

Platte River

Recovery Implementation Program

IMPLEMENTATION OF THE WHOOPING CRANE MONITORING PROTOCOL

2021 FALL



Photo: Colleen Childers

**Prepared for: PRRIP Technical Advisory and Governance
Committees**

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Summary

The Executive Director's Office (EDO) of the Platte River Recovery Implementation Program ("Program" or "PRRIP") conducted whooping crane monitoring during the fall 2021 migration in accordance with *Platte River Recovery Implementation Program – Whooping Crane Monitoring Protocol – Migrational Habitat Use in the Central Platte River Valley* rev. June 2017. Fall migration monitoring took place from October 9th through November 19th, 2021. During the 42-day monitoring period, surveys were conducted using systematic flight transects along the Platte River from Chapman to Lexington, NE. Of the 76 scheduled flights typical of a 38-day fall monitoring season, 52 (68.4%) were completed. To finalize data collection for whooping cranes remaining within the survey area beyond the usual November 15th cutoff, an additional four days of monitoring were conducted resulting in the completion of an additional seven systematic monitoring flights. Cancellation of morning surveys due to weather, while large numbers of whooping cranes were present within the reach also resulted in two opportunistic evening flights. Systematic and opportunistic sightings resulted in the observation of 88 individual whooping cranes, 17.39% of the estimated Aransas – Wood Buffalo (AWB) migratory whooping crane population. Streamflow in the Platte River ranged from 107-2,300 cfs (cubic feet per second) during the monitoring period. Unobstructed channel width at whooping crane use sites averaged 762 feet and nearest forest averaged 601 feet. Information from this monitoring effort will be used to help evaluate the biological response of whooping cranes to the water and land management activities of the Program.

Introduction

The Program is responsible for implementing certain aspects of the endangered whooping crane (*Grus americana*) recovery plan. More specifically, the Program's First Increment Adaptive Management Plan (AMP) management objective is to *contribute to the survival of whooping cranes during migration* (PRRIP 2021a). Performance indicators include:

- Increase area of suitable roosting and foraging habitat,
- Increase crane use days, and
- Increase proportion of whooping crane population use.

During development of the Program's AMP in the early 2000's, there was substantial disagreement about the appropriate management strategy to achieve the management objective. Program participants developed a number of priority hypotheses that reflected whooping crane (WC)-related uncertainties. In 2010, those hypotheses were sequenced to develop a smaller set of Tier 1 hypotheses to receive focused attention during the First Increment of the Program (2007-2019) (PRRIP 2021b) including:

- **WC-1:** Whooping crane use will increase as a function of Program land and water management activities.
- **WC-3:** Whooping crane use is related to habitat suitability. Riverine habitat suitability for whooping cranes is a function of channel characteristics such as water depth, channel width, and unobstructed-view widths.

As a means of better linking science learning to Program decision-making, priority hypotheses were further refined into a set of “Big Questions” that provided a template for linking specific hypotheses and performance measures to management objectives and overall Program goals.

The two “Big Questions” that relate directly to whooping cranes include ([PRRIP 2020](#)):

- **Big Question #5** – Do whooping cranes select suitable riverine roosting habitat in proportions equal to its availability?
- **Big Question #10** – Do Program management actions in the central Platte River contribute to whooping crane habitat and their use of the Associated Habitats?

Implementation of the whooping crane monitoring protocol is intended to provide the systematically-collected whooping crane use and habitat (i.e., landscape level attributes at roost sites and diurnal use sites) data necessary to test the Tier 1 whooping crane hypotheses, evaluate learning related to the whooping crane Big Questions, and ultimately assess progress toward meeting the whooping crane management objective ([PRRIP 2017a](#), [PRRIP 2020](#)).

The Program’s whooping crane monitoring protocol includes two major components ([PRRIP 2017b](#)):

- 1) Detect and confirm whooping crane stopovers in the study area through systematic targeted aerial surveys of river channel and palustrine wetland habitat within the 90-mile Associated Habitat Reach (AHR). Stopover data is used to comparatively evaluate changes in the frequency and distribution of stopovers within the study area over time.
- 2) Collect landscape-level habitat data at use locations. Habitat data is used for resource selection analyses and other analyses intended to inform Program habitat creation and maintenance activities.

Methods

The PRRIP EDO conducted fall 2021 migration monitoring in accordance with the *Platte River Recovery Implementation Program – Whooping Crane Monitoring Protocol – Migrational Habitat Use in the Central Platte River Valley* rev. June 2017 ([PRRIP 2017b](#)). General methods are described below.

Study area

The area of study (Figs. 1-2) is the Program’s AHR, extending from the Highway 283 Platte River bridge near Lexington, Nebraska (40° 44’ 08.15” N; 99° 44’ 37.31” W) to the Platte River bridge near Chapman, Nebraska (40° 59’ 07.06” N; 98° 08’ 40.40” W) focusing on Platte River channels and adjacent wetlands and ponds within 3.5 miles of the river channel(s). The monitoring area encompasses a total of approximately 90 linear miles of river.

Systematic flight transects

Two Cessna 172 aircraft, each crewed by a pilot and two observers, were used to make aerial observations along predetermined systematic flight transects. The pilot utilized a GPS unit to follow the pre-loaded route and track miles flown. Systematic aerial transects were flown daily,

conditions permitting, at an air speed of approximately 100 MPH and an altitude of approximately 750 feet, unless conditions demanded higher altitudes. Two flights were initiated each morning, one from Grand Island (east route, shown in red on Figs. 1-2) and one from Kearney (west route, shown in green on Figs. 1-2). Planes were required to be at transect starting points ½ hour before sunrise. Flights were typically completed in less than two hours. In the event of adverse weather, crews were able to wait up to two hours after sunrise for conditions to improve before cancelling the flight. Pilots were also able to cancel flights the night before or morning of a flight if they judged weather to be unsuitable for flying.

Two types of transects were flown to ensure coverage of both on-channel riverine and off-channel wetland habitat. On-channel river transects (OSE and OSW, river shown in blue on Figs. 1-2) were flown east to west and the plane was oriented south of the southern-most river channel to reduce the effect of sun glare. Starting points along riverine transects were alternated daily between two flight routes to allow different sections of the study area to be observed as early as possible in the flight times. Off-channel transects (in red and green on Figs. 1-2) were designed to sample existing off-channel habitat within the 3.5-mile limit, as well as to serve as functional routes for planes to return to starting airports.

Route 1 (Fig. 1): Transects began at Minden bridge and Chapman bridge and followed the southern channel of the Platte River (OSW and OSE shown in blue) ending at Lexington bridge and Minden bridge, respectively. The primary wetland return transects (PWRTW, PWRTE) were then flown back east, along with one secondary transect (CSRT) in the east route, to get back to the airports.

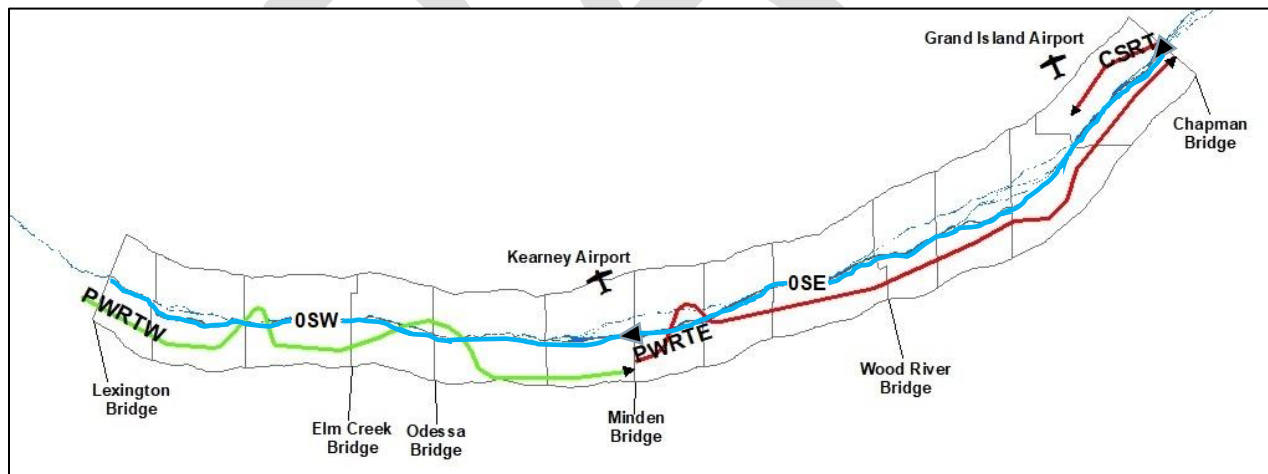


Figure 1. Route 1 east and west flight transects. Black and grey triangles indicate starting points. River channel transect shown in blue (OSW, OSE). West primary wetland return transect (PWRTW) is shown as a green line. East primary wetland return transect (PWRTE) and secondary return transect (CRST) are shown as red lines.

Route 2 (Fig. 2): Transects began at the midpoint of the OSW and OSE river channel transects (Odessa bridge and Wood River bridge, respectively). The west half of the river transects were flown first and ended at Lexington and Minden bridges. The primary wetland return transects (PWRTW, PWRTE) were then flown back east ending at Minden bridge and Chapman bridge.

Once the primary return transects were completed, the east half the river channel transects were then completed and ended at Odessa bridge and Wood River bridge. To return to the airports, secondary return transects (ESRT, WSRT) were then flown east from Elm Creek (Hwy 183) and Wood River bridges.

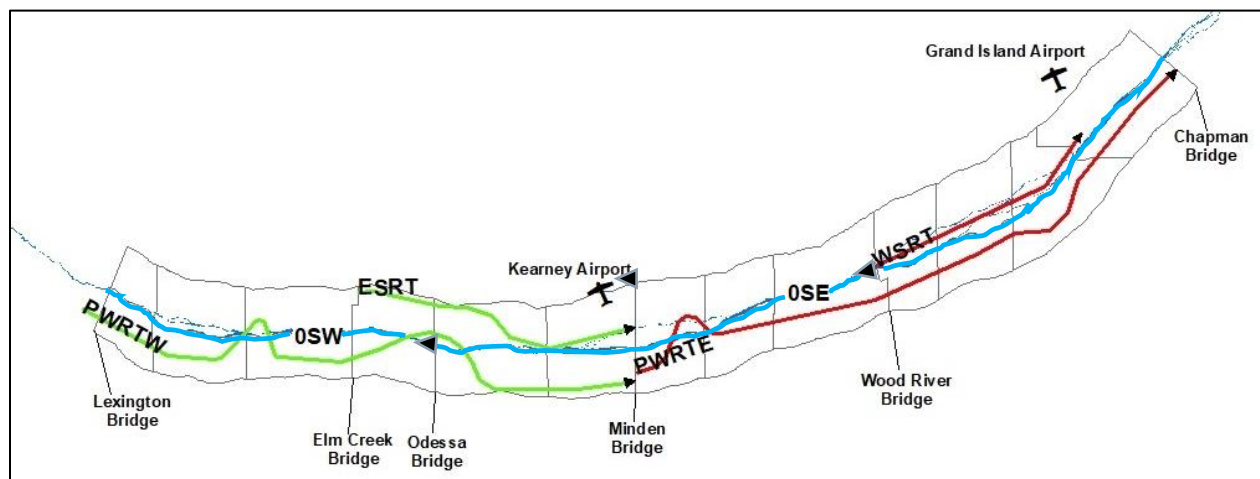


Figure 2. Route 2 east and west flight transects. Black and grey triangles indicate starting points. River channel transect shown in blue (OSW, OSE). West primary wetland return transect (PWRTW) and secondary return transect (ESRT) are shown as green lines. East primary wetland return transect (PWRTE) and secondary return transect (WRST) are shown as red lines.

The fall monitoring period is a 38-day season occurring from October 9th to November 15th. This year the monitoring season was extended due to continued whooping crane presence past the monitoring end date of November 15th (as per established protocol ([PRRIP 2017b](#))). Aerial surveys were conducted until no cranes were observed for two consecutive days. This resulted in the season being extended four days and ending November 19th, totaling a 42-day monitoring period. The extended season resulted in seven additional systematic flights completed (3 east; 4 west). There were also two evenings (11/3 and 11/4) for which opportunistic flights of the channel were conducted over the east half of the reach due to morning flight cancellations and the large number of cranes present in that area. A count in the evening when cranes were more likely to have returned to the river for roosting was deemed necessary to provide more accurate counts than an attempt to count large numbers of birds distributed widely over the reach through ground efforts with limited accessibility.

Observations and data collection

At the beginning of each transect and at turn around points, the aerial crews relayed their position via mobile phone to the nearby ground crews so they could stay in relative proximity. The aerial observers utilized binoculars for sighting and a Canon Rebel T6s 760D camera for photo documentation. If an aerial crew spotted potential whooping crane(s), aerial photographs were taken of them along with the surrounding area to later confirm the identity and location. If additional observations for confirmation were needed, aerial crew contacted the nearest ground

observer via mobile phone, who then positioned themselves to make a positive identification of the crane(s) without disturbing them. The U.S. Fish and Wildlife Service (USFWS) were notified of daily survey results following the completion of both flights.

In addition to systematic flights, the aerial and ground crews also confirmed and reported opportunistic sightings. Immediately after receiving a report, either a plane was deployed from the nearest airport and/or ground personnel surveyed the area until the crane(s) were located and confirmed, or sufficient search time was allocated to confirm the cranes had left and/or were not present in the immediate area.

Aerial and ground crews used photographs and data sheets to document their observations of whooping crane groups, documenting numbers and age category of individuals, location, habitat type, time, and date of observation. A crane group was defined as one or more whooping cranes observed at one location. Each crane group was given a unique crane group ID (e.g., 2021FA01 = year-season-number) at sighting and would be re-labeled as a new group and given a new crane group ID the next day if they were observed again. Aerial flight logs and ground search data sheets were used to document time and mileage devoted to searching for and identifying whooping cranes. Universal Transverse Mercator (UTM) coordinates within UTM Zone 14N were determined for each crane group utilizing satellite imagery with a Geographic Information System (GIS) in conjunction with observation photos and location descriptions from datasheets. Use sites were given a numerical value at the time of sighting if the crane group was observed in a riverine, lacustrine, or palustrine environment. Crane groups sighted outside of these environments were not assigned a use site number, but rather the location's appropriate land cover classification was recorded or denominated as "AIR" if the group was sighted while in flight. All data were later transcribed from the completed data sheets directly to the PRRIP species database. Data were then subjected to Quality Assurance/Quality Control (QA/QC) checks by the EDO to ensure accuracy.

Results

Whooping Crane Observations and Associated Habitat Metrics

Confirmed whooping crane sightings

PRRIP monitoring identified 88 individual whooping cranes within 11 unique groups through 68 systematic and opportunistic observations, including multiple observations of the same group on the same day. Details of each observation can be found in Appendix A. Of the 88 individuals, 46 were associated with smaller groups that intermingled during their stay and, accordingly, were recorded as a single cohesive crane group.

USFWS/PRRIP data comparison






Table 1 provides a comparison of PRRIP monitoring results and USFWS whooping crane sighting data (provided by Matt Rabbe – USFWS whooping crane lead) for the fall migration. The table includes PRRIP icons associated with each unique crane group, the date(s) the group was observed, the number of individuals in the group and PRRIP/USFWS identification (ID) numbers assigned





to the respective groups. The difference in ID numbers is due to the USFWS data operating on an “initial sighting” basis of identification, whereas PRRIP assigns a new crane group ID number each day a group is observed.

There were three instances (21B-16, 21B-41, and 21B-75) where USFWS reported a crane group that was not observed by PRRIP. Group 21B-16 was observed in the north channel that PRRIP transects do not cover and 21B-75 arrived after PRRIP monitoring ended. 21B-41 was likely observed by PRRIP on days prior but missed on 11/12. There was also one instance that PRRIP observed a group (Radio Group) opportunistically after being informed that there was a GPS marked bird that had been missed. This group was not reported to the USFWS by PRRIP or given a PRRIP ID because the group would not have been observed without the locational data from the GPS marked bird.


Table 1 crane use days are calculated for both PRRIP and USFWS data by multiplying the number of individual cranes in each group by the number of days the group was present, plus one day per crane. This is because each crane observed during early morning PRRIP aerial surveys was assumed to have been present the evening prior to the morning of the first observation. Exceptions to this formula for calculating use days are noted and explained in the footnotes of Table 1. Unique groups are typically individually identifiable by their arrival date, location, and group composition. This year, the fission-fusion nature of the cranes making up the [redacted] group, made it impossible to distinguish between groups as they joined and split over time, changing in composition and exact location over time, though remaining in the same general portion of the reach. Therefore, PRRIP reporting for this group is based upon the number of individuals counted each day from Shelton bridge to Hwy 281 bridge, the area being utilized by the [redacted] group from 11/3-11/11, without an attempt to distinguish between arriving and departing groups or partial groups. The USFWS dates/groups are based upon initial sightings and maintain initial group sizes during their entire stay length even when partial group departures occurred, which artificially inflates crane use days.

Table 1. Comparison of PRRIP and USFWS whooping crane (WC) sightings including: PRRIP group icon, group identification (ID), dates present, number and age category (adults (Ad) : juveniles (Juv)) of individuals, and crane use days.

PRRIP						USFWS				
Group Icon	Group ID	Dates Present	Use Days = (Days Present x Cranes) + 1 day per crane on first day observed			Group ID	Dates Present	Use Days = (Days Present x Cranes) + 1 day per crane on first day observed		
			# of WC Ad:Juv	Days Present	Use Days			# of WC Ad:Juv	Days Present	Use Days
	2021FA01	10/23	3:0	1	6	21B-07	10/23	3:0	1	6
	2021FA02	10/31	4:2	1	12	21B-09	10/31	4:2	1	12
	2021FA03	10/31	8:2	1	20	21B-10	10/31	8:2	1	20
	Radio Group	10/31	2:1	1	6 ^a	Not Reported				
	2021FA04	10/31	1:0	1	2	21B-11	10/31	1:0	1	2
Not Observed						21B-16	10/31	2:0	1	4

	2021FA05,06,09,10	11/3	38:7	1	90	21B-28,29,31,32,64	11/3	39:7	1	92 ^b
	2021FA15,16,17,18,19	11/4	29:6	1	35	21B-28,29,31,32,64,41	11/4	41:8	1	49 ^{bc}
	2021FA21,22,23	11/5	33:7	1	40	21B-28,29,31,32,64,41	11/5	41:8	1	49 ^b
	2021FA25,26,27,29,30	11/6	39:7	1	46	21B-28,29,31,32,64,41	11/6	41:8	1	49 ^b
	2021FA35,36	11/7	39:7	1	46	21B-28,29,31,32,64,41	11/7	41:8	1	49 ^b
	2021FA37,38,39,40,41	11/8	39:7	1	46	21B-28,29,31,32,64,41	11/8	41:8	1	49 ^b
	2021FA44	11/9	14:0	1	14	21B-28,31,41	11/9	20:5	1	25 ^b
	2021FA46	11/10	14:0	1	14	21B-28,31,41	11/10	20:5	1	25 ^b
	2021FA49	11/11	14:0	1	14	21B-28,31,41	11/11	20:5	1	25 ^b
	Not observed					21B-41	11/12	2:1	1	3 ^b
	2021FA07,14,24.5,28.5	11/3-11/6	4:1	4	25	21B-73	11/3-11/6	4:1	4	25
	2021FA08,13,24,28,33,45,48,50,52,54,55,56	11/3-11/17	2:1	15	48	21B-30	11/3-11/17	2:1	15	48
	2021FA11,12,20,32,42,47	11/3-11/10	2:1	8	24 ^d	21B-33	11/3-11/10	2:1	8	24 ^d
	2021FA18.5,34,43	11/4-11/8	5:0	5	25 ^d	21B-36	11/4-11/8	5:0	5	25 ^d
	2021FA51,53	11/13-11/14	2:1	2	9	21B-74	11/13-11/14	2:1	2	9
Not Observed						21B-75	11/19	4:0	1	8
Totals			72:16		522	Totals			80:17	598

^aThe Program recognizes this telemetry group that was reported to and observed by PRRIP as contributing both to number of birds observed by PRRIP and crane use days.

^bCrane use days differ between PRRIP and FWS due to the differences in documenting the  group. FWS data maintains initial group sizes during their entire stay length even when partial group departures occurred. PRRIP based crane use days for this group off observed daily count.

^cOne day was not added per crane for group 21B-41 as the group included a telemetry marked bird that arrived exactly on the 4th.

^dOne day was not added per crane as the first observation of these groups were in the evening.

Overall, PRRIP calculated a total of 522 crane use days during the fall survey period (Table 1). Linear regression analysis of the fall crane use day data from 2007 – 2021 demonstrated a significant increasing long-term trend in crane use days through time (y intercept = -33907.58, slope coefficient = 16.88, $r^2 = 0.33$, p-value = 0.02) at an alpha level of 0.05 (Fig. 3).

Proportion of population

According to the most recent survey conducted by the U.S. Fish and Wildlife Service during the winter of 2019-2020, the Aransas – Wood Buffalo (AWB) migratory whooping crane population was estimated to be 506 birds (95% CI: 342.6 - 678.0; [USFWS 2020](#)). The 88 individuals (72:16) observed by PRRIP during the fall 2021 monitoring effort constitute approximately 17.39% of the estimated migratory population. This proportion will be updated once the 2022 USFW winter survey results are published.

Observed whooping crane use of the central Platte River during fall systematic surveys of the AHR for PRRIP has varied from year to year (Fig. 3). Since the initiation of PRRIP monitoring efforts in 2007, the estimated proportion of the AWB population observed on the central Platte River through implementation of the PRRIP monitoring protocol has ranged from 0.59% - 17.39%. Linear regression analysis of the fall proportion data from 2007 – 2021 demonstrated no significant long-term trend (y intercept = 0.003, slope coefficient = 0.00, $r^2 = 0.094$, p-value = 0.222) at an alpha level of 0.05.

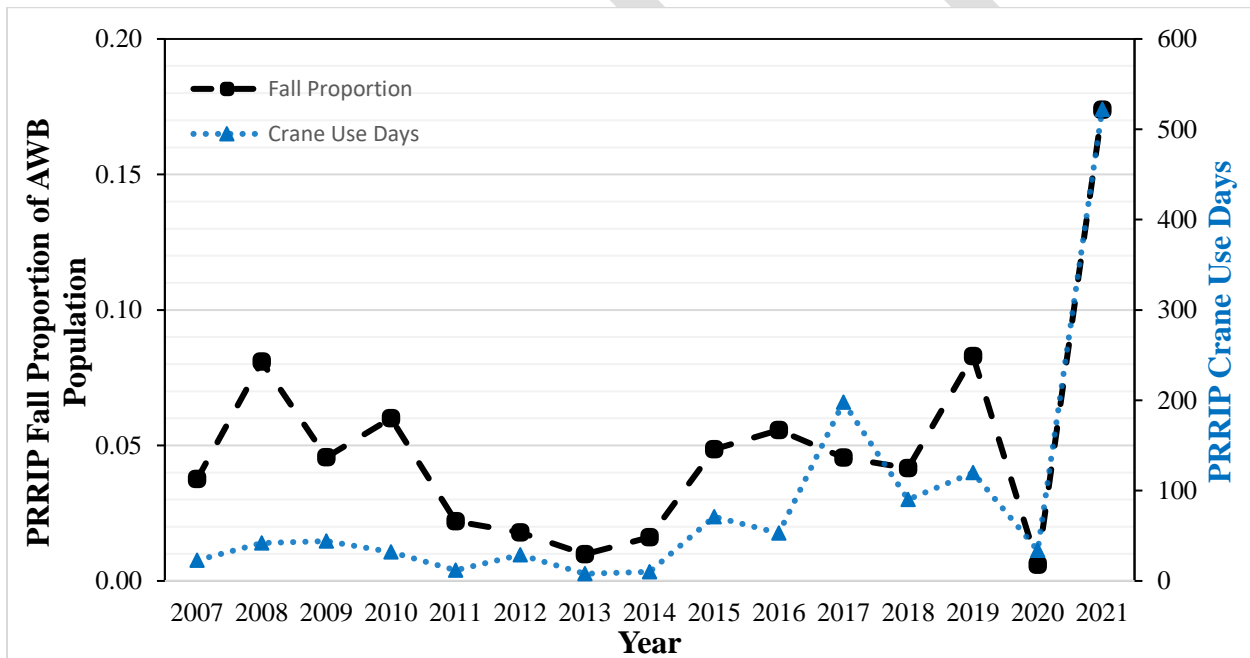









































Figure 3. Annual proportion of the estimated Aransas-Wood Buffalo (AWB) whooping crane population observed (black squares) and number of crane use days (blue triangles) during aerial systematic and opportunistic fall migration surveys from 2007-2021.

Streamflow and unobstructed channel width at whooping crane use locations

During the fall 2021 whooping crane migration monitoring period, Platte River flow in the AHR ranged from a low of 107 cubic feet per second (cfs) at Cottonwood Ranch on 10/18/21 ([USGS 2021b](#)) to a high of 2,300 cfs at Kearney on 11/1/21 ([USGS 2021c](#)). Instantaneous discharge at the nearest gaging station at the time crane groups were observed, ranged from 203 cfs – 2,110 cfs (Table 2).

244 **Table 2.** In-channel crane group use sites and associated streamflow discharge (cfs) from nearest gaging station and
 245 time of observation.

Unique Group Icon	Crane Group ID	# of Cranes Adults:Juv	Use Site #	Date	Gaging station ^a	Discharge (cfs)
	2021FA01	3:0	1	10/23/21	Kearney	203
	2021FA02	4:2	2	10/31/21	Cottonwood	1550
	2021FA03	8:2	3	10/31/21	Overton	2110
	Radio Group	2:1	4	10/31/21	Cottonwood	1570
	2021FA05,06	13:2/4:0	5,6	11/3/21	Grand Island	2050
	2021FA07	4:1	7	11/3/21	Kearney	823
	2021FA08	2:1	8	11/3/21	Kearney	823
	2021FA11	2:1	11	11/3/21	Kearney	649
	2021FA05,06,09,10	13:2/6:2/15:3/4:0	9,10,12,13	11/3/21	Grand Island	2080
	2021FA07	4:1	14	11/3/21	Kearney	649
	2021FA08	2:1	15	11/3/21	Kearney	649
	2021FA12	2:1	16	11/4/21	Kearney	524
	2021FA13	2:1	17	11/4/21	Kearney	524
	2021FA14	4:1	17	11/4/21	Kearney	524
	2021FA15,16	13:2/4:0	18,13	11/4/21	Grand Island	1400
	2021FA12	2:1	16	11/4/21	Kearney	485
	2021FA13	2:1	17	11/4/21	Kearney	485
	2021FA15,19	13:2/16:4	18,20	11/4/21	Grand Island	1020
	2021FA18.5	5:0	19	11/4/21	Kearney	485
	2021FA22	13:2	21	11/5/21	Grand Island	632
	2021FA24	2:1	22	11/5/21	Kearney	438
	2021FA24.5	4:1	22	11/5/21	Kearney	438
	2021FA25	6:2	23	11/6/21	Grand Island	465
	2021FA28	2:1	24	11/6/21	Kearney	391
	2021FA28.5	4:1	24	11/6/21	Kearney	391
	2021FA29,30	2:1/9:1	25,26	11/6/21	Grand Island	452
	2021FA32	2:1	27	11/6/21	Kearney	382
	2021FA33	2:1	28	11/7/21	Kearney	358
	2021FA34	5:0	29	11/7/21	Kearney	358
	2021FA37,38,39,40,41	10:0/3:2/2:0/17:4/7:1	30,31,32	11/8/21	Grand Island	375
	2021FA42	2:1	16	11/8/21	Kearney	319
	2021FA43	5:0	33	11/8/21	Kearney	319
	2021FA45	2:1	28	11/9/21	Kearney	322
	2021FA46	14:0	34	11/10/21	Grand Island	340
	2021FA47	2:1	35	11/10/21	Kearney	333
	2021FA48	2:1	36	11/10/21	Kearney	333
	2021FA54	2:1	37	11/15/21	Kearney	279
	2021FA55	2:1	38	11/16/21	Kearney	301
	2021FA56	2:1	36	11/17/21	Kearney	716

246 ^aGaging Stations: Overton ([USGS 2021a](#)), Cottonwood Ranch – Elm Creek ([USGS 2021b](#)), Kearney ([USGS 2021c](#)),
 247 and Grand Island ([USGS 2021d](#)).

Figs. 4-7 display discharge during the fall 2021 monitoring period at USGS river gages located at Overton (USGS 2021a), Cottonwood Ranch (USGS 2021b), Kearney (USGS 2021c), and Grand Island (USGS 2021d). The daily number of cranes observed for each crane group are displayed in stacked bars.

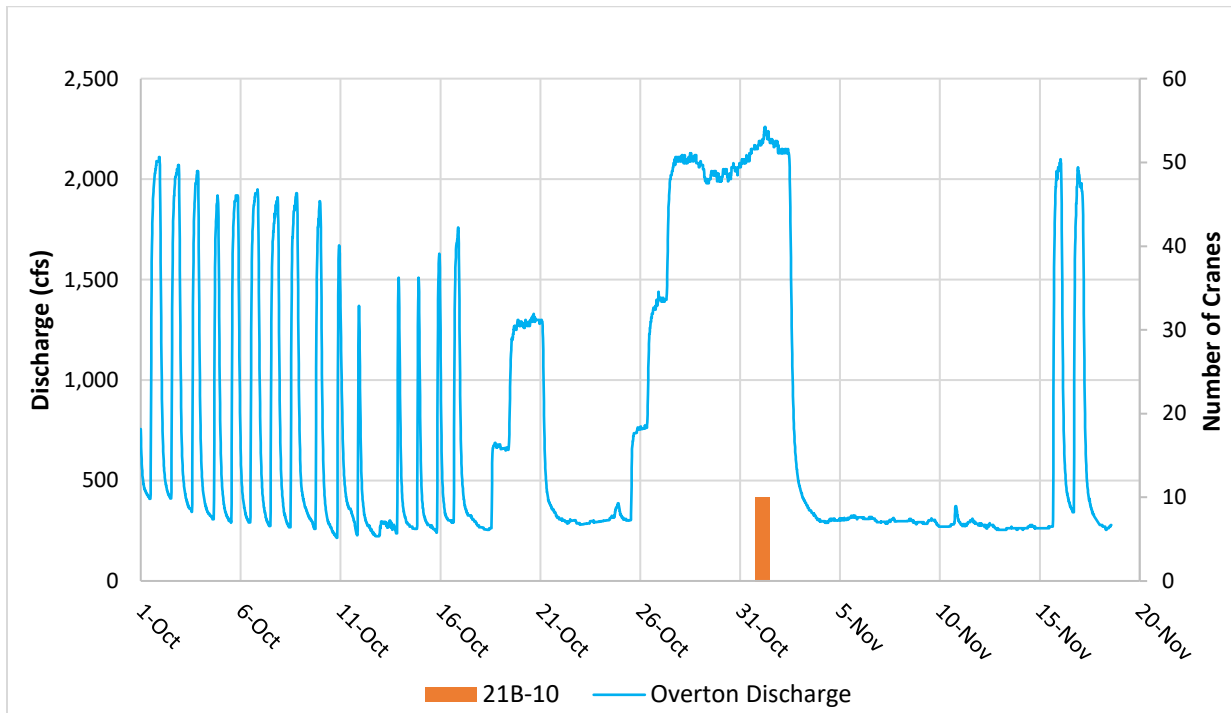


Figure 4. Discharge (blue line) at the Overton gage from 10/1 – 11/18 (USGS 2021a) and numbers of whooping cranes from each group (USFWS crane group 21B-10 in orange bar) observed on the indicated dates either on- or off-channel at locations for which Overton was the nearest gaging station.

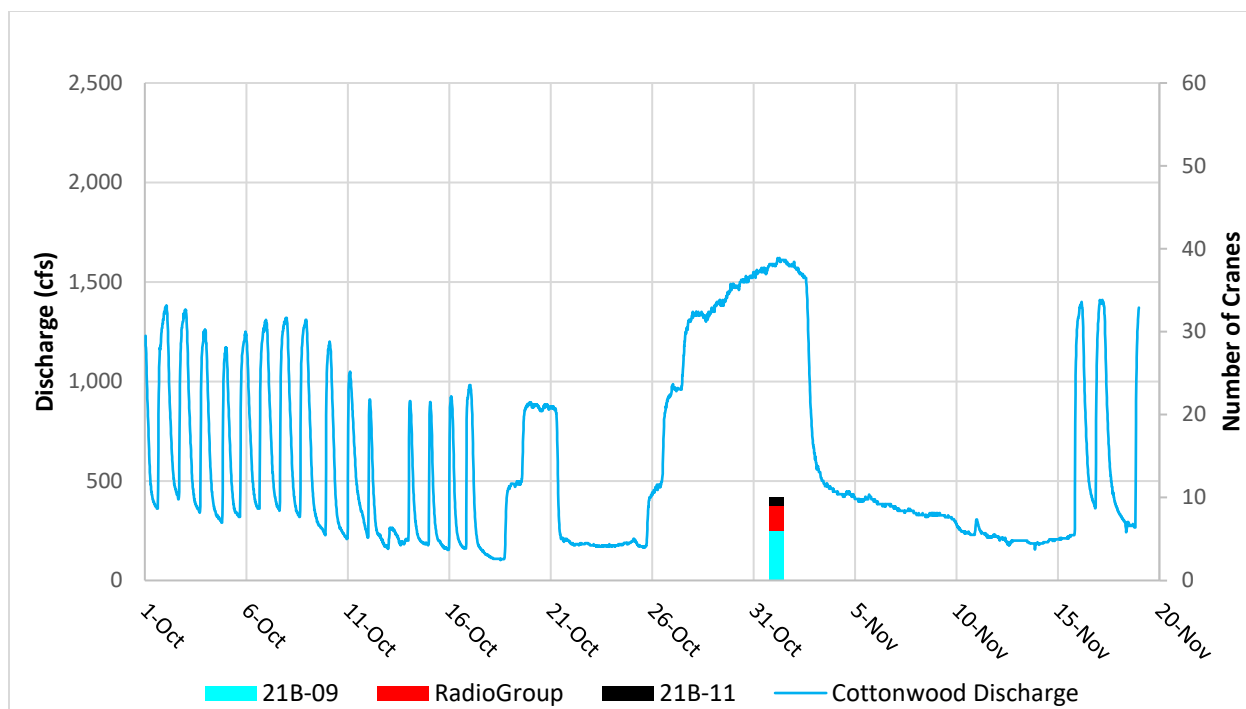


Figure 5. Discharge (blue line) at the Cottonwood gage from 10/1 – 11/18 ([USGS 2021b](#)) and numbers of whooping cranes from each group (USFWS 21B-09, 21B-11, and “Radio Group” in colored bars) observed on the indicated dates either on- or off-channel at locations for which Cottonwood was the nearest gaging station.

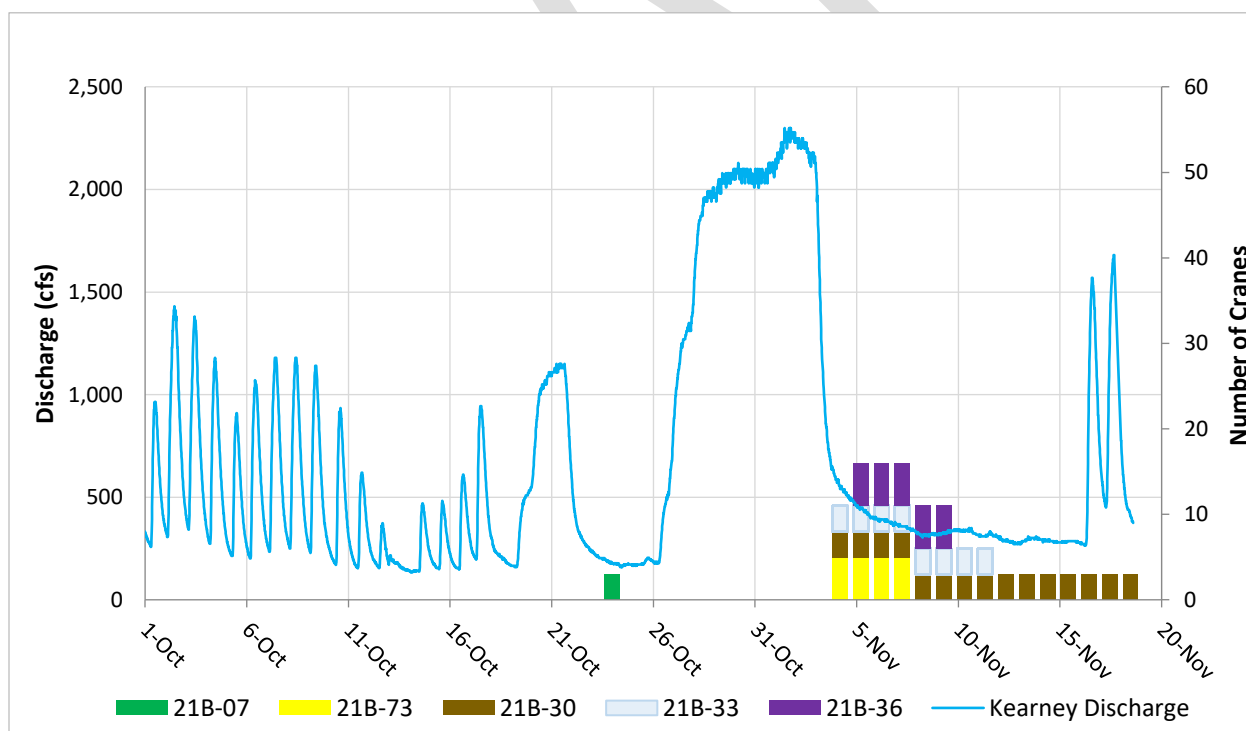


Figure 6. Discharge (blue line) at the Kearney gage from 10/1 – 11/18 ([USGS 2021c](#)) and numbers of whooping cranes from each group (USFWS 21B-07, 21B-73, 21B-30, 21B-33, and 21B-36 in colored bars) observed on the indicated dates either on- or off-channel at locations for which Kearney was the nearest gaging station.

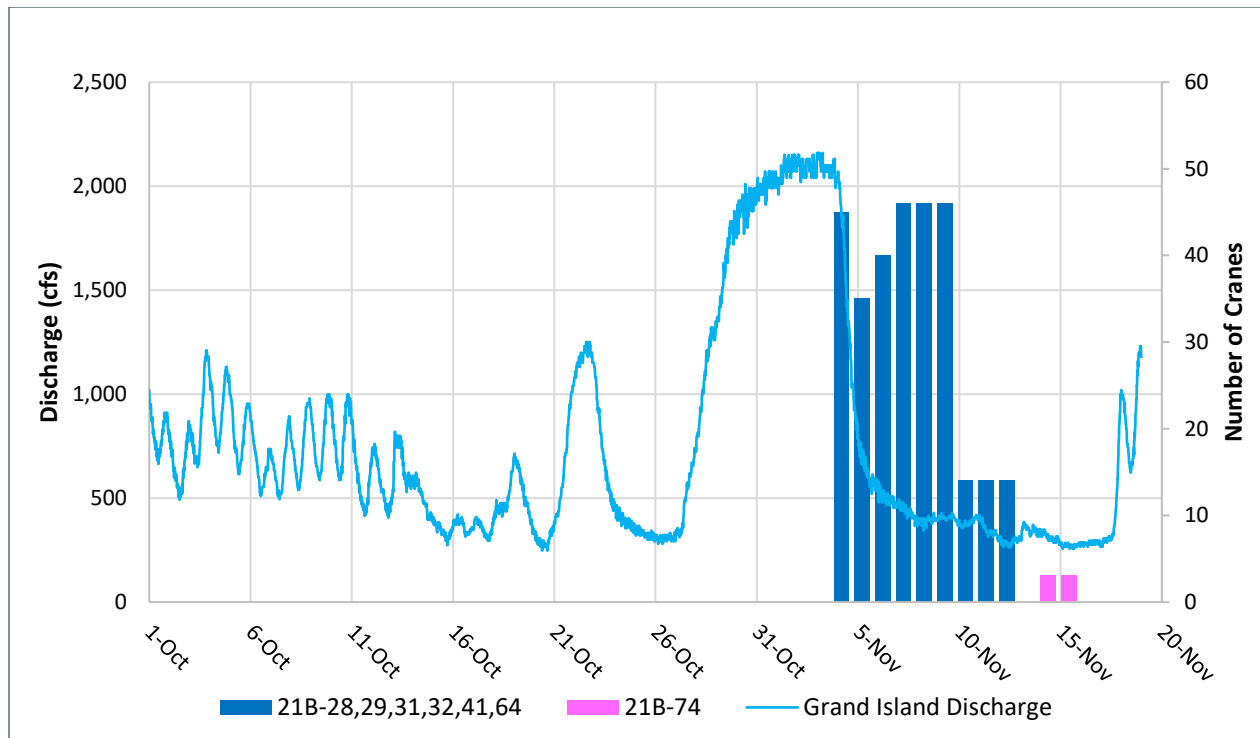








































Figure 7. Discharge (blue line) at the Grand Island gage from 10/1 – 11/18 ([USGS 2021d](#)) and numbers of whooping cranes from each group (USFWS 21B-28,29,31,32,41,64 and 21B-74 in colored bars) observed on the indicated dates either on- or off-channel at locations for which Grand Island was the nearest gaging station.

Unobstructed channel width (width of channel unobstructed by dense vegetation) and nