

# Implementing Conservation Plans for Avian Species of Concern: Submitted to Audubon Minnesota

**Submitted by:**

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**TABLE OF CONTENTS**

PROJECT OVERVIEW..... 1

METHODS..... 1

    Survey Design and Procedures..... 1

    Tern Surveys..... 3

    Vegetation Surveys ..... 4

RESULTS AND DISCUSSION..... 4

    IBA-Specific Survey Results ..... 4

        Agassiz National Wildlife Refuge (1) ..... 4

        Camp Ripley-Pillsbury-Lake Alexander (7) ..... 5

        Carlos Avery (8) and Higgins Lake ..... 6

        Chippewa Plains (9)..... 7

        Kittson-Roseau Aspen Parkland (20)..... 7

        Lac Qui Parle-Big Stone (21)..... 8

        Lake Maria State Park- Henry Larson County Forest (23) ..... 9

        Lake Osakis (25) ..... 9

        Mille Lacs (28) ..... 10

        North Metro Mississippi River (33) ..... 11

        Sherburne National Wildlife Refuge (41) ..... 11

        Swan Lake (48) ..... 12

        Thief Lake (50)..... 13

        Whitewater Valleys (57)..... 14

OVERALL SUMMARY ..... 15

REFERENCES ..... 16

**LIST OF TABLES**

**Table 1.** List of potential Important Bird Area (IBA) black tern monitoring locations for the 2020 field season..... 3

**LIST OF FIGURES**

**Figure 1.** Location of Audubon’s Important Bird Areas (IBAs; MN\_IBA\_Boundaries) in Minnesota..... 2

**Figure 2.** Potential black tern monitoring survey locations ( $n = 4$ ; AG.1 – AG.4) established in the Agassiz NWR IBA in 2020..... 5

**Figure 3.** Potential black tern monitoring survey locations ( $n = 3$ ; CA.1, CA.2, and HL.1) established in and just outside of the Carlos Avery IBA in 2020. .... 6

**Figure 4.** Potential black tern monitoring survey location ( $n = 1$ ; KR.1) established in the Kittson-Roseau IBA in 2020..... 8

**Figure 5.** Potential black tern monitoring survey location ( $n = 1$ ; LQP.1) established in the Lac Qui Parle-Big Stone IBA in 2020..... 9

**Figure 6.** Potential black tern monitoring survey location ( $n = 1$ ; ML.1) established in the Lac Qui Parle-Big Stone IBA in 2020..... 11

**Figure 7.** Potential black tern monitoring survey locations ( $n = 2$ ; SH.1 and SH.2) established in the Sherburne NWR IBA in 2020. .... 12

**Figure 8.** Potential black tern monitoring survey locations ( $n = 3$ ; SL.1, SL.2, and SL.3) established in the Swan Lake IBA in 2020. .... 13

**Figure 9.** Potential black tern monitoring survey locations ( $n = 3$ ; TL.1, TL.2, and TL.3) established in the Thief Lake IBA in 2020..... 14

**Figure 10.** Potential black tern monitoring survey location ( $n = 1$ ; WWV.1) established in the Whitewater Valleys IBA in 2020..... 15

**LIST OF APPENDICES**

**Appendix A:** Standard Operating Procedures for data entry (tern monitoring and vegetation surveys) ..... 17

## PROJECT OVERVIEW

Audubon Minnesota is interested in establishing benchmark survey locations throughout Minnesota to guide restoration and enhance activities within designated Important Bird Areas (IBAs) for three species of conservation concern: common tern, black tern, and yellow rail. Data collected during the 2009–2013 Minnesota Breeding Bird Atlas (MNBBA) project (Pfanmuller et al. 2017) were used to identify potential and confirmed breeding locations for black tern and common tern in the state. These data were then aligned with IBA boundaries and previously established survey locations from Audubon’s statewide marshbird monitoring program. Using this information, survey locations were identified within selected IBAs to document presence and abundance of tern species during the 2020 breeding season. Collectively, survey results can be used as a first step by Audubon Minnesota to formalize high-priority benchmark survey locations for long-term monitoring of these species in IBAs throughout the state.

## METHODS

The following activities were conducted by researchers at the Natural Resources Research Institute (NRRI) in Duluth, MN:

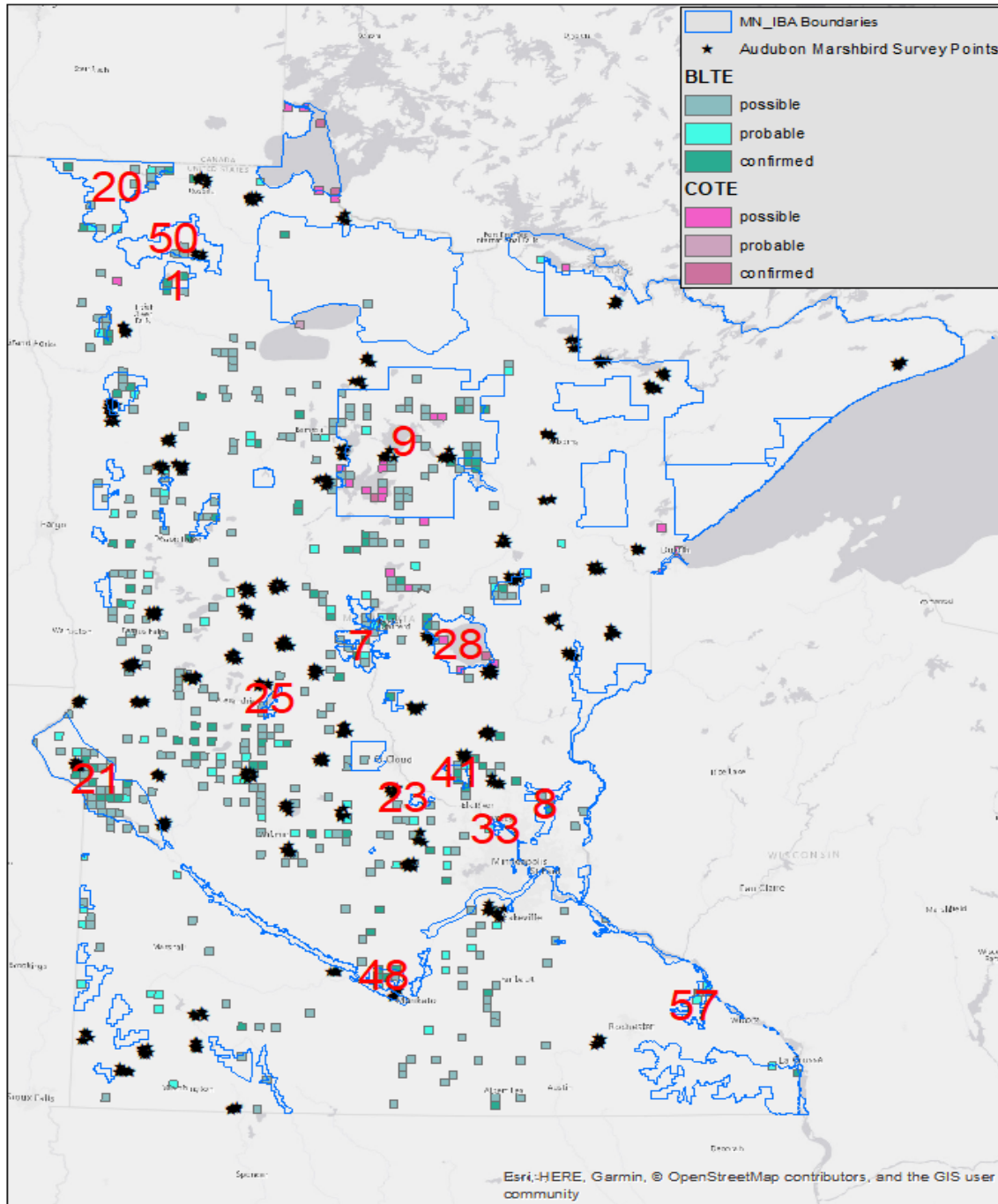
- 1) created a GIS layer of potential benchmark sites to ground truth based on MNBBA tern observations, restricted to MN IBAs (Fig. 1);
- 2) conducted visual surveys within each selected IBA for black terns; and
- 3) conducted visual wetland vegetation surveys to document dominant plant species cover and other general structural observations (e.g., interspersions and vegetation height) within each survey location.

Locations where common terns were observed was also documented, although official surveys were not conducted for this species.

### **Survey Design and Procedures**

In 2020, a total of 14 IBAs were identified across the state as potential locations to establish long-term black tern monitoring locations (Table 1). Due to restrictions associated with Covid-19, surveys were conducted by a single person and were restricted to land for safety reasons. The surveyor scouted each IBA prior to establishing a survey location(s), using a spotting scope and binoculars to identify the best sites based on presence of target species, accessibility to site, and vantage point. Within each IBA where birds were observed, and where accessible, 1–3 survey locations were established based on the above criteria.

Although future long-term monitoring plans can include on-water flush surveys, establishing quality land-based survey locations is important to ensure logistic feasibility for long-term monitoring at these sites. Once the best survey location(s) was determined, the surveyor conducted a 10-min point-count from the shore or edge of the wetland to document all observations of black terns present. Observations of common terns were also noted. Black tern counts and vegetation surveys were conducted simultaneously at each point-count location between 11–24 June, 2020.



**Figure 1.** Location of Audubon’s Important Bird Areas (IBAs; MN\_IBA\_Boundaries) in Minnesota. Unique identification of IBAs selected to be scouted in 2020 are listed numerically (in red) and correspond to IBA ID in Table 1 ( $n = 14$ ). Black tern (BLTE) and common tern (COTE) observations (possible, probable, and confirmed nesting) are based on the Minnesota Breeding Bird Atlas (MNBBA) data. Locations of Audubon’s marshbird survey points are also included.

**Table 1.** List of potential Important Bird Area (IBA) black tern monitoring locations for the 2020 field season. Unique IBA identification numbers (IBA ID) correspond with locations in Figure 1. The breeding status for each species – black tern (BLTE) and common tern (COTE) – is based on Minnesota Breeding Bird Atlas (MNBBA) data. These breeding codes, listed in order of increasing importance are: possible, probable, and confirmed. No = species was not detected at this location during the MNBBA or Audubon Marshbird survey. We also state whether an Audubon Marshbird survey route is located within the IBA.

IBA ID	IBA Name	BLTE	COTE	Audubon Marshbird Survey
1	Agassiz NWR	Confirmed	No	No
7	Camp Ripley-Pillsbury-Lake Alexander	Confirmed	No	No
8	Carlos Avery	Confirmed	No	No
9	Chippewa Plains	Confirmed	Confirmed	Yes
20	Kittson-Roseau Aspen Parkland	Probable	No	No
21	Lac Qui Parle- Big Stone IBA	Probable	No	Yes
23	Lake Maria State Park- Henry Larson County Forest	Possible	No	No
25	Lake Osakis	Possible	No	No
28	Mille Lacs	Probable	Confirmed	No
33	North Metro Mississippi River	Probable	No	No
41	Sherburne NWR	Confirmed	No	No
48	Swan Lake	Confirmed	No	No
50	Thief Lake	Possible	No	Yes
57	Whitewater Valleys	Probable	No	No

### **Tern Surveys**

Surveys were conducted from sunrise to early afternoon (~15:00) during favorable weather conditions (i.e., only when there was no sustained rain or heavy fog and when the wind speed was < 18 mph (Beaufort scale wind of 4 or less)). All shoreline counts were conducted by a single observer. Upon arrival, the wetland was scanned from various locations along the shoreline using binoculars and a spotting scope. When terns were detected, the shoreline count began. For the purpose of these counts, a colony could consist of multiple sub-colonies 100–300 m apart. If groups of terns were > 800 m away, they were treated as a separate colony. If no terns were observed during scouting or if accessibility to a given IBA was difficult or not possible, that was noted (see ‘IBA-Specific Survey Results’). Data were entered using an online data entry system (123 Survey; <https://survey123.arcgis.com/>; see Appendix A for data entry details).

During each 10-min unlimited distance shoreline point-count, all terns observed in the air or resting on the surface of the marsh were recorded. Observers also recorded weather conditions, global positioning system (GPS) coordinates of the point-count locations (Figs. 2–10), date, and count start and end times. In the absence of flush counts, the observer should record best estimates of the location of 1–4 possible

nests, if possible, based on where adults are observed settling within the wetland, and record whether the nests are in the incubation stage or nestling stage.

### **Vegetation Surveys**

At each specified tern monitoring point-count location, observers also conducted a vegetation survey, a modified version of the National Protocol Framework for the Inventory and Monitoring of Waterbirds and their Habitats (Loges et al. 2017), which was provided by Audubon Minnesota. Surveys consisted of a full-circle, unlimited-distance visual assessment of habitat (dominant vegetation cover) and landscape features (e.g., interspersion) with the estimated location of the colony being the centroid. Observers should be able to visually assess > 70% of the area surrounding the point-count. If < 70% could be visually assessed from that location, additional vantage points should be added, if possible. Vegetation surveys were conducted once during the breeding season (see Appendix A for data entry details).

## **RESULTS AND DISCUSSION**

A total of 20 survey locations were identified within 9 IBAs across the state and one survey location identified on Higgins Lake, just outside of the Carlos Avery IBA. Black terns were either not observed or sites were inaccessible at five of the IBAs visited (IBA ID: 7, 9, 23, 25, and 33). Sites were surveyed once between June 11–24 2020, although several IBAs were visited on multiple occasions to try to find either additional or new survey locations. A total of 299 adult black terns were observed during the course of these surveys. Of the 20 survey locations visited, we recommend 15 survey points in 9 IBAs become part of the long-term monitoring plan at Audubon Minnesota. Because surveys were restricted to land, estimating the location of nests was not feasible because most colonies were located too far away to visibly observe nests and/or vegetation height obscured views. Black tern observations and vegetation surveys were recorded in the field using an iPad. Therefore, all data were entered digitally using an online data entry system that was sent directly to Audubon Minnesota.

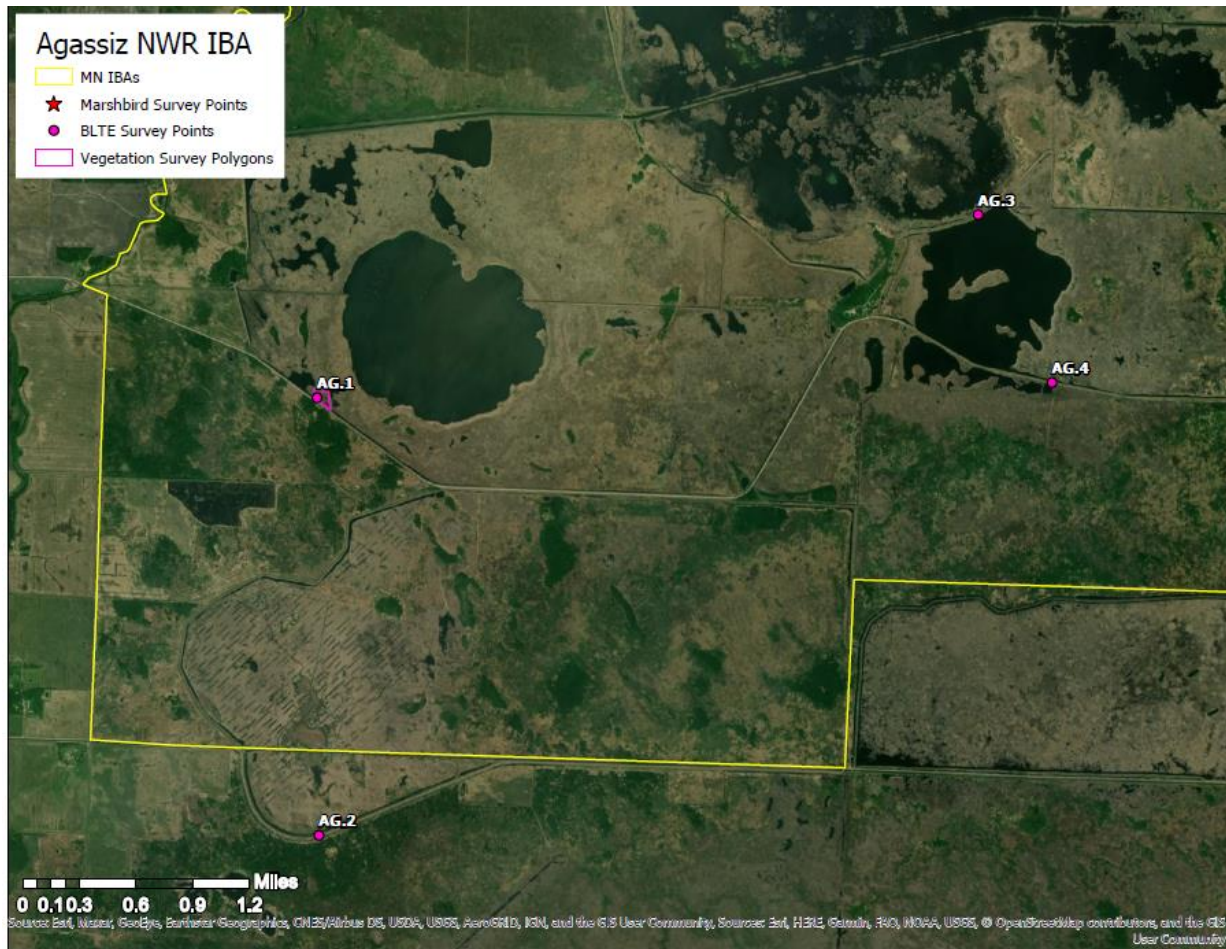
### **IBA-Specific Survey Results**

#### *Agassiz National Wildlife Refuge (1)*

A total of 106 black terns were observed from four survey points that were established within the Agassiz NWR (Fig. 2). Survey point AG.1 was conducted at Parker Pool and has a nice observation deck, which made for easy access to this location. This was the only survey location from which an official survey was conducted and where 37 black terns were observed. Survey point AG.2 was located at Farmes Pool, where the largest number of black terns were observed in any of the IBAs surveyed ( $n = 55$ ). However, this survey location was situated slightly outside of the Agassiz NWR IBA, and therefore a 10-minute point count was not conducted. If this is not an issue, we suggest this survey location be included in a long-term monitoring plan. Survey points AG.3 and AG.4 were located at Agassiz Pool, both of which were highly accessible, and a smaller number of terns were observed; however, no formal surveys were conducted at either of these locations. Sites AG.3 and AG.4 could serve as backup survey points or additional survey points, if desired. **Recommended:** For the Agassiz NWR IBA, we recommend



including survey points AG.1 and AG.2 (Parker Pool and Farnes Pool) in the long-term monitoring plan. These sites had the largest numbers of black terns observed and were easily accessible.



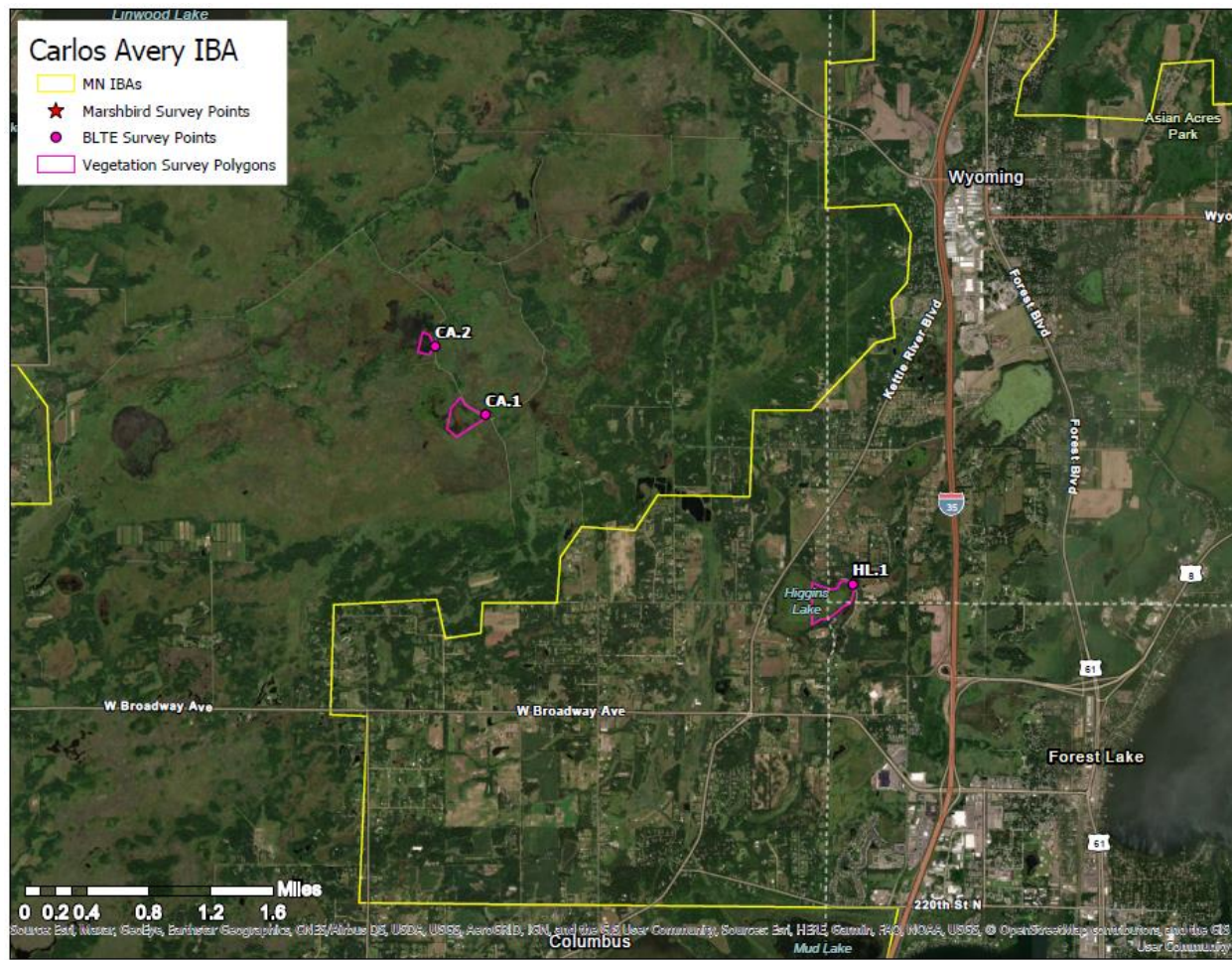
**Figure 2.** Potential black tern monitoring survey locations ( $n = 4$ ; AG.1 – AG.4) established in the Agassiz NWR IBA in 2020. A formal survey was conducted at point AG.1, which includes the estimated range of visibility around the centroid of the vegetation survey.

#### *Camp Ripley-Pillsbury-Lake Alexander (7)*

We were unable to visit or conduct any formal surveys at the Camp Ripley-Pillsbury-Lake Alexander IBA due to an insufficient amount of time available to request access to the military reservation and travel restrictions associated with Covid-19. All roads were gated. Several lakes and ponds that appeared to have suitable habitat and were located in the IBA, but not part of the military lands, were visited; however, terns were not observed. Based on these restrictions, we cannot make a formal recommendation for or against including this IBA in Audubon’s long-term monitoring plan for black terns. We recommend this IBA be visited during the 2021 breeding season to determine whether it is appropriate to include in the monitoring plan.

*Carlos Avery (8) and Higgins Lake*

A total of 17 black terns were observed at two survey points established within the Carlos Avery IBA and one survey point located near Higgins Lake, just outside the Carlos Avery IBA (Fig. 3). The lakes within the Carlos Avery IBA are heavily populated with residential homes and there also seems to be a lack of appropriate breeding habitat. However, the central portion of the IBA is the most promising location because it is part of the Carlos Avery Wildlife Management Area (WMA) and has suitable marsh vegetation. Survey points CL.1 and CL.2 were both located near pools in the WMA, where surveys were conducted on the sides of dirt roads. Black tern observations in this IBA were low, but could vary annually based on habitat availability. The survey point on Higgins Lake (HL.1) is very near Carlos Avery (Fig. 3). This site is not very accessible by land, but it does seem promising, perhaps if access by boat was an option. **Recommended:** For the Carlos Avery IBA, although the number of black terns observed in 2020 was low, there is appropriate habitat available which could accommodate larger numbers of nesting terns. Therefore, we recommend survey points CA.1, CA.2, and HL.1 be included for long-term monitoring.



**Figure 3.** Potential black tern monitoring survey locations ( $n = 3$ ; CA.1, CA.2, and HL.1) established in and just outside of the Carlos Avery IBA in 2020. A formal survey was conducted at each of the three points, which include the estimated range of visibility around the centroid of the vegetation survey.

*Chippewa Plains (9)*

A total of five lakes (Leech Lake, Walker Bay, White Oak Lake, Big Rice Lake, and Rice Lake) and a number of small ponds located in the Chippewa Plains IBA were scouted during the 2020 breeding season. However, there were no black terns observed at any of these locations, and much of the shoreline was difficult to access due to private property. Aside from accessibility issues, there didn't appear to be suitable nesting habitat for black terns. Some of the smaller lakes that were scouted appeared to have suitable habitat, but no terns were observed. Common terns were observed on Leech Lake, where there is a known breeding colony, but they were very distant and difficult to count. There are three islands in the southern half of Leech Lake (Gull Island, Little Pelican Island, and Pelican Island) that have been used consistently by common tern for breeding, but high-water flooding events may be impacting breeding colonies. These islands are owned and managed by the Leech Lake band of Ojibwe; we suggest reaching out to see if monitoring data is available. Because there were no black tern observations within the Chippewa Plains IBA, we did not conduct any tern or vegetation surveys and cannot make a recommendation for or against including this IBA in Audubon's long-term monitoring plan. We recommend scouting locations within this IBA in 2021 or attempting to access locations with appropriate habitat by boat.

*Kittson-Roseau Aspen Parkland (20)*

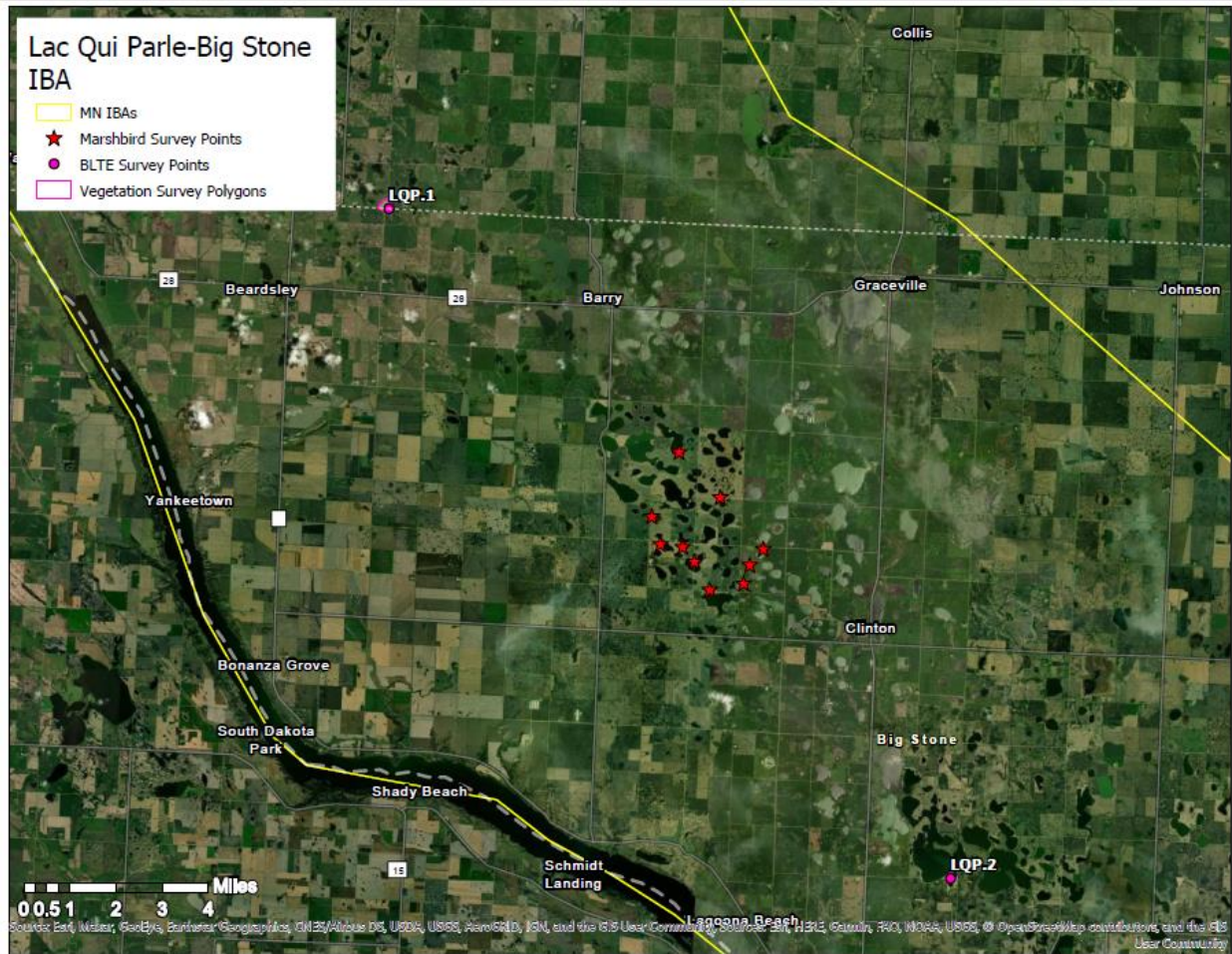
A total of 27 black terns were observed from one survey point established within the Kittson-Roseau Aspen Parkland IBA (Fig. 4). This survey point (KR.1) was located at Twin Lakes, which has a nice observation deck but requires a spotting scope for easy observation of terns. **Recommended:** We recommend KR.1 be included in the long-term monitoring plan due to the number of birds observed, ease of access, and proximity to IBAs 1 & 50.



**Figure 4.** Potential black tern monitoring survey location ( $n = 1$ ; KR.1) established in the Kittson-Roseau IBA in 2020. A formal survey conducted at this point includes the estimated range of visibility around the centroid of the vegetation survey.

*Lac Qui Parle-Big Stone (21)*

A total of five black terns were observed at one survey location (LQP.1) within the Lac Qui Parle-Big Stone IBA (Fig. 5). Two survey locations were identified (LQP.1 and LQP.2). A small colony of five birds was located in a small wetland in a pasture between agricultural fields. Although expansive, the wetlands within this IBA did not appear to have a lot of appropriate marsh habitat for breeding black terns. There were no black terns observed from survey point LQP.2, and therefore a formal survey was not conducted. However, the habitat was appropriate, and it could be considered as a backup or additional survey location. **Recommended:** We recommend LQP.1 be included in the long-term monitoring plan. Although a small number of terns were observed, it appeared to be one of the only accessible locations within this IBA with suitable nesting habitat for black terns.



**Figure 5.** Potential black tern monitoring survey location ( $n = 1$ ; LQP.1) established in the Lac Qui Parle-Big Stone IBA in 2020. A formal survey was conducted at this point, which includes the estimated range of visibility around the centroid of the vegetation survey. The location of Audubon’s Marshbird Survey Points that occur within this IBA are also included.

*Lake Maria State Park- Henry Larson County Forest (23)*

Sugar and Ida Lakes, located within the Lake Maria State Park-Henry Larson County Forest IBA, were scouted during the 2020 breeding season. Most of the lakes in this IBA were on private land, and there appeared to be a lot of human activity and not a lot of appropriate nesting habitat for black terns. There were no black terns observed during the scouting of this IBA, and therefore no tern or vegetation monitoring points established. Therefore, we cannot make a recommendation for a location to include in Audubon’s long-term monitoring plan for this IBA.

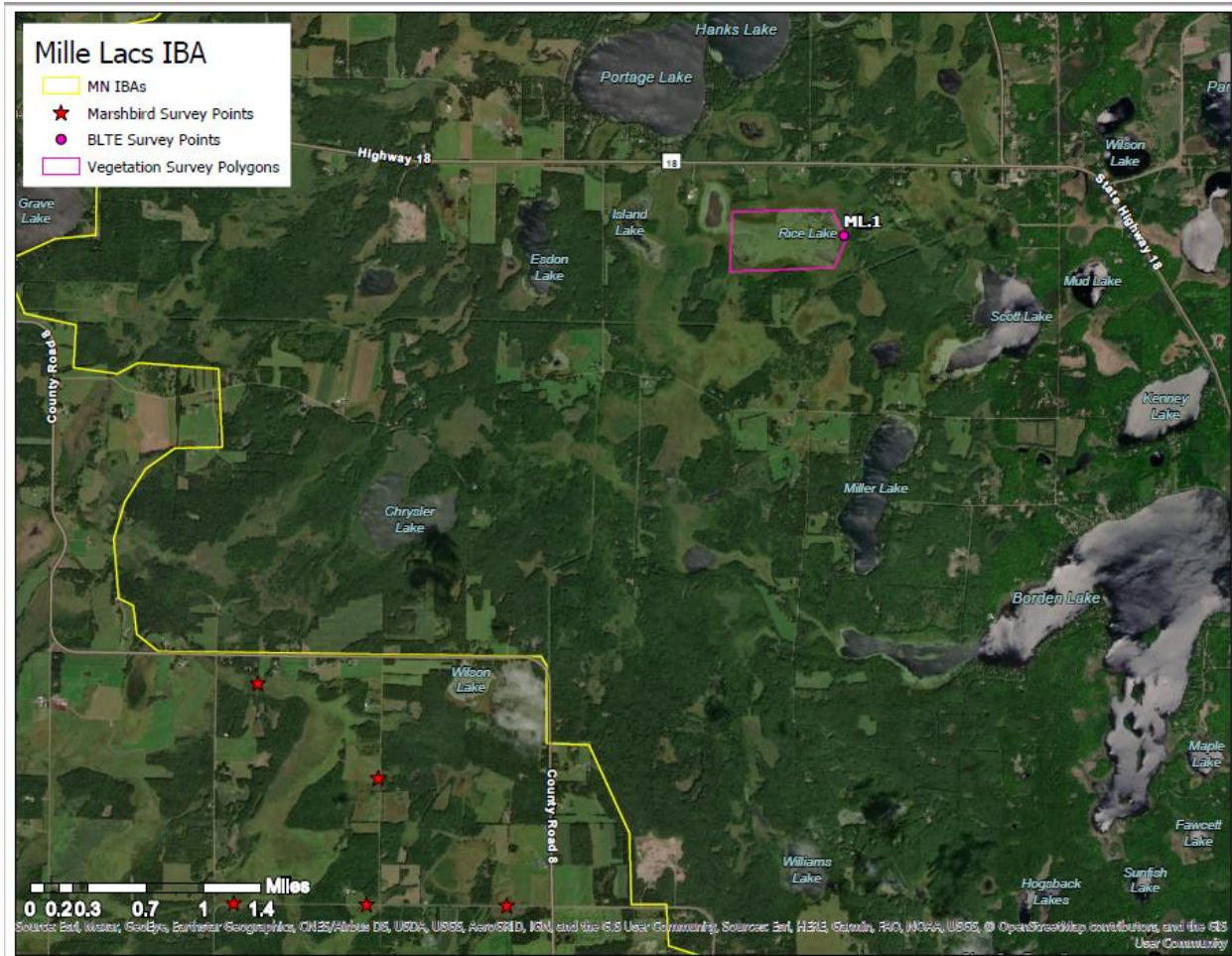
*Lake Osakis (25)*

Lake Osakis, located within the Lake Osakis IBA, was scouted during the 2020 breeding season. The majority of the shoreline along this lake was residential, so access was limited. From the public access points, there were no black terns observed. Although terns may have been present in other locations

within the lake, it was difficult to assess from the public access points. It may be worth spending some additional time looking for access points on this lake or using a boat to scout the area. There were no black terns observed during the scouting of this IBA, and therefore no tern or vegetation monitoring points established. Therefore, we cannot make a recommendation for a location to include in Audubon's long-term monitoring plan for this IBA.

#### *Mille Lacs (28)*

A total of 23 black terns were observed at one survey location (ML.1) on Rice Lake in the Mille Lacs IBA (Fig. 6). The survey point was established on Hesitation WMA, a small WMA that provided public access to Rice Lake. It has a nice floating dock that allows for easy access and good visibility. There were also common terns observed on Mille Lacs Lake, where there is a known established colony. The common tern nest on Spirit and Hennepin Islands is located a few miles from the southern shoreline and thus cannot be monitored from shore. These are long-term nesting sites for this species; since 1998, Hennepin Island has been used for breeding. Rice Lake NWR staff have been working with Mille Lacs band of Ojibwe to protect the remaining habitat. We suggest contacting these entities to determine if long-term monitoring data is available or if they have suggestions about best survey locations for colony counts. **Recommended:** We recommend survey point ML.1 be included in the long-term monitoring plan. There is good habitat available for nesting black terns, and the survey location is relatively close to an established Audubon marshbird survey monitoring route (Fig. 6).



**Figure 6.** Potential black tern monitoring survey location ( $n = 1$ ; ML.1) established in the Lac Qui Parle-Big Stone IBA in 2020. A formal survey was conducted at this point, which includes the estimated range of visibility around the centroid of the vegetation survey. The location of Audubon’s Marshbird Survey Points that occur just outside the IBA are also included.

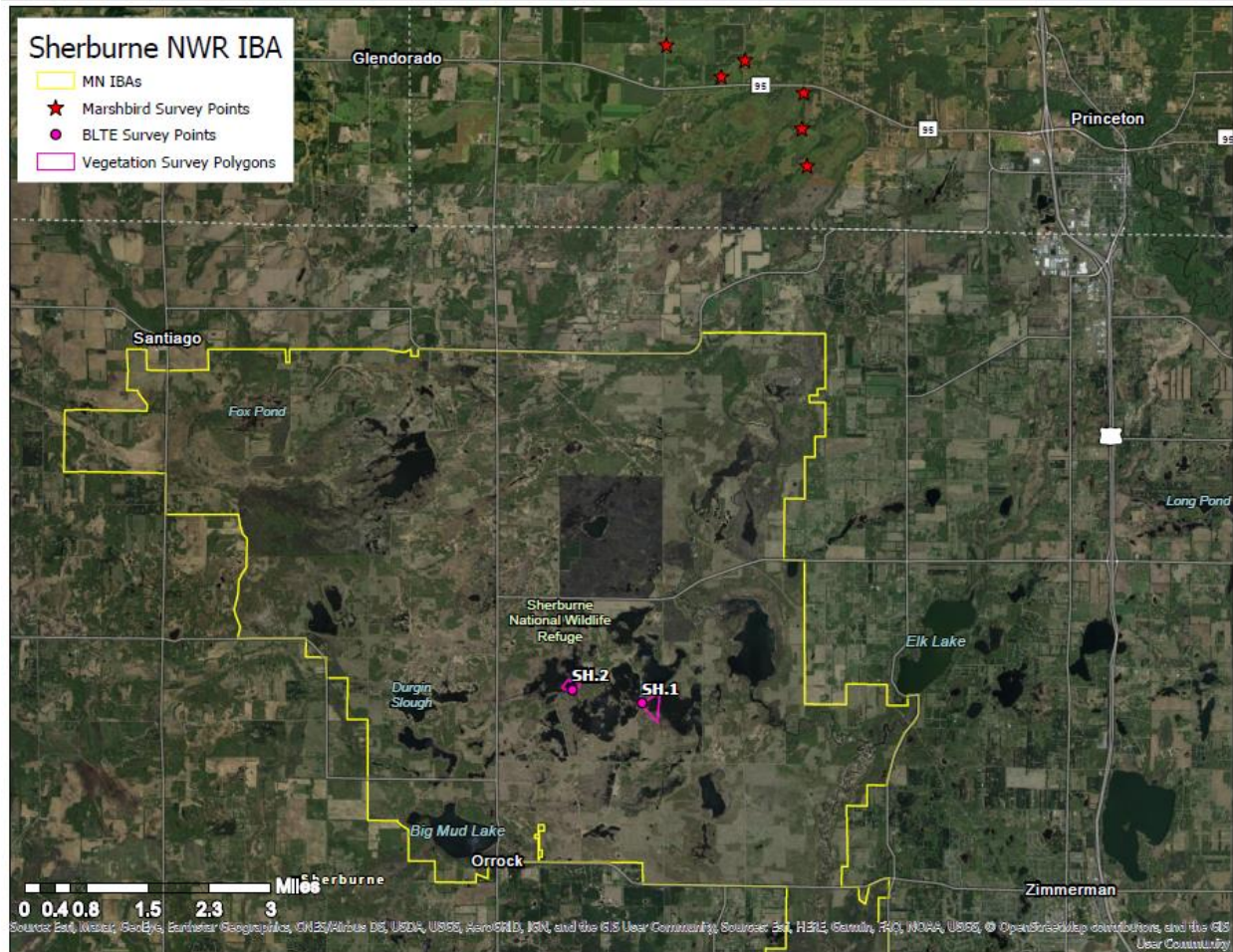
*North Metro Mississippi River (33)*

Rice Lake, Mud Lake, and Goose Lake, located in the Elm Creek Park Reserve within the North Metro Mississippi River IBA, were scouted during the 2020 breeding season. Access points to this IBA were limited due to being heavily populated and because it lies within a state park. The park had a lot of human activity and did not appear to have appropriate nesting habitat for black terns. There were no black terns observed during the scouting of this IBA, and therefore no tern or vegetation monitoring points established. Therefore, we cannot make a recommendation for a location to include in Audubon’s long-term monitoring plan for this IBA.

*Sherburne National Wildlife Refuge (41)*

A total of 24 black terns were observed from two survey locations (SH.1 and SH.2) on Pool 14 and Stickney Pool located around Prairie’s Edge Wildlife Drive in the Sherburne NWR (Fig. 7). Subcolonies of

black terns were observed within both of these survey locations. **Recommended:** We recommend including SH.1 and SH.2 in the long-term monitoring plan. Both of these sites have suitable habitat for nesting terns, observation decks, and safe places to stop and observe birds.



**Figure 7.** Potential black tern monitoring survey locations ( $n = 2$ ; SH.1 and SH.2) established in the Sherburne NWR IBA in 2020. A formal survey was conducted at these points, which includes the estimated range of visibility around the centroid of the vegetation surveys. The location of Audubon’s Marshbird Survey Points that occur just outside the IBA are also included.

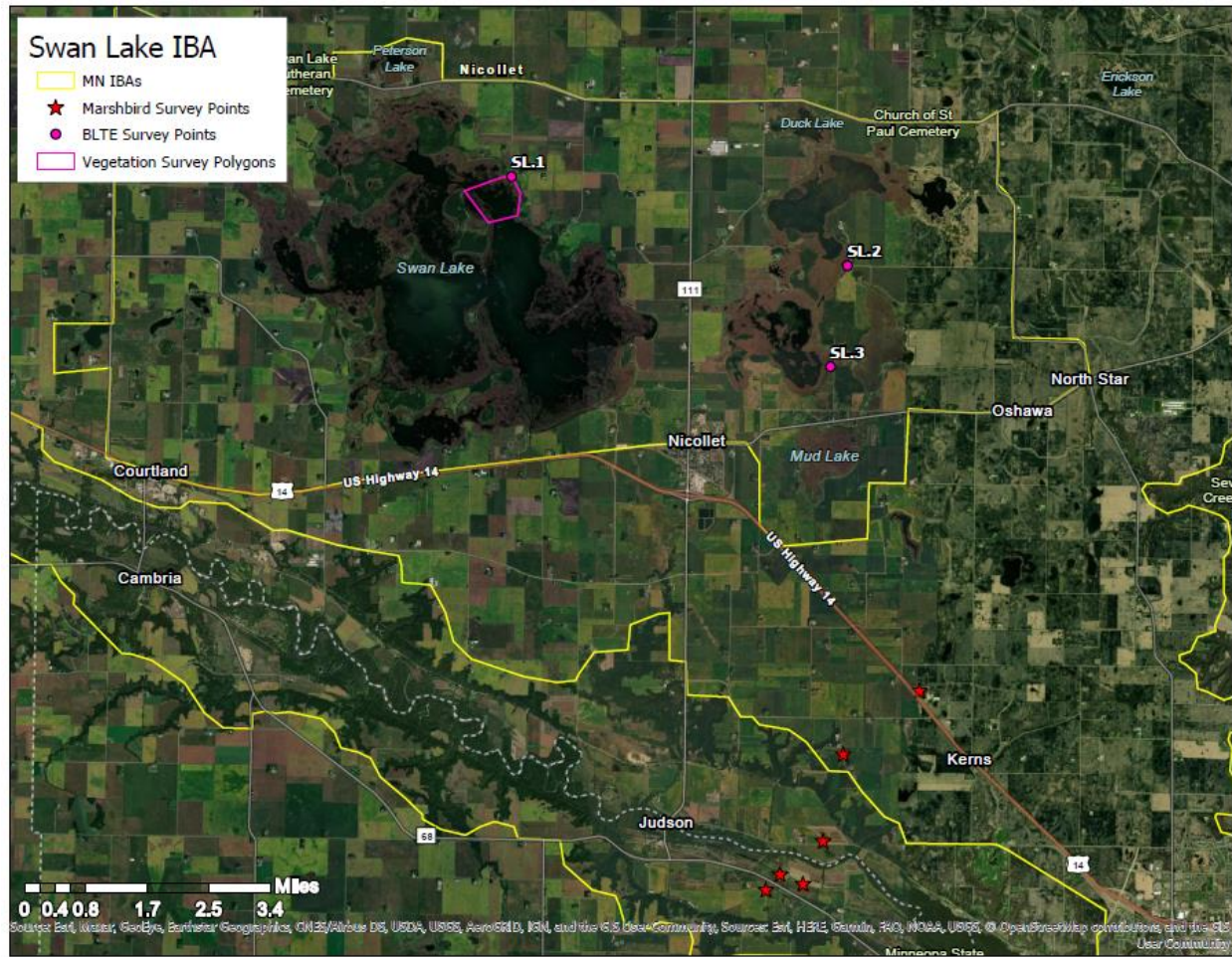
### *Swan Lake (48)*

A total of 20 black terns were observed at survey point SL.1 on Swan Lake in the Swan Lake IBA (Fig. 8). Survey locations were also established at two additional points on Middle Lake (SL.2 and SL.3), although no terns were observed, and therefore formal surveys were not conducted. Access to Swan Lake was difficult, so we recommend using a public access point to get a boat on the water to do future surveys. There is likely a larger number of black terns present in the middle of the lake, which was not possible to see from the land-based survey locations. Also, the survey points established on Middle Lake had very tall cattail present, making visibility difficult. Those sites may also not have appropriate nesting habitat, but do have public access, and therefore could be used to better assess conditions using a boat.

**Recommended:** We recommend including SL.1 in the long-term monitoring plan, as it offers the best



vantage point for viewing birds within this IBA. However, we would also recommend accessing this location using a boat to potentially identify a more suitable or additional survey location(s) on the water.

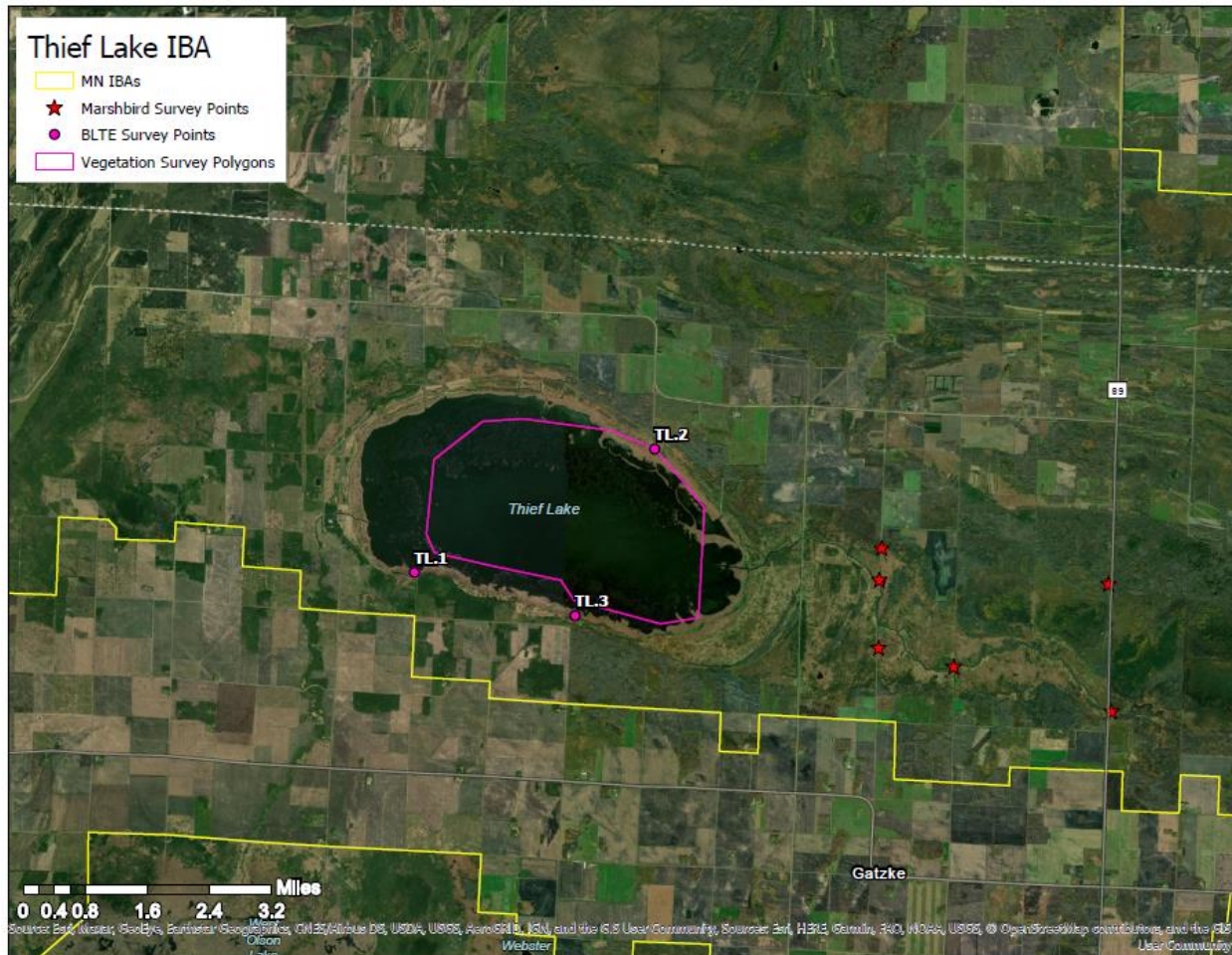


**Figure 8.** Potential black tern monitoring survey locations ( $n = 3$ ; SL.1, SL.2, and SL.3) established in the Swan Lake IBA in 2020. A formal survey was conducted at point SL.1, which includes the estimated range of visibility around the centroid of the vegetation survey. The location of Audubon’s Marshbird Survey Points that occur just outside the IBA are also included.

*Thief Lake (50)*

A total of 73 black terns were observed at two survey points (TL.1 and TL.2) in the Thief Lake IBA (Fig. 9). An additional survey location was also established in this IBA (TL.3), although there were only four birds observed here, visibility was low, and most terns observed were likely birds previously counted at the other survey points. Therefore, no formal count was conducted at this survey location. This point could be used as a backup location with public access. Survey point TL.1 was conducted on an observation mound in the Thief Lake WMA. Birds were observed everywhere on the lake, and a scope is necessary for observing birds at this site. Survey point TL.2 offers an additional vantage point, although visibility was not as good as TL.1, and some of the birds were likely counted at point TL.1. A vegetation survey was only conducted at TL.1 because TL.2 was considered a subcolony using the same habitat as that recorded in TL.1. **Recommended:** We recommend including TL.1 and TL.2 in the long-term monitoring

plan, as these sites offer the best vantage points and this IBA had the highest number of black tern observations after Agassiz NWR.



**Figure 9.** Potential black tern monitoring survey locations ( $n = 3$ ; TL.1, TL.2, and TL.3) established in the Thief Lake IBA in 2020. A formal survey was conducted at points TL.1 and TL.2, which include the estimated range of visibility around the centroid of the vegetation surveys. At this IBA, visibility was nearly the entire lake. The location of Audubon’s Marshbird Survey Points that occur within the IBA are also included.

*Whitewater Valleys (57)*

A total of four black terns were observed from one survey location (WWV.1) in the Whitewater Valleys IBA (Fig. 10). This survey point was located in a small wetland complex in a cow pasture. The amount of appropriate nesting habitat for black terns appears to be limited in this IBA, with the exception of the northern part of the Mississippi. We had hoped to scout Dorer Pools as a potential survey location, but the road was closed. **Recommended:** We recommend including WWV.1 in the long-term monitoring plan, as this is one of the only places in the IBA that appeared to have appropriate nesting habitat for black terns. However, we also recommend that Dorer Pools be scouted when the road becomes accessible.



**Figure 10.** Potential black tern monitoring survey location ( $n = 1$ ; WWV.1) established in the Whitewater Valleys IBA in 2020. A formal survey was conducted at this point, which includes the estimated range of visibility around the centroid of the vegetation survey. The location of Audubon’s Marshbird Survey Points that occur just outside the IBA are also included.

**OVERALL SUMMARY**

The IBAs that were chosen to be scouted in 2020 represented locations within IBAs where black terns had been observed during the 2009–2013 MNBBA project. It is possible that black terns are nesting in scouted IBAs where terns were not detected as well as in other IBAs in Minnesota that were not included in this 2020 scouting effort. The IBAs that were included were chosen based on best available breeding season data for these species within the state. Because sites were only visited once during the 2020 breeding season and because this effort was primarily aimed at identifying potential long-term monitoring locations, there is not sufficient information to provide a meaningful summary of the vegetation data as it relates to bird abundance.

With a goal of establishing long-term monitoring locations within MN IBAs to guide restoration and enhance activities within designated IBAs for black tern, common tern, and yellow rail, it will be important to include monitoring locations where habitat appears appropriate. However, based on our observations, these species were also using several areas where habitat was less extensive. Including

areas with small patches of habitat and lower number of birds in the monitoring will help identify key habitat features associated with occupancy and to identify IBAs where restoration activities could be implemented to enhance nesting habitat. Over time, these monitoring sites can be used to determine colony persistence and document changes in colony size, which can assist in adapting best management practices for these species in Minnesota IBAs.

We suggest a more extensive and thorough inventory of Minnesota's IBAs extended to the 2021 breeding season. This will provide Audubon with additional black tern monitoring locations to consider and the ability to identify IBAs that would also be valuable for monitoring the other target species (i.e., common tern and yellow rail). Once these key locations have been established, they should be fixed throughout the season and across years to ensure data comparability and inference between IBAs.

In our scouting and survey efforts, the highest number of black tern observations within the nine IBAs surveyed were located in three IBAs in the northwestern portion of the state (Thief Lake, Agassiz NWR, and Kittson-Roseau Aspen Parkland). Throughout many of the IBAs visited, the limiting factor was either shoreline access and/or appropriate nesting habitat was lacking or not visible from the land-based survey locations. It may be useful to scout some of these IBAs by boat to determine black tern or common tern occupancy and potentially identify landowners who would be willing to allow access to their property, if colonies are discovered. Establishing these long-term monitoring locations is a vital step in this very important effort by Audubon to provide data-driven restoration objectives aimed at maintaining and increasing populations of these vulnerable species in the state.

## REFERENCES

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## Appendix A: Standard Operating Procedures for data entry (tern monitoring and vegetation surveys)

### Tern Monitoring Protocol

Data were entered using an online data entry system (123 Survey; <https://survey123.arcgis.com/>). The following information was entered at each point-count location:

- *Monitor Name*: First and Last name of observer
- *Email*: Observers email address
- *Phone*: Observers phone number
- *Location Name*: Unique identification name or number associated with the point-count location within each IBA
- *Subcolony name (in applicable)*: Name each subcolony if several are present (could be based on their location within the wetland complex, i.e., North Subcolony, East Subcolony)
- *Survey Period*: Survey Period 1 (June 1–30) or Survey Period 2 (July 1–31)
- *Date*: Date survey was conducted
- *Site Visit #*: For this survey it will always be 1 since we will only be conducting one survey
- *Location (map)*: Enter GPS coordinates for point-count locations. If more than one subcolony is present, enter a separate data entry form for each sub-colony
- *Weather*: Record the following weather variables at each point-count location
  - *Wind*: Categorize wind speed based on the Beaufort scale: 0=smoke rises vertically; 1=wind direction shown by smoke drift; 2=wind felt on face; leaves rustle; 3=leaves & small twigs in constant motion and light flag extended; 4=raises dust and loose paper -- small branches are moved; 5=small trees with leaves sway -- crested wavelets on inland waters
  - *Cloud Cover*: 0-10%, 10-50%, 50-90%, 90-100%
  - *Precipitation*: No precipitation, Fog, Drizzle, Rain, Snow, Snow/Sleet
- *Count Start Time*: Enter time count began
- *Count End Time*: Enter time count ended
- *Colony Active?* Yes or No
- *Number of adult terns present*:
- *If nesting documented*: Record the GPS coordinates for 1–4 nests identified after the shore survey. Use estimates if you are able to detect nests but not able to access the site for flush counts.
  - *For each nest, identify nesting stage*: Incubation or Nestling

### Vegetation Monitoring Protocol

Data were entered using an online data entry system (123 Survey; <https://survey123.arcgis.com/>). The following information was entered at each vegetation location:

- *Monitor name*: First and last name
- *IBA name*: Unique name of the IBA being surveyed
- *Site ID*: Unique name of wetland point-count location
- *Date*: Date wetland was surveyed in mmddyyyy format
- *Vegetation Survey Location*: Identify location of observation points on map, record GPS coordinates for each (Veg\_Lat & Veg\_Lon) and outline estimated range of visibility (in meters)

- *Subcolony name (in applicable)*: Name each subcolony if several are present (could be based on their location within the wetland complex, i.e., North Subcolony, East Subcolony)

Visual estimates of the following were conducted using the Loges et al. (2017) protocol:

- *Visibility*: (> 70% based on delineation map)
- *Start Temperature*: Temperature in °F when survey was started
- *Wind*: (Beaufort scale)
- *WD* = Water Depth using 6 class types (*Dry, Saturated/Mud, 0-5cm, 5-15cm, 15-25cm, >25cm*). Water Depth: % of unit in each category (must sum to 100%)
- *HC* = Habitat Cover of five types (open water, bare ground/mudflat, emergent, scrub-shrub, or forest). Percent Habitat Cover: % of location in each category (sum to 100%)
- *Interspersion*: using three class configurations (**Class L**: large and connected patches of water/bare ground features; **Class S**: small, disconnected patches of water/bare ground; **Class M**: discernible regions of both classes L and S)
- *VH* = Vegetation height using seven categories (<2.5cm, 2.5 – 15cm, 15 – 30cm, 30 – 60cm, 60cm – 3m, 3 – 6m, >6m). Vegetation Height (%) of location in each category (Sum to 100%)
- *Percent vegetation cover for dominant plant species*: (1 to 5 species) by name (Plant species name) and Percentage/dispersion.
- *Disturbance Severity*: (1–4)
- *Comments*: Any additional information about the survey location at the time of survey