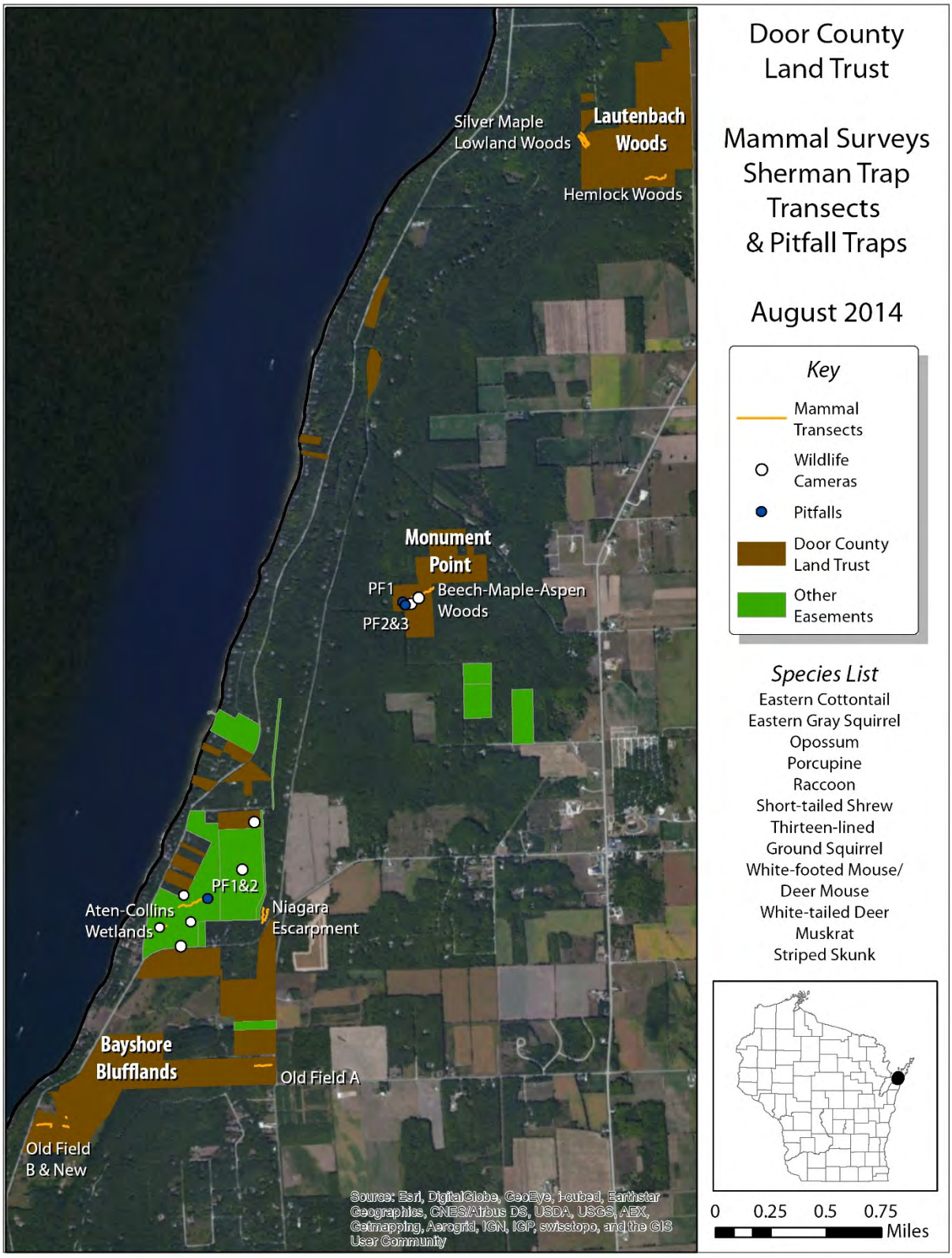
Appendix A. Map of the Door County Land Trust Small Mammal Surveys (Aug 8-11, 2014).



	Day 1	8/9/14			
Location	Start Time	Sky	Wind	Temp	
Lautenbach Woods_Lowlands	7:15	0	0	62	
Lautenbach Woods_Uplands	8:00	0	1	68	
Monument Point	9:12	0	1	71	
Bayshore Blufflands_Old Field A	10:25	0	1	75	
Bayshore Blufflands_Old Field B	10:00	0	1	73	
Niagra Escarpment	10:45	0	1	75	
Aten Wetlands	11:29	0	2	75	
	Average	0	1	71	
Location	Day 2:	8/10/14			
	Time	Sky	Wind	Air Temp	
Lautenbach Woods_Lowlands	6:50	0	0	63	
Lautenbach Woods_Uplands	7:40	0	0	66	
Monument Point	8:16	0	0	66	
Bayshore Blufflands_Old Field A	8:57	0	1	70	
Bayshore Blufflands_Old Field B	9:10	0	1	70	
Niagra Escarpment	9:32	0	1	72	
Aten Wetlands	9:53	0	0	72	
	Average	0	0	68	
Location	Day 3:	8/11/14			
	Time	Sky	Wind	Temp	
Lautenbach Woods_Lowlands	6:37	2	0	64	
Lautenbach Woods_Uplands	7:15	3	0	66	
Monument Point	7:58	2	0	70	
Bayshore Blufflands Old Field	9:10	2	1	72	
Niagra Escarpment	8:46	2	1	72	
Aten Wetlands New	9:38	2	2	72	
	Average	2	1	69	

Ear Marking	
Night 1	Blue
Night 2	Orange
PB	Peanut Butter
BS	Bird Seed

WIND

0 Less than 1 km/h; calm; smoke rises vertically

1 1-5 km/h (1-3 m/h); smoke drift shows wind direction

2 6-11 km/h (4-7 m/h); leaves rustle, wind is felt on face

3 12-19 km/h (8-12 m/h); leaves, small twigs in constant motion; light flag extend

4 20-28 km/h (13-18 m/h); raises dust, leaves, loose paper; small branches in moti

5 23-38 km/h (19-24 m/h); small trees in leaf sway

6 39-49 km/h (25-31 m/h); larger branches in motion; whistling heard in wires

7 50-61 km/h (32-38 m/h); whole trees in motion; resistance felt walking against t

8 62-74 km/h (39-46 m/h); twigs, small branches broken off trees; walking genera

9 Greater than 75 km/h (47 m/h) Why are you still surveying?!

SKY CODE

0	Clear; 0-15% cloud cover
1	Partly cloudy; 16-50% cover
2	Mostly cloudy; 51-75% cover
3	Overcast; 76-100% cover
4	Wind-driven sand, dust; snow
5	Fog or haze
6	Drizzle
7	Rain
8	Snow
9	Thunderstorm; with or without precipitation

Location	Door County Land Trust: Bayshore Bluff														
Bait	PB & Bird seed														
Observers	J. Callaghan and D. Loedding (processors); T. Vargo & D. Collins (check traps); A. Reis (Data recorder)														
Day	Old Field B		Total Time	Old Field A		Total Time	Niagra Escarpment (NE)		Total Time	Aten Wetlands (Aten_Wet & Aten_BW)		Total Time			
Day 1	Start Time:	10:00 AM	0:15:00	Start Time:	10:25 AM	0:10:00	Start Time:	10:45 AM	0:29:00	Start Time:	11:29 AM	0:23:00			
Day 1	Stop Time:	10:15 AM		Stop Time:	10:35 AM		Stop Time:	11:14 AM		Stop Time:	11:52 AM				
Day	Old Field B		Total Time	Old Field A		Total Time	Niagra Escarpment (NE)		Total Time	Aten Wetlands (Aten_Wet & Aten_BW)		Total Time			
Day 2	Start Time:	9:10	9m	Start Time:	8:57	6m	Start Time:	9:32	10m	Start Time:	9:53	12m			
Day 2	Stop Time:	9:19		Stop Time:	9:03		Stop Time:	9:42		Stop Time:	10:05				
Day	New Old Field		Total Time		Niagra Escarpment (NE)		Total Time		Aten Wetlands (Aten_Wet & Aten_BW)		Total Time				
Day 3	Start Time:	9:10	15m		Start Time:	8:46	13m		Start Time:	9:38	7m				
Day 3	Stop Time:	9:25			Stop Time:	8:59			Stop Time:	9:45					
Station	Trap Night	Species	Sex	Age	Marked	Habitat	Recap	Weight (g)	Trap Condition	Bait	Tampered	Notes	Pregnant	Tail Length (mm)	Ear Length (mm)	Picture Num
BB_OFB_1	1								OWB	PB						
BB_OFB_2	1								OWB	BS						
BB_OFB_3	1								OWB	PB						
BB_OFB_4	1								OWB	BS						
BB_OFB_5	1								OWB	PB		chewed				
BB_OFB_6	1								OWB	BS						
BB_OFB_7	1								OWB	PB						
BB_OFB_8	1								OWB	BS						
BB_OFB_9	1								OWB	PB						
BB_OFB_10	1								OWB	BS						
BB_OFB_11	1								OWB	PB						
BB_OFB_12	1								OWB	BS						
BB_OFB_13	1								OWB	PB						
BB_OFA_1	1								OWB	BS		earwigs				

BB_OFA_2	1								OWB	PB						
BB_OFA_3	1								OWB	BS						
BB_OFA_4	1								OWB	PB						
BB_OFA_5	1								OWB	BS						
BB_OFA_6	1								OWB	PB						
BB_OFA_7	1								OWB	BS						
BB_OFA_8	1								OWB	PB						
BB_OFA_9	1								OWB	BS						
BB_OFA_10	1								OWB	PB						
BB_OFA_11	1								OWB	BS						
BB_OFA_12	1								OWB	PB						
BB_OFA_13	1								OWB	BS						
NE1	1	Blarina bre	F	A	Tail	Cedar-H	No	14	CWB	PB			Yes	24		1757-17
NE2	1								OWB	BS						
NE3	1								OWB	BS		scat				
NE4	1								CWB	PB						
NE5	1								OWB	BS						
NE6	1								OWB	PB						
NE7	1	Peromysc	F	A	Right Ear	Cedar-H	No	29	CWB	BS			Yes	76	15	1759.jp
NE8	1								OWB	PB						
NE9	1								OWB	BS						
NE10	1								OWB	PB						
NE11	1								OWB	BS						
NE12	1	Peromysc	M	SA	Unknown	Cedar-H	No	19	CWB	PB				69	15	1760.jp
NE13	1	Peromysc	M	A	Left Ear	Cedar-H	No	22	CWB	PB		ants		76	13	1761.jp
NE14	1								CWB	PB						
NE15	1								CWB	BS						
NE16	1								ONB	PB						
NE17	1								OWB	BS						
NE18	1								ONB	PB						
NE19	1	Peromysc	M	A	Left Ear	Cedar-H	No	23	CWB	BS				80	17	1763.jp
NE20	1								CNB	U						
NE21	1								CWB	PB						
NE22	1								CNB	BS						
NE23	1								CNB	PB						
NE24	1								CWB	BS						
NE25	1								CWB	PB						
NE26	1								CNB	PB						
Aten_Wet_1	1								OWB	PB						
Aten_Wet_2	1								OWB	BS						

Aten_Wet_3	1								OWB	PB						
Aten_Wet_4	1								OWB	BS						
Aten_Wet_5	1	Peromysc	M	SA	Left Ear	Cedar S	No	16	CWB	PB				83	16	1764.jp
Aten_BW_6	1								CNB	BS						
Aten_BW_7	1								CNB	PB						
Aten_BW_8	1								CNB	BS						
Aten_BW_9	1								CNB	PB						
Aten_BW_10	1								CWB	BS						
Aten_BW_11	1								ONB	PB						
Aten_BW_12	1								ONB	BS						
Aten_BW_13	1								ONB	PB						
Aten_BW_14	1								CNB	BS						
Aten_BW_15	1								CWB	PB						
Aten_BW_16	1								Lost	U						
Aten_BW_17	1								ONB	PB						
Aten_BW_18	1	Peromysc	F	A	Right Ear	Ash-Sec	No	21	CWB	BS			Yes	76	16	1765.jp
BB_OFB_1	2								OWB	PB						
BB_OFB_2	2								OWB	BS						
BB_OFB_3	2								OWB	PB						
BB_OFB_4	2								OWB	BS						
BB_OFB_5	2								OWB	PB						
BB_OFB_6	2								OWB	BS						
BB_OFB_7	2								OWB	PB						
BB_OFB_8	2								OWB	BS						
BB_OFB_9	2								OWB	PB						
BB_OFB_10	2								OWB	BS						
BB_OFB_11	2								OWB	PB						
BB_OFB_12	2								OWB	BS						
BB_OFB_13	2								OWB	PB						
BB_OFA_1	2								OWB	PB						
BB_OFA_2	2								OWB	BS						
BB_OFA_3	2								OWB	PB						
BB_OFA_4	2								OWB	BS						
BB_OFA_5	2								OWB	PB						
BB_OFA_6	2								OWB	BS						
BB_OFA_7	2								OWB	PB						
BB_OFA_8	2								OWB	BS						
BB_OFA_9	2								OWB	PB						
BB_OFA_10	2								ONB	BS						
BB_OFA_11	2								OWB	PB						

BB_OFA_12	2								OWB	BS							
BB_OFA_13	2								OWB	PB							
NE1	2								CWB	PB	Yes						
NE2	2								CNB	BS	Yes	mouse scat					
NE3	2								CNB	PB	Yes	scat					
NE4	2								CNB	BS	Yes	scat on top					
NE5	2								CNB	PB	Yes						
NE6	2								CWB	BS	Yes						
NE7	2								CWB	PB	Yes						
NE8	2								CNB	BS	Yes						
NE9	2								CWB	PB	Yes						
NE10	2								OWB	BS	Yes						
NE11	2								CWB	PB	Yes						
NE12	2								CWB	BS	Yes	scat					
NE13	2								OWB	PB	Yes	scat					
NE14	2								CWB	BS	Yes						
NE15	2								CNB	PB	Yes						
NE16	2								CNB	BS	Yes						
NE17	2								CWB	PB	Yes	scat					
NE18	2								CWB	BS	Yes						
NE19	2								CWB	PB	Yes						
NE20	2								CNB	BS	Yes						
NE21	2								CNB	PB	Yes						
NE22	2								CWB	BS	Yes						
NE23	2								ONB	PB	Yes						
NE24	2								CWB	BS	Yes						
NE25	2								CNB	PB	Yes						
NE26	2								OWB	BS	Yes						
Aten_Wet_1	2								CNB	PB	Yes						
Aten_Wet_2	2								CNB	BS	Yes	stick jammed in trap					
Aten_Wet_3	2								CNB	PB	Yes						
Aten_Wet_4	2								CNB	BS	Yes						
Aten_Wet_5	2								CNB	PB	Yes						
Aten_BW_6	2								OWB	BS							
Aten_BW_7	2								CNB	PB	Yes						
Aten_BW_8	2								CWB	BS	Yes						
Aten_BW_9	2								ONB	PB	Yes						
Aten_BW_10	2								CNB	BS	Yes						
Aten_BW_11	2								ONB	PB	Yes						
Aten_BW_12	2								CNB	BS	Yes						

Aten_BW_13	2								ONB	PB	Yes					
Aten_BW_14	2								CWB	BS	Yes					
Aten_BW_15	2								CNB	PB	Yes					
Aten_BW_16	2								Lost	BS						
Aten_BW_17	2								ONB	PB	Yes					
Aten_BW_18	2								CWB	BS						
BB_OFNEW_1A	1								OWB	BS						
BB_OFNEW_1B	1								OWB	PB						
BB_OFNEW_2A	1								OWB	BS						
BB_OFNEW_2B	1								OWB	PB						
BB_OFNEW_3A	1								OWB	BS						
BB_OFNEW_3B	1								OWB	PB						
BB_OFNEW_4A	1								OWB	BS						
BB_OFNEW_4B	1								OWB	PB						
BB_OFNEW_5A	1								OWB	BS						
BB_OFNEW_5B	1								CWB	PB						
BB_OFNEW_6A	1								OWB	BS						
BB_OFNEW_6B	1								OWB	PB						
BB_OFNEW_7A	1								OWB	BS						
BB_OFNEW_7B	1	Peromysc	M	A	No	Old Fiel	No	22	CWB	PB				76	14	1789.jp
BB_OFNEW_8A	1								OWB	BS						
BB_OFNEW_8B	1	Peromysc	M	A	No	Old Fiel	No	20	CWB	PB				70	15	1790.jp
NE1	3								ONB	BS						
NE2	3								ONB	BS	Yes					
NE3	3								CWB	BS	Yes					
NE4	3								CWB	BS	Yes					
NE5	3								CWB	BS						
NE6	3								OWB	BS	Yes					
NE7	3								OWB	BS						
NE8	3								ONB	BS	Yes					
NE9	3								Not set	BS						
NE10	3								CWB	BS	Yes					
NE11	3								CNB	BS	Yes					
NE12	3								CNB	BS	Yes					
NE13	3								OWB	BS		Scat				
NE14	3								CNB	BS	Yes					
NE15	3								CWB	BS	Yes					
NE16	3								CWB	BS	Yes					
NE17	3								CWB	BS	Yes					
NE18	3								CNB	BS	Yes					

NE19	3								CNB	BS	Yes					
NE20	3								CNB	BS	Yes					
NE21	3								CNB	BS	Yes					
NE22	3								CNB	BS	Yes					
NE23	3								CNB	BS	Yes					
NE24	3								CWB	BS	Yes					
NE25	3								CNB	BS	Yes	Bent Trap				
NE26	3								CNB	BS						
Aten_NewWet_1A	1								OWB	BS						
Aten_NewWet_1B	1								CWB	BS	Yes					
Aten_NewWet_2A	1								CNB	BS	Yes					
Aten_NewWet_2B	1								CNB	BS	Yes					
Aten_NewWet_3A	1								CWB	BS						
Aten_NewWet_3B	1								CNB	BS	Yes					
Aten_NewWet_4A	1								CWB	BS	Yes					
Aten_NewWet_4B	1								CNB	BS	Yes					
Aten_NewWet_5A	1								CNB	BS	Yes					
Aten_NewWet_5B	1								OWB	BS						
Aten_NewWet_6A	1								CNB	BS	Yes					
Aten_NewWet_6B	1								CNB	BS	Yes					
Aten_NewWet_7A	1								CNB	BS						
Aten_NewWet_7B	1								OWB	BS						
Aten_NewWet_8A	1								CNB	BS	Yes					
Aten_NewWet_8B	1								ONB	BS	Yes					
PF1	1								Visited	BS	Yes					
PF2	1								Visited	BS	Yes					
		9														

Location	Door County Land Trust: Monument Point																	
Bait	Peanut Butter and Bird Seed																	
Observers	J. Callaghan and D. Loedding (processors); T. Vargo & D. Collins (check traps); A. Reis (Data recorder)																	
Day 1	Monument Point	Total Time																
Start Time:	9:12	18m											IF(AND(65<=O20,O20<=95,16<=I26,I26<=30),"WFM					
Stop Time:	9:30												IF(AND(42<=O20,O20<=69,12<=I20, I20<=24),"DM					
Day 2																		
Start Time:	8:16	22m																
Stop Time:	8:38																	
Day 3																		
Start Time:	7:58	27m																
Stop Time	8:25																	
Station	Trap Night	Species	Sex	Age	Marked	Habitat	Recap	Weight (g)	Trap Condition	Bait	Tampered	Notes	Pregnant	Tail Length (mm)	Ear Length (mm)	Picture Num	Range WFM	Range DM
MP1	1								OWB	BS								
MP2	1								OWB	PB								
MP3	1	Peromyscus	M	A	Left Ear	Hemlock-Maple-Birch	No	28	CWB	BS				80	17	1750-1751.jpg	WFM	
MP4	1								CNB	PB		scat						
MP5	1								CWB	BS								
MP6	1								OWB	BS								
MP7	1								OWB	PB								
MP8	1								ONB	U								
MP9	1								OWB	BS								
MP10	1								OWB	U								
MP11	1	Peromyscus	M	A	Right Ear	Hemlock-Maple-Birch	No	25	CWB	BS				86	14	1752-1753.jpb	WFM	
MP12	1								OWB	PB								
MP13	1								OWB	BS								
MP14	1								OWB	PB								
MP15	1	Peromyscus	M	SA	Right Ear	Hemlock-Maple-Birch	No	19	CWB	BS				70	16	1754.jpg	WFM	DM
MP16	1								OWB	PB								
MP17	1								OWB	BS								
MP18	1								CNB	U		scat						

MP19	1								OWB	BS							
MP20	1								OWB	PB							
MP21	1								OWB	BS							
MP22	1	Peromyscus	F	A	Right Ear	Hemlock-Maple-Birch	No	28	CWB	PB				78	17	1755-1756.jpg	WFM	
MP23	1								OWB	BS							
MP24	1								OWB	U							
MP25	1								OWB	BS							
MP1	2	Peromyscus	M	A	R ear	Hemlock-Birch-Maple	No	22	CWB	PB				72	16	1774.jpg	WFM	DM
MP2	2								OWB	BS							
MP3	2								CNB	PB							
MP4	2								OWB	BS							
MP5	2								ONB	PB							
MP6	2								OWB	BS							
MP7	2								CNB	PB							
MP8	2								OWB	BS							
MP9	2								OWB	PB							
MP10	2								OWB	BS							
MP11	2	Peromyscus	M	A	no	Hemlock-Birch-Maple	D1	22	CWB	PB		escaped						
MP12	2								OWB	BS							
MP13	2								CNB	PB							
MP14	2								CWB	BS							
MP15	2	Peromyscus	F	A	L ear	Hemlock-Birch-Maple	D1	18	CWB	PB			Yes	68	15	1775.jpg	WFM	
MP16	2								OWB	BS							
MP17	2								ONB	PB							
MP18	2								OWB	BS							
MP19	2								OWB	PB							
MP20	2								OWB	BS							
MP21	2	Peromyscus	M	SA	R ear	Hemlock-Birch-Maple		18	CWB	PB				70	17	1776.jpg	WFM	DM
MP22	2								CWB	BS							
MP23	2								CNB	PB							
MP24	2								OWB	BS							
MP25	2	Peromyscus	M	A	L ear	Hemlock-Birch-Maple	D1	29	CWB	PB				74	15	1777.jpg	WFM	
MP1	3								OWB	PB							
MP2	3								CNB	BS	Yes						
MP3	3								OWB	PB							
MP4	3	Peromyscus	M	A	No	Hemlock-Birch-Maple	No	23	CWB	BS	Yes			79	15	1788.jp	WFM	
MP5	3								ONB	PB							

MP6	3								OWB	BS							
MP7	3								CNB	PB							
MP8	3								OWB	BS	Yes						
MP9	3								ONB	PB							
MP10	3								CNB	BS	Yes						
MP11	3	Peromyscus	M	A	no	Hemlock-Birch-Maple	D1	21	CWB	PB		escaped					
MP12	3								CNB	BS	Yes						
MP13	3								CWB	PB							
MP14	3								CWB	BS	Yes						
MP15	3	Peromyscus	F	A	No	Hemlock-Birch-Maple	D1, D2	19	CWB	PB			Yes	68	16	1787.jpg	WFM	DM
MP16	3								CWB	BS	Yes						
MP17	3	Peromyscus	F	SA	no	Hemlock-Birch-Maple	D2	16	CWB	PB	Yes			71	16	1786.jpg	WFM	DM
MP18	3								CWB	BS	Yes						
MP19	3								ONB	PB	Yes						
MP20	3								CWB	BS	Yes						
MP21	3								CWB	PB	Yes	bent trap					
MP22	3								CWB	BS							
MP23	3								CWB	PB	Yes						
MP24	3								OWB	BS		scat					
MP25	3								CWB	PB	Yes						
PF1	1								no bait								
PF2	1								with bait								
PF3	1	Blarina brevicauda		A					with bait							1783-1785.jpg	
		13															

Location	Door County Land Trust: Lautenbach Woods																	
Bait	Peanut Butter and Bird Seed																	
Observers	J. Callaghan and D. Loedding (processors); T. Vargo & D. Collins (check traps); A. Reis (Data recorder)																	
											transition zone							
Day 1	Lowland Woods	Total Time		Upland Woods	Total Time										IF(AND(65<=O26,O26<=95, 15<			
Start Time:	7:15																	
Stop Time:				8:36	1h 21m	includes walking time from LW to UW												
Day 2	Lowland Woods	Total Time		Upland Woods	Total Time													
Start Time:	6:50	31m		7:40	18m													
Stop Time:	7:21			7:58														
Day 3	Lowland Woods	Total Time		Upland Woods	Total Time													
Start Time:	6:37	18m		7:15	18m													
Stop Time	6:55			7:33														
Station	Trap Night	Species	Sex	Age	Marked	Habitat	Recap	Wt (g)	Trap Condition	Bait	Tampered	Notes	Pregnant	Tail Length (mm)	Ear Length (mm)	Picture Num	Range WFM	Range DM
LW_LW_N1	1								ONB	BS								
LW_LW_N2	1								ONB	BS		larger scat						
LW_LW_N3	1								CNB	BS								
LW_LW_N4	1								CNB	BS								
LW_LW_N5	1								OWB	BS								
LW_LW_N6	1								OWB	BS								
LW_LW_N7	1								OWB	BS								
LW_LW_N8	1	Peromyscus	F	A	No	Silver Maple Swamp	No	26	CWB	BS			Yes	74	14	1736-1737.jpg	WFM	
LW_LW_N9	1	Peromyscus	M	A	No	Silver Maple Swamp	No	21	CWB	BS				75	15	1738-1740.jpg	WFM	
LW_LW_N10	1								OWB	BS								
LW_LW_M1	1	Peromyscus	F	A	L ear	Silver Maple Swamp	No	30	CWB	PB			Yes	79	18	1744.jpg		
LW_LW_M2	1								OWB	PB								
LW_LW_M3	1								OWB	PB								
LW_LW_M4	1								CWB	PB								
LW_LW_M5	1	Peromyscus	U	A	R ear	Silver Maple Swamp	No	19	CWB	PB		bot fly	No	64	14	1743.jpg	WFM	
LW_LW_M6	1	Peromyscus	F	A	L ear	Silver Maple Swamp	No	22	CWB	PB			Yes	70	13	1742.jpg	WFM	

LW_LW_M7	1	Peromyscus	F	A	R ear	Silver Maple Swamp	No	18	CWB	PB				70	14	1741.jpg	WFM
LW_LW_M8	1								OWB	PB		scat					
LW_LW_M9	1								OWB	PB							
LW_LW_M10	1								OWB	PB							
LW_LW_S1	1								OWB	PB							
LW_LW_S2	1	Peromyscus	F	A	L ear	Silver Maple Swamp	No	23	CWB	BS			Yes	79	15	1745.jpg	WFM
LW_LW_S3	1								OWB	PB							
LW_LW_S4	1								CWB	BS							
LW_LW_S5	1								OWB	PB							
LW_LW_S6	1								ONB	BS							
LW_LW_S7	1								OWB	PB							
LW_LW_S8	1								OWB	BS							
LW_LW_S9	1								OWB	PB							
LW_LW_S10	1								OWB	BS		scat					
LW_UW_1A	1	Peromyscus	M	A	L ear	Beech-Hemlock	No	21	CWB	PB			No	74	13	1746-48.jpg	WFM
LW_UW_1B	1	Peromyscus	F	A	L ear	Beech-Hemlock	No	22	CWB	BS		scat	Yes	76	15	1749.jpg	WFM
LW_UW_2A	1								OWB	PB							
LW_UW_2B	1								OWB	BS							
LW_UW_3A	1								OWB	PB							
LW_UW_3B	1								OWB	BS							
LW_UW_4A	1								OWB	PB							
LW_UW_4B	1								CWB	BS							
LW_UW_5A	1								OWB	PB							
LW_UW_5B	1								OWB	BS							
LW_UW_6A	1								OWB	PB							
LW_UW_6B	1								OWB	BS							
LW_UW_7A	1								OWB	PB							
LW_UW_7B	1								OWB	BS							
LW_UW_8A	1								OWB	PB							
LW_UW_8B	1								OWB	BS							
LW_UW_9A	1								OWB	PB							
LW_UW_9B	1								OWB	BS							
LW_UW_10A	1								OWB	PB							
LW_UW_10B	1								OWB	BS							
LW_UW_11A	1								OWB	PB							
LW_UW_11B	1								OWB	BS							
LW_UW_12A	1								OWB	PB							
LW_UW_12B	1								OWB	BS							

LW_UW_13A	1								OWB	PB								
LW_UW_13B	1								OWB	BS								
LW_UW_14A	1	Peromyscus	M	A	No	Sugar Maple-Aspen V	No		CWB	PB		escaped			13	no pic		
LW_UW_14B	1								OWB	BS								
LW_UW_15A	1								OWB	PB								
LW_UW_15B	1								OWB	BS								
LW_LW_N1	2								CWB	PB		blood on trap						
LW_LW_N2	2	Peromyscus	M	A	R ear	Silver Maple Swamp	No	27	CWB	PB				84	17	1766.jpg	WFM	DM
LW_LW_N3	2								OWB	PB								
LW_LW_N4	2								CWB	PB								
LW_LW_N5	2								OWB	PB								
LW_LW_N6	2	Peromyscus	M	A	R ear	Silver Maple Swamp	No	22	CWB	PB				70	15	1767.jpg	WFM	
LW_LW_N7	2								OWB	PB								
LW_LW_N8	2								ONB	PB								
LW_LW_N9	2	Peromyscus	F	A	R ear	Silver Maple Swamp	No	17	CWB	PB				62	15	1768.jpg	WFM	
LW_LW_N10	2	Peromyscus	F	A	R ear	Silver Maple Swamp	No	20	CWB	PB				70	14	1769.jpg	WFM	
LW_LW_M1	2								CWB	BS								
LW_LW_M2	2								CWB	BS								
LW_LW_M3	2								CNB	BS								
LW_LW_M4	2								OWB	BS								
LW_LW_M5	2	Peromyscus	F	SA	Forehea	Silver Maple Swamp	D1	18	CWB	BS			Yes	72	16	1770.jpg	WFM	DM
LW_LW_M6	2								CNB	BS								
LW_LW_M7	2								CNB	BS								
LW_LW_M8	2								OWB	BS								
LW_LW_M9	2								CNB	BS								
LW_LW_M10	2								CWB	BS								
LW_LW_S1	2								OWB	BS								
LW_LW_S2	2								CNB	PB								
LW_LW_S3	2								CWB	BS	Yes							
LW_LW_S4	2								ONB	PB	Yes							
LW_LW_S5	2								CNB	BS								
LW_LW_S6	2								ONB	PB								
LW_LW_S7	2								CWB	BS								
LW_LW_S8	2								CNB	PB								
LW_LW_S9	2								CWB	BS								
LW_LW_S10	2								CNB	PB	Yes							
LW_UW_1A	2								OWB	BS								

LW_UW_1B	2	Peromyscus	F	A	R ear	Beech-Hemlock	D1	20	CWB	PB			Yes	73	17	1771.jpg	WFM	DM
LW_UW_2A	2								OWB	BS								
LW_UW_2B	2								OWB	PB								
LW_UW_3A	2								CWB	BS								
LW_UW_3B	2								OWB	PB								
LW_UW_4A	2								OWB	BS								
LW_UW_4B	2								OWB	PB								
LW_UW_5A	2								OWB	BS								
LW_UW_5B	2								CWB	PB								
LW_UW_6A	2								ONB	BS								
LW_UW_6B	2								OWB	PB								
LW_UW_7A	2								CWB	BS								
LW_UW_7B	2								CWB	PB								
LW_UW_8A	2								OWB	BS								
LW_UW_8B	2								CNB	PB								
LW_UW_9A	2								OWB	BS								
LW_UW_9B	2								OWB	PB								
LW_UW_10A	2								OWB	BS								
LW_UW_10B	2								OWB	PB								
LW_UW_11A	2								OWB	BS								
LW_UW_11B	2	Peromyscus	F	SA	L ear	Maple Sugar-Aspen V	No	17	CWB	PB				73	16	1772.jpg	WFM	DM
LW_UW_12A	2								OWB	BS								
LW_UW_12B	2								OWB	PB								
LW_UW_13A	2	Peromyscus	F	A	L ear	Maple Sugar-Aspen V	No	25	CWB	BS			Yes	73	15	1773.jpg	WFM	
LW_UW_13B	2								OWB	PB								
LW_UW_14A	2								OWB	BS								
LW_UW_14B	2								OWB	PB								
LW_UW_15A	2								CWB	BS		scat & nest						
LW_UW_15B	2								OWB	PB								
LW_LW_N1	3								CNB	PB	Yes							
LW_LW_N2	3								CNB	PB	Yes	slug						
LW_LW_N3	3								CNB	PB	Yes							
LW_LW_N4	3								CNB	PB	Yes							
LW_LW_N5	3								CWB	PB	Yes							
LW_LW_N6	3								CNB	PB	Yes							
LW_LW_N7	3								CNB	PB	Yes							
LW_LW_N8	3								CNB	PB	Yes							
LW_LW_N9	3								CNB	PB	Yes							

LW_LW_N10	3								CNB	PB	Yes							
LW_LW_M1	3								CNB	BS	Yes							
LW_LW_M2	3								CNB	BS	Yes							
LW_LW_M3	3								CNB	BS	Yes							
LW_LW_M4	3								CNB	BS	Yes							
LW_LW_M5	3								CNB	BS	Yes							
LW_LW_M6	3								ONB	BS	Yes							
LW_LW_M7	3								CNB	BS	Yes							
LW_LW_M8	3								CNB	BS	Yes							
LW_LW_M9	3								ONB	BS	Yes							
LW_LW_M10	3								CNB	BS	Yes							
LW_LW_S1	3								ONB	PB	Yes							
LW_LW_S2	3								CNB	BS	Yes							
LW_LW_S3	3								CNB	PB	Yes							
LW_LW_S4	3								CNB	BS	Yes							
LW_LW_S5	3								CNB	PB	Yes							
LW_LW_S6	3								ONB	BS	Yes							
LW_LW_S7	3								CNB	PB	Yes							
LW_LW_S8	3								CNB	BS	Yes							
LW_LW_S9	3								CNB	PB	Yes							
LW_LW_S10	3								CNB	BS	Yes							
LW_UW_1A	3								CWB	BS	Yes							
LW_UW_1B	3								CWB	PB	Yes							
LW_UW_2A	3								CNB	BS	Yes							
LW_UW_2B	3								CNB	PB	Yes							
LW_UW_3A	3								ONB	BS	Yes							
LW_UW_3B	3	Peromyscus	F	A	No	Beech-Hemlock	D1, D2		CWB	PB	Yes		Yes					
LW_UW_4A	3								ONB	BS	Yes							
LW_UW_4B	3								CNB	PB	Yes							
LW_UW_5A	3	Peromyscus	M	A	No	Beech-Hemlock	D1	25	CWB	BS				70	17	1781-1782.jpg	WFM	DM
LW_UW_5B	3								CWB	PB	Yes							
LW_UW_6A	3								CWB	BS	Yes							
LW_UW_6B	3								CNB	PB								
LW_UW_7A	3								CWB	BS	Yes	Scat with Picture				1780.jpg		
LW_UW_7B	3								CNB	PB	Yes							
LW_UW_8A	3								CNB	BS	Yes	severely bent trap, Scat with Picture				1779.jpg		
LW_UW_8B	3								CNB	PB	Yes							

LW_UW_9A	3								OWB	BS	Yes						
LW_UW_9B	3								OWB	PB							
LW_UW_10A	3								CNB	BS	Yes	bent trap					
LW_UW_10B	3								ONB	PB							
LW_UW_11A	3								OWB	BS	Yes						
LW_UW_11B	3	Peromyscus	F	SA	No	Maple Sugar-Aspen V	D2	16	CWB	PB				70	17	1778.jpg	WFM	DM
LW_UW_12A	3								OWB	BS							
LW_UW_12B	3								CWB	PB							
LW_UW_13A	3								OWB	BS							
LW_UW_13B	3								OWB	PB							
LW_UW_14A	3								OWB	BS		scat					
LW_UW_14B	3								OWB	PB							
LW_UW_15A	3								ONB	BS		scat					
LW_UW_15B	3								ONB	PB	Yes						
		21															

Capture Rate

		Day 1	Day 2	Day 3	Total
Lautenbach Woods					
	LW_UW	10%	10%	10%	10%
	LW_LW	23%	17%	0%	13%
Monument Point					
	MP	16%	20%	16%	17%
	Pitfall Traps (3 set)			33%	
Bayshore Blufflands					
	BB_OF	0%	0%	13%*	
	BB_NE	19%	0%	0%	6%
	BB_Wet	11%	0%	0%	6%
	Pitfall Traps (2 set)			0%	

* New Old Field Location 3rd night

Recaptures

	n1	n2	m2	N	SD	95% Lower CI	95% Upper CI
LW_UW	2	3	1	5	1.41	3.59	6.41
LW_LW	5	5	1	17	6.93	10.07	23.93
MP	4	5	3	6.5	0.87	5.63	7.37
BB_OF	no captures						
BB_NE	4	0	0	4	0	4	4
BB_Wet	2	0	0	2	0	2	2

Deer Mice/White Footed Mouse Range for Tail & Ear Length and Weight

		Tail Length	Ear Length	Weight (g)
	White-footed Mous	56-92	12-17	9-33
	Deer Mouse	66-103	16-20	7-27

IF(AND(56<=O19,O19<=92,12<=P19,P19<=17,9<=I19,I19<=33),"WFM","")
IF(AND(66<=O19,O19<=103,16<=P19,P19<=20,7<=I19,I19<=27),"DM","")

	Arctic Shrew	Masked	Pigmy S	Short-ta	Star-nosed Mole
LW_UW (Hemlock-Beech and Sugar Maple	Aspen				
LW_LW (Silver-Maple Swamp)					
MP (Hemlock-Birch-Maple)					
BB_OF					
BB_NE (Cedar-Hemlock)					
BB_Wet (Cedar Swamp, Ash-Sedge)					

	Eastern Chipmunk	Woodch	Thirteen	Eastern	Eastern	Red Sq	Northern Flying Squirrel
LW_UW							
LW_LW							
MP							
BB_OF							
BB_NE							
BB_Wet							

	American Beaver	White-fo	Deer Mo	Souther	Meadow	Muskrat
LW_UW						
LW_LW						
MP						
BB_OF						
BB_NE						
BB_Wet						

	Southern Bog Lem	House M	Meadow	Common Porcupine
LW_UW				
LW_LW				
MP				

S&A, 2014 Natural Habitat	Equivalent DCLT NA	Arctic Shrew	Masked Shrew	Pygmy Shrew	Short-tailed Shrew
Sedge Wetlands	BB_Wet	x	x		
Shrub Wetlands	BB_Wet	x	x		
Cedar Swamp	BB_Wet		x	x	x
Floodplain Forest	LW_LW		x	x	x
Northern Mesic Forest	LW_UW, MP				x
Dry Prairie	BB_Old Fields		x	x	

Based on >=40% probability of occupancy from Stephens & Anderson (2014)

Natural Habitat	Equivalent DCLT NA	Meadow Vole	Meadow Jumping Mouse	Southern Red-backed Vole	White-footed Mouse	Deer Mouse	Southern Bog Lemming
Sedge Wetlands	BB_Wet	x					
Shrub Wetlands	BB_Wet	x	x		x		
Cedar Swamp	BB_Wet		x	x	x	x	x
Floodplain Forest	LW_LW	x	x	x	x		
Northern Mesic Forest	LW_UW, MP		x		x	x	
Dry Prairie	BB_Old Fields		x		x	x	

BB_OF					
BB_NE					
BB_Wet					

	Opossum	Eastern	Snowsh	White-tailed Jackrabbit
LW_UW				
LW_LW				
MP				
BB_OF				
BB_NE				
BB_Wet				

	Coyote	Red Fox	Commo	Black B	Commor	Ermine	Long-tailed Weasel
LW_UW							
LW_LW							
MP							
BB_OF							
BB_NE							
BB_Wet							

	Least Weasel	Mink	America	Striped	Northern	White-tailed Deer
LW_UW						
LW_LW						
MP						
BB_OF						
BB_NE						
BB_Wet						

Natural Area	Habitat	Abbrevia	Veg Cover Type
Lautenbach Woods	Upland Woods	LW_UW	Hemlock-Beech Or Sugar Maple Aspen
	Lowland Woods	LW_LW	Silver Maple Swamp
Monument Point	Monument Point	MP	Hemlock-Birch-Maple
Bayshore Blufflands	Old Fields	BB_OF	Grain grass Or Grain Grass & Hawthorne
Atens-Collins Property	Niagara Escarpment	BB_NE	Cedar-Hemlock
	Wetlands	BB_Wet	Conifer Swamp Or Ash-Sedge Meadow

Natural Habitat	Equivalent DCLT NA	^Eastern Chipmunk	*Thirteen-lined Ground Squirrel
Sedge Wetlands	BB_Wet		
Shrub Wetlands	BB_Wet		
Cedar Swamp	BB_Wet		
Floodplain Forest	LW_LW		
Northern Mesic Forest	LW_UW, MP		
Dry Prairie	BB_Old Fields		x

	Eastern Gray Squirrel	Thirteen-lined Ground Squirrel	Raccoon	Porcupine	White-tailed Deer	Opposum	Rodent sp.
Monument Point_WC1*	x (black morph)						
Monument Point_WC2^	x		x				x
Aten-Collins Easement North			x		x	x	
Aten-Collins Easement South			x	x	x		
Aten-Collins Spring			x				
Aten-Collins Wetland			x		x		
Aten-Collins Trail	x		x		x		
Bayshore Blufflands Old Field		x					
*(beech tree shelf with bird seed and peanut butter)							
^(topped tree with carnivore pellets and bird seed)							

Conservation Master Plan for Bay Shore Blufflands State Natural Area

December 2014

Draft Plant Species List

2014, Dan Collins and Nancy Aten

Funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA13NOS4190043

WISCONSIN COASTAL MANAGEMENT PROGRAM

Draft Plant Species List for Bay Shore Blufflands	
Period:	Field observations 2001 through 2014
Location:	Door County, Wisconsin, USA, Bayshore Blufflands (southern unit), SNA #377,
	Includes parts of T28N-R26E, Sections 5 and 6, and parts of T29N-R26E, Sections 29, 31, 32.
	Location town and range may need to add Standish easment tracts and others
Area:	Approximately 500 acres, 1236 hectares
Last update:	26-Dec-2014
Key use on species list:	
NA	Nancy Aten
PM	Paul Mahlberg
MS	Mary Standish
A-C	Aten-Collins Tracts, 120 acres
BB	Bayshore Bluffland DCLT, Standish tracts
	Green highlighted items need verification
Notes:	FQA values (mean C and FQI) for a site must be considered in relation to other sites within the same region. As this method becomes more widely used and the range of FQA values for a given region becomes known, future site values will be more meaningful. In order to develop a database of site values across the state, we encourage users of the WFQA methodology to share their results with us and the Wisconsin DNR via a reporting page that will be developed for this website.
	A computer program to apply the Wisconsin Floristic Quality Assessment method is currently under development by the Wisconsin DNR. A reporting page for collecting WFQA results is also being developed. These will both be accessible from the WIS-DNR's website in the future.

Bay Shore Blufflands Plant Species List - Draft 2014

Species	Common Name	C (UWSP)	ID Source	Location	Notes	Photo file link	Photo http://picasaweb.google.com/atencollins/
Abies balsamea (L.) Mill.	Balsam fir	5	NA, PM	A-C, BB			
Acer negundo L.	Boxelder	0	NA	A-C, BB			
Acer rubra	Red Maple	5	DC	BB	Upper BB trail, s. edge		
Acer saccharinum L.	Silver Maple	2	bb wiki	BB			
Acer saccharum Marshall var. saccharum	Sugar maple	5	NA, PM	A-C, BB		Sugar maple	2010October10DoorCounty#5532035737709300178
Acer spicatum Lam.	Mountain Maple	6	NA	A-C			
Actaea pachypoda Elliott	White baneberry	6	NA	A-C			
Actaea rubra	Red baneberry	7	NA	A-C			
Adiantum pedatum L.	Maidenhair fern	7	NA	A-C		Maidenhair fern	2010May31DoorCounty#5477582810761902066
Adlumia fungosa (Aiton) Greene ex Britton, Sterns & Poggenb.	Climbing fumitory	7	NA	A-C		Climbing fumitory	2010November16DoorCounty#5542836452703214498
Alopecurus aequalis	Short-awn foxtail	6	NA	A-C	e. end eph, n. of new bw		
Allium tricoccum Sol.	Wild leek	6	NA, DC	A-C		Wild leek	
Alnus incana (L.) Moench subsp. rugosa (Du Roi) R.T.Clausen	Swamp alder	4	PM	A-C	Speckled Alder per pm		
Amelanchier laevis Wiegand	Amelanchier	6	NA	A-C		4-Jul-10	
Amphicarpaea bracteata	Hog peanut	5	PM, DC	A-C			
Anemone acutiloba (DC.) G.Lawson	Sharp-lobed hepatica	7	NA, DC	A-C, BB		Sharp-lobed hepatica	
Anemone canadensis L.	Canada anemone	4	NA	A-C			
Anemone cylindrica	Thimbleweed	6	DC	BB	south boundary trail		
Anemone quinquefolia L. var. quinquefolia	Wood anemone	6	MS			Wood anemone	
Anemone virginiana	Tall Thimbleweed	5	DC	A-C	d'way, removed A. cylindrica		
Apocynum androsaemifolium L.	Dogbane	5	NA				
Aquilegia canadensis L.	Columbine	5	NA	A-C		Columbine	2010May31DoorCounty#5477574256110308610
Aralia nudicaulis L.	Wild sarsaparilla	6	NA, PM	A-C		Wild sarsaparilla	2010May24DoorCounty#5476331761192536274
Aralia racemosa	Spikenard	7	NA	A-C		Spikenard	2002JulySeptemberDoorCounty#5484705288658156994
Arisaema triphyllum (L.) Schott subsp. triphyllum	Jack-in-the-pulpit	5	NA	A-C			
Asclepias incarnata	Swamp Milkweed	5	NA	A-C	300' e. of b'shore at t'pole	7-Aug-13	pic exists
Asclepias exaltata	Poke milkweed	7				4-Jul-10	
Asclepias syriaca L.	Common milkweed	1	NA	A-C			
Asplenium rhizophyllum L.	Walking fern	10	NA, other			Walking fern	2010November16DoorCounty#5542836449407101586
Aster boreale	Northern bog aster	10	NA	A-C	far side Myst bridge	6-Sep-11	
Aster cordifolius	Common blue wood aster	6	NA	A-C	Maybe a. ciliolatus, a. cordifolius not known in D.C.		
Aster drummondii	Drummond's aster	4	NA	A-C	Above Escarpment at C'ville & Ledge Rd	photo 11/8/2012	
Aster lateriflorus (L.) Britton	Goblet aster	3					
Aster macrophyllus L.	Largeleaf aster	4	NA, PM	A-C		Largeleaf aster	2003September06DoorCounty#5484708013717192402
Aster novae-angliae	New England aster	3	DC				
Athyrium filix-femina (L.) Roth ex Mert. var. angustum (Willd.) G.Lawson	Lady Fern	5	NA	A-C			
Bidens frondosus		1	NA	A-C	walk toward myst bridge	9/6/2011 photo	
Bidens connatus		6	NA	A-C	walk toward myst bridge	9/6/2011 photo	

Bay Shore Blufflands Plant Species List - Draft 2014

Species	Common Name	C (UWSP)	ID Source	Location	Notes	Photo file link	Photo http://picasaweb.google.com/atencollins/
Bidens cernuus	Nodding burr-marigold	4	NA	A-C	walk toward myst bridge	9/6/2011 photo	
Betula papyrifera Marshall	Paper Birch	3	NA	A-C			
Bolboschoenus fluviatilis (Torr.) Soják	River bulrush	6			Herb. Specimen	River bulrush	2010August28DoorCounty#5510904365917101522
Botrychium virginianum (L.) Sw.	Rattlesnake fern	6	NA, PM	A-C		Rattlesnake fern	
Bouteloua curtipendula	Side oats grama	6					
Calamagrostis canadensis (Michx.) P.Beauv.	Blue joint grass	5	DC				
Caltha palustris L.	Marsh marigold	6	NA	A-C		Marsh marigold	
Campanula aparinoides	Marsh bellflower	7	NA			22-Jul-07	
Cardamine bulbosa	Spring cress	6			Needs verification		
Carex aquatilis Wahlenb. var. aquatilis	Water sedge	7	DC	A-C	Herb. Specimen		
Carex arcta Boott	Bear sedge	8	MS	A-C	MS Notebook as arietinum companion with ? On 4/30/01		
Carex aurea Nutt.	elk sedge, golden fruited sedge	5	NA	A-C	Herb. Specimen		
Carex comosa Boott	Bristly sedge	5	DC	A-C	Herb. Specimen	s. myst bridge	
Carex cryptolepis	small yellow sedge	8	JK	A-C	Herb. Specimen		
Carex bebbii	Bebb's Sedge	4					
Carex blanda Dewey	Wood sedge	3	NA	A-C			
Carex cephalophora	Short-headed sedge	4	DC	A-C	Herb. Specimen		
Carex deweyana Schwein. var. deweyana	Dewey's sedge	7	DC	A-C	Herb. Specimen		
Carex disperma		10	DC, NA	A-C	Herb. Specimen, high tuft / log pile in eph.		
Carex diandra	check this specimen	9	DC	A-C	Herb. Spec, w. edge pond, forming tussock		
Carex eburnea Boott	Bristle-leaf sedge	8	NA, PM	A-C			
Carex Gracillima	Graceful Sedge	5	NA	A-C	Herb. Specimen, e. of old board walk		
Carex Granularis	limestone medow sedge	3	DC	A-C	Herb. Specimen		
Carex Hirtafolia		5	DC				
Carex Hystericina	Porcuepine sedge	3	DC	A-C	Herb. Specimen		
Carex interior	Interior Sedge	7	DC	A-C	Herb. Spec. front pond s.		
Carex intumenscens	Shining Bur sedge	5	DC	A-C	Herb. Specimen, e. of old board walk		
Carex lacustris	Common lake sedge	6	DC		e. of Bay Shore	Common lake sedge	
Carex lasiocarpa Ehrh. subsp. americana (Fernald) D.Löve & Bernard		9	NA	A-C	Herb. Specimen		
Carex lupulina		6	DC	A-C	checking with Anton		
Carex pensylvanica Lam.	Penn sedge	3	NA	A-C			
Carex pseudocyperus	cypress-like sedge	8	DC	A-C	Herb. Spec.		
Carex stipata	Common Fox sedge	2	DC	A-C	Herb Spec, trail behind lodge		
Carex stricta	Tussock sedge	7	NA	A-C	Herb. Specimen		
Carex tenara	Marsh straw sedge	4	DC	A-C	Herb. Specimen		
Carex umbellata	Early oak sedge	6	DC	A-C	Herb. Specimen		
Carex vulpinoidea Michx.	Fox sedge	2	DC	A-C	Herb. Specimen		
Carpinus caroliniana Walter subsp. virginiana (Marshall) Furlow	Muscle wood, Blue beech	6			esc. at curve in W. Carlsville Rd.		
Ceanothus americnus	New Jersey Tea	9	NA	A-C			

Bay Shore Blufflands Plant Species List - Draft 2014

Species	Common Name	C (UWSP)	ID Source	Location	Notes	Photo file link	Photo http://picasaweb.google.com/atencollins/
Celastrus scandens L.	Bittersweet	3				Bittersweet	2010October10DoorCounty#5532036082265794258
Chelone glabra	Turtlehead	7	DC			Turtlehead	2010September12DoorCounty#5516602271340000434
Circaea alpina L. subsp. alpina	Alpine Enchanter's Nightshade	7	NA, PM	A-C			
Circaea lutetiana L. subsp. canadensis (L.) Asch. & Magnus	Enchanter's Nightshade	2	PM	A-C			
Clinopodium vulgare	Wild Basil	3	DC	A-C	d'way		
Clintonia borealis (Aiton) Raf.	Blue-bead-lily	7	PM		Upland 1/4 m. e. of lost creek		
Comandra umbellata (L.) Nutt. subsp. umbellata	Bastard-toadflax	6	NA, MS	A-C		Bastard-toadflax	2009May26DoorCounty#5476361430614809906
Comarum palustre L.	marsh cinquefoil	8				16-Jul-10	
Conyza canadensis (L.) Cronquist var. canadensis	Fleabane	0			Needs verification		
Coptis trifolia (L.) Salisb.	Goldthread	8	NA	A-C			
Corallorhiza maculata (Raf.) Raf.	Spotted coralroot	7	MS				
Corallorhiza striata Lindl. var. striata	Striped coralroot	9	MS	White C. F	per MS 2001 notes "across (White) Cedar from Brooks"	25-May-02	
Corallorhiza trifida Châtel.	Early coralroot	7	MS, DC	White C. F	per MS notes 5/28/01 on Standish		
Cornus alternifolia L.f.	Alternate-leaved dogwood	7					
Cornus amomum Mill. var. schuetzeana (C.A.Mey.) Rickett	Silky dogwood	4					
Cornus canadensis L.	Bunch berry	7	PM	A-C		Bunch berry	2010May31DoorCounty#5477579458908937010
Cornus racemosa Lam.	Gray dogwood	2					
Cornus rugosa	Round-leaved dogwood	7	NA	A-C		10-Oct-10	
Cornus stolonifera Michx.	Red osier dogwood	3	NA	A-C			
Corylus americana Walter	Amercian Hazelnut	5	PM	A-C			
Crataegus L.	Hawthorn sp.	2	NA		3 spp per Aten		
Cryptotaenia canadensis (L.) DC.	Canadian Honewort	4	NA	A-C		7/2/11	
Cynoglossum boreale Fernald	Northern wild comfrey	8	NA, PM	A-C			
Cypripedium arietinum R.Br.	Ram's Head Lady-slipper	10	NA, PM	undisclosed		Ram's Head Lady-slipp	2009May26DoorCounty#5476365236266188082
Cypripedium parviflorum Salisb. var. makasin (Farw.) Sheviak	Small yellow lady-slipper	9	DC	undisclosed			
Cypripedium parviflorum Salisb. var. pubescens (Willd.) O.W.Knight	Large yellow lady-slipper	9	PM	undisclosed		Large yellow lady-slipp	2009May26DoorCounty#5476364064228959890
Cystopteris bulbifera (L.) Bernh.	Bulblet fern	8	NA, PM	A-C		Bulblet fern	2010May24DoorCounty#5476331763264109506
Deschampsia cespitosa	tufted hair grass	10	NA	A-C	Herb. Spec.		south end eph. Wetland, in wet area with spearwart
Desmodium glutinosum (Muhl. ex Willd.) A.W.Wood	pointed tick-trefoil	6	NA	BB	photo at BB on 7/29/2001		
Diervilla lonicera Mill.	Northern bush honeysuckle	6	NA, PM	A-C			
Diphasiastrum complanatum (L.) Holub	running cedar,	7	DC	A-C	Herb. Specimen		
Dirca palustris L.	Leatherwood	9	NA, DC			Leatherwood	2010October10DoorCounty#5532036087455656498
Dryopteris cristata (L.) A.Gray	Crested wood fern	7	PM	A-C			

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Dryopteris intermedia (Muhl.)	Spiney woodfern	7	DC	A-C	Verify name/fqi w/ above, Hebr. Spec.		
Eleocharis acicularis (L.) Roem. & Schult.	Needle spike-rush	5				Needle spike-rush	2010August10DoorCounty#5504978972717615170
Eleocharis palustris (L.) Roem. & Schult.	common spike-rush	6			Herb. Specimen		
Elymus hystrix	Bottlebrush grass	6					
Epifagus virginiana	Beechdrops	9	NA	A-C	below escarpment in large beechs		
Epilobium ciliatum	Hairy Willow-herb	3	NA	A-C	Stream margine, bell bridge path, Herb spec.		
Equisetum arvense L.	Common horsetail	1	DC				
Equisetum scirpoides Michx.	Dwarf scouring rush	7		A-C			
Equisetum variegatum Schleich. ex F.Weber & D.Mohr subsp. variegatum	Variegated horsetail	7	bb wiki				
Erigeron strigosus	daisy fleabane	2	NA	A-C			
Erigeron philadelphicus L.	Common fleabane	2	NA			Jun-11	
Erythronium albidum Nutt.	Trout Lily, White	7	DC	BB	escarpment base, may be yellow		
Eupatorium perfoliatum	Common boneset	6				12-Sep-10	
Eupatorium purpureum	Purple joe-pye weed	6				12-Sep-10	
Euthamia graminifolia	Grass-Leaved Goldenrod	4		A-C	n. woods trail, e. side		
Fagus grandifolia Ehrh.	American beech	8	PM	A-C		American beech	2010October10DoorCounty#5532035747032068322
Fragaria virginiana Duchesne	Wild Strawberry	1	NA	A-C		Wild Strawberry	2009May26DoorCounty#5476360708601122866
Fraxinus nigra Marshall	Black ash	8				Black ash	
Fraxinus pennsylvanica Marshall	Green ash	2					
Galium lanceolatum Torr.	Lance leaved wild licorice	7	NA	A-C		7/2/11	
Galium triflorum Michx.	Sweet-scented bedstraw	5					
Geranium bicknellii	Bicknell's Cranesbill	4		A-C		5/31/99	
Geranium maculatum L.	Geranium	4					
Geranium robertianum L.	Herb robert	2					
Geum canadense Jacq.	White avens	2					
Glyceria borealis (Nash) Batch.	Northern manna grass	8				Northern manna grass	2010September25DoorCounty#5523901238548123826
Glyceria septentrionalis Hitchc.	floating manna grass	8			Needs verification		
Glyceria striata (Lam.) Hitchc.	fowl manna grass	4	NA	A-C	Board walk		
Gymnocarpium dryopteris (L.) Newman	Oak Fern	7	NA	A-C			
Hackelia virginiana (L.) I.M.Johnst.	Stickseed	3			Needs verification		
Hamamelis virginiana L.	Witchhazel	7	NA	A-C		Witchhazel	2010October10DoorCounty#5532035414787398530
Heracleum lanatum Michx.	Cow parsnip	3					
Hippuris vulgaris L.	Mare's tail	10	NA	A-C	Herb. Specimen		
Huperzia lucidula (Michx.) Trevis.	Shining club moss	7					
Hydrophyllum appendiculatum Michx.	Great waterleaf	8					
Hydrophyllum virginianum L.	Virginia waterleaf	4					
Hypericum pyramidatum	Great St. John's wort	6					
Ilex mucronata (L.) M.Powell, V.Savolainen & S.Andrews	Mountain Holly	8		A-C	At Girls rock, needs spp. Verif.		
Impatiens capensis Meerb.	Jewelweed	2	PM	A-C		12-Sep-10	
Iris lacustris Nutt.	Dwarf Lake Iris	9	MS	Standish			

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Iris versicolor L.	Blue flag	5	DC				
Juncus alpinoarticulatus Chaix	Northern green rush	6	JK			Northern green rush	2010May31DoorCounty#5477586032198511170
Juncus tenuis	path rush	1			everywhere		
Juniperus communis L. var. depressa Pursh	Common juniper	3	NA	A-C			
Juniperus horizontalis Moench	Creeping juniper	9	DC	BB	S. of Carlsville, 1/4 m e. of Bayshore		
Lactuca canadensis L.	Wild lettuce	2	PM	A-C			
Larix laricina (Du Roi) K.Koch	Tamarack	8	NA	A-C			
Lathrus venosus	Forest pea	6	NA	A-C	Talus slope		
Lemna minor	Small Duckweed	4	DC	A-C	Pond		
Leucophysalis grandiflora (Hook.) Rydb.	Large-flowered ground-cherry	5	NA, MS				
Lilium philadelphicum L.	Wood lilly	9	DC, PM	DCLT on B'shore		7/3/2006, 6/30/2011	
Linnaea borealis L. subsp. americana (Forbes) Hultén ex R.T.Clausen	Twin flower	9	NA, PM	A-C		Twin flower	2010May31DoorCounty#5477582803423773234
Lonicera canadensis W.Bartram ex Marshall	American Fly Honeysuckle	8	PM	A-C		American Fly Honeysu	2010May31DoorCounty#5477582804691031474
Ludwigia palustris (L.) Elliott	Marsh purslane	4	DC	A-C	Herb. Spec. Found at wet creek at d'way w.		
Lycopodium clavatum L.	Running pine	6	DC	A-C			
Lycopus americanus Muhl. ex W.P.C.Barton	Water-Horehound	4	NA	A-C		2-Jul-11	
Lysimachia ciliata L.	Fringed loosestrife	5	NA	A-C		Fringed loosestrife	2007DoorCounty#5480415638900867362
Lysimachia thyrsiflora L.	Swamp loostrife	7				Swamp loostrife	2010June27DoorCounty#5487869622758908642
Maianthemum canadense Desf.	Canada Mayflower	5	NA, PM	A-C		2-May-10	Canada Mayflower
Maianthemum racemosum (L.) Link subsp. racemosum	False Solomon's seal	5	NA, PM	A-C	foot of esc. at bend in W Carlsvillel		
Maianthemum stellatum (L.) Link	Starry false Solomon's seal	5	NA, PM	A-C		Starry false Solomon's seal	
Maianthemum trifolium (L.) Sloboda	three-leaf Solomon's-seal	10	DC	A-C	Trail to Myst & s.w. pond margin		
Matteuccia struthiopteris (L.) Todaro var. pensylvanica (Willd.) C.V.Morton	Ostrich fern	5	NA, PM	A-C			
Mentha arvensis L. var. canadensis (L.) Kuntze	Wild Mint	3	PM				
Mitella diphylla	Two-leaved mitrewort	8	DC	A-C	Herb. Specimen	Two-leaved mitrewort	2011May30DoorCounty#5612946253227949490
Mitella nuda L.	naked miterwort, small bishop's-cap	9	NA			naked miterwort, small	2010May24DoorCounty#5476332479922612114
Monarda fistulosa L. subsp. fistulosa	Wild Bergamot	3					
Monotropa uniflora	Indian-pipe	5	NA		Stage-coach tail, per NA		
Muhlenbergia glomerata (Willd.) Trin.	Marsh mully	9	DC	A-C	Herb. Specimen (tb confirmed)		
Oenothera parvilora	Small-Flowereed Evening-Primrose	2	DC	A-C	d'way		
Onoclea sensibilis L.	Sensitive fern	5	NA, PM	A-C			
Oryzopsis asperifolia (Michx.)	Rough-leaved rice grass	6	DC	A-C	Herb. Specimen		
Osmorhiza claytonii (Michx.) C.B.Clarke	Hairy Sweet cicely	5	other				

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Osmorhiza longistylis (Torr.) DC.	Sweet cicely	4			could be O. claytonii, at foot of esc. at bend in W. Carlsville Rd		
Osmunda cinnamomea L.	Cinnamon fern	7	NA	A-C			
Osmunda regalis L. var. spectabilis (Willd.) A.Gray	Royal fern	7				Royal fern	2010May31DoorCounty#5477586033715699122
Ostrya virginiana (Mill.) K.Koch	Ironwood	5				Ironwood	2006July03DoorCounty#5484692590879000594
Oxalis stricta L.	Wood sorrel	0					
Panax quinquefolius L.	American Ginseng	10				American Ginseng	2010July4DoorCounty#5490963965853262562
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper	5	NA	A-C			
Pedicularis canadensis L. subsp. canadensis	Swamp Lousewort, Wood-betony	8	NA	A-C		Swamp Lousewort, W	2009May26DoorCounty#5476364471238688370
Petasites frigidus (L.) Fr. var. palmatus (Aiton) Cronquist	Northern sweet-colt's-foot	7	NA,PM	A-C		Northern sweet-colt's-f	2002May25DoorCounty#5484701311440123090
Phragmites australis (Cav.) Trin. ex Steud.	Giant reed grass	1	NA	A-C	"Native"		
Picea glauca (Moench) Voss	White spruce	7	NA	A-C			
Picea mariana (Mill.) Britton, Sterns & Poggenb.	Black spruce	8	NA	A-C			
Pilea pumila	Canada Clearweed	3	DC	A-C			
Pinus resinosa Aiton	Red pine	7	NA, PM	A-C		Red pine	2010October10DoorCounty#5532036496523843938
Pinus strobus L.	White pine	5	NA, PM	A-C			
Platanthera hookeri (Torr. ex A.Gray) Lindl.	Hooker's Orchid	9	NA, PM			Hooker's Orchid	2009May26DoorCounty#5476363104277057602
Polygala paucifolia Willd.	Gaywings	7	NA	A-C			
Polygonatum biflorum (Walter) Elliott	Solomon's seal	4	PM				
Polygonum amphibium L.	Water smartweed	5	DC			Water smartweed	2010August10DoorCounty#5504978970316720994
Polypodium virginianum L.	Common polypodium	9	NA	A-C			
Populus balsamifera L. subsp. Balsamifera	Balsam poplar	4	DC	A-C	s. of eph margin at trail		
Populus deltoides Bartram ex Marshall subsp. monilifera (Aiton) Eckenw.	Cottonwood	2	DC				
Populus grandidentata Michx.	Large tooth aspen	3	MS				
Creeping spearwort	Quaking aspen	2	NA	A-C			
Prenanthes alba	White lettuce	5	NA, PM	A-C			
Prunella vulgaris	Heal-All	1	DC	A-C	d'way		
Prunus pensylvanica L. f.	Pin cheery	4	DC	BB	n. of upper parking lot		
Prunus serotina Ehrh.	Black cherry	3	NA	A-C			
Prunus virginiana L. var. virginiana	Chokecherry	3			Needs verification		
Pteridium aquilinum (L.) Kuhn var. latiusculum (Desv.) Underw. ex A.Heller	Bracken fern	2	NA, PM	A-C			
Pyrola chlorantha	Green-Flowered Shin-Leaf	7	NA	A-C	E of Girls Rock, sp. needs conf.		photo exists, 6/4/2011
Quercus bicolor Willd.	Swamp white oak	7	bb wiki		Needs verification, near driveway and Carlsville, not listed in DC		
Quercus rubra L.	Red oak	5				10-Oct-10	

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Quercus macrocarpa	Bur Oak	5	DC	A-C	might have been planted?		c'ville rd, just e. of 6040 d'way
Rhamnus alnifolia	Alder leaved buckthorn	8	NA	A-C	Herb spec		s. end of eph wetland
Ranuculus flammula var. reptans	Creeping spearwort	9	DC	A-C	Herb. Specimens, both reptans & ovalis	photo	
Ranuculus sceleratus	Cursed crowfoot	3	DC	A-C	inlet, muddy flat	Cursed crowfoot	2011May30DoorCounty#5612945515842027618
Ranunculus aquatilis L. var. diffusus With.	white water crowfoot	8				white water crowfoot	2010August10DoorCounty#5504979224197273474
Ranunculus flabellaris Raf.	Yellow water crowfoot	8				picture 6/6/11	
Ranunculus hispidus Michx. var. nitidus (Chapm.) T.Duncan	Swamp buttercup	5				Swamp buttercup	2010June27DoorCounty#5487670119515990098
Ranunculus recurvatus Poir. var. recurvatus	Hooked Buttercup	5	NA		Herb. Specimen		
Ratibidia pinnata	Yellow Coneflower	4	DC	A-C	near drive, (or cut-leaved?)need var.		
Rhus hirta (L.) Sudw.	Staghorn sumac	2	NA	A-C			
Ribes americanum Mill.	American black currant	4	NA	A-C	Lost Creek, herb spec,	American black curran	2011May30DoorCounty#5612946360184744978
Ribes cynosbati L.	Prickly wild gooseberry	3	NA	A-C			
Rosa blanda Aiton	Rose	4	NA	A-C	Check sp.		
Rubus idaeus L. var. strigosus (Michx.) Maxim.	Red raspberry	3	DC	A-C			
Rubus occidentalis L.	Black raspberry	2	DC	A-C			
Rubus parviflorus Nutt.	Thimble Berry	7	DC	A-C			
Rubus pubescens Raf.	Dwarf Red Raspberry	7	NA	A-C		Dwarf Red Raspberry	2010June27DoorCounty#5487669115172091154
Rudbeckia hirta	Black-eyed Susan	4	DC	A-C	d'way		
Rumex (xx)	Water Dock	2		A-C	could be R. britannica (outlet) or verticillatus		
Salix candida	Sage Willow	10	DM	A-C	Herb. Specimen		
Salix bebbiana Sarg.	Beaked willow, Bebb's willow	7	DC	A-C	Herb. Specimen		
Salix discolor Muhl.	Pussy willow	2	NA	A-C			
Salix lucida	Shining willow	5	NA	A-C	e. of Bay Shore 10m		
Salix nigra Marshall	Black willow	4			Needs verification		
Sanguinaria canadensis	Bloodroot	6	NA	A-C	At curve in road on escarpment		
Sanicual gregaria	Clustered snakeroot	3	NA	A-C	Above Escarpment at C'ville & Ledge Rd	7-Jun-12	
Sanicula marilandica L.	Black snakeroot	5	NA	A-C			
Schoenoplectus acutus (Muhl. ex Bigelow) A.Löve & D.Löve var. acutus	hard-stem bulrush	6	DC	A-C		hard-stem bulrush	2010June27DoorCounty#5487669725575036882
Scutellaria galericulata L.	Marsh skullcap	5					
Scutellaria laeriflora L.	Mad-dog skull cap	5	NA	A-C	path at bell bridge, Herb. Spec.		
Shepherdia canadensis (L.) Nutt.	Russet buffalo-berry	7	NA, PM	A-C			
Sium suave Walter	water-parsnip	5	NA			12-Sep-10	
Smilax ecirrhata S.Watson	upright carrion-flower	5	DC		E of Girls Rock, sp.		
Smilax herbacea L.	Carrion flower	5	PM		Not known in DC, photo by J. Stiefel		
Smilax lasioneura Hook.	Carrion flower	4			Needs verification		

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Solidago canadensis	Common goldenrod	1					
Solidago flexicaulis L.	Zigzag goldenrod	6	PM	A-C			
Solidago gigantia	Smooth goldenrod	3	NA	A-C	e. of Bay Shore 30m	photo on 7/25/12	
Solidago speciosa	Showy goldenrod	5	NA	A-C			
Sorghastrum nutans	Indian grass	5			Needs verification		
Sparganium angustafolium	Narrow-leaved burr read	9	NA	A-C	Near outlet of pond,	Narrow-leaved burr rea	2010August10DoorCounty#5504979231662906050
Staphylea trifolia L.	American bladdernut	7			Needs verification		
Streptopus lanceolatus (Aiton) Reveal var. longipes (Fernald) Reveal	Twisted stalk	7	PM	A-C	Called Streptopus roseus Michx. By PM	Twisted stalk	2009May26DoorCounty#5476361899254134034
Symphoricarpos albus (L.) S.F.Blake	Snowberry	7	NA, PM	A-C			
Taxus canadensis Marshall	Canada yew	10		A-C	Near bell bridge		
Thalictrum dioicum L.	Early meadow-rue	7	NA	A-C			
Thuja occidentalis L.	white cedar	9	NA	A-C			
Tilia americana L. var. americana	Basswood	5	NA	A-C			
Toxicodendron radicans (L.) Kuntze subsp. negundo (Greene) Gillis	Poison ivy	4	NA, PM	A-C			
Trientalis borealis Raf. subsp. borealis	Starflower	7	NA, PM	A-C		Starflower	2010May31DoorCounty#5477586849320468434
Trillium grandiflorum (Michx.) Salisb.	Large Flowered Trillium	6	NA, PM	A-C		Large Flowered Trillium	
Triosteum aurantiacum E.P.Bicknell	Orange fruited Horse gentian	5	NA	A-C		Orange fruited Horse g	2010May24DoorCounty#5476333328347403330
Tsuga canadensis (L.) Carrière	Hemlock	8	DC				
Typha latifolia L.	Broad-leaved cattail	1	DC				
Ulmus americana L.	American elm	3					
Ulmus rubra Muhl.	Slippery elm	4			Needs verification		
Uvularia grandiflora	Bellwort	7	NA, PM	A-C		2-May-10	
Vaccinium myrtilloides Michx.	Low Blueberry	6	NA	A-C	Vaccinim vacillans per Aten		
Veronica americana	American speedwell	9	NA	A-C	C'ville Rd spring to creek	7-Jun-12	
Veronica scutellata	Marsh speedwell	5	NA	A-C	Herb. Spec. Found at wet creek at outlet of eph.		
Viburnum acerifolium L.	Maple-leaved viburnum	7	NA			Jun-11	
Viburnum lentago L.	Nannyberry	4	PM				
Viburnum opulus L. var. trilobum (Marshall) McAtee	Highbush cranberry	6	NA, PM	A-C		Highbush cranberry	2010May31DoorCounty#5477586971289395266
Viburnum rafinesquianum Schult.	Downy Arrowwood	7	NA	A-C			
Viola blanda	Sweet White Violet	5	NA	A-C	Trail e. end of eph, herb. spec.		
Viola cucullata Aiton	Blue marsh violet	7	NA	A-C	Myst bridge trail		
Viola labradorica Schrank	alpine violet, dog violet	4	NA	A-C	Viola conspersa per Aten		
Viola pubescens Aiton	Yellow violet	5	NA	A-C		Yellow violet	2009May26DoorCounty#5476363580134991698
Viola renifolia A.Gray	kidney-leaved violet, white violet	7	NA	A-C	Rock garden trail?		
Viola rostrata Pursh	Long-spured violet	8	bb wiki				
Viola sororia Willd.	Common blue violet	3					
Vitis riparia Michx.	Grape	2					
Zizia aurea (L.) W.D.J.Koch	common golden alexanders	7	NA	A-C			

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	sum of Cs	**1587**					
	n	**290**		**08/24/14**			
	sqrt n	**17.03**					
	mean C	**5.47**					
	FQI (meanC * sqrt n)	**93.19**	**87.36**	**40771**			
Unlikely but reported, or possible but not confirmed							
Cystopteris protrusa (Weath.) Blasdell	Fragile fern	6			Needs verification		
Lycopodim clavatum or Lycopodim spp.	running pine				Species confirmation		
Orobanch uniflora L.	Cancer root	6					
Thalictrum dasycarpum	Tall meadow-rue						
Urtica dioica	Stinging nettle						
Verbena hastata	Blue Vervain						
Carex oligosperma Michx.	Few seeded hop sedge	10			Called "Bog sedge" by PM, not know in Door County, maybe in 5/26/09 photo	Not sure if this is anyth	Few seeded hop sedge
Silax sericia	Silkey willow				In BB, F south of creek pool		
Salix eriocephala Michx.							
Lobelia kalmii L	Kalm's lobelia	9					
Betula alleghaniensis Britton	Yellow Birch	7	PM	A-C			
Carya cordiformis	Yellowbud hickory						
Chara sp.	Muskgrasses, in pond		DC	A-C	We have it, but no FQI found		
Agrostis stolonifera	Spreading bent gras				We have it, seems like native, but no FQI		
Claytonia caroliniana Michx.	Spring Beauty	6			Needs verification		
Muhlenbergia racemosa							
Juniperus virginiana L. var. virginiana	Red Cedar	3					
Lathyrus Ochroleucus	Pale vetchling	6			On escarpment, tbd.		
poa paludigena							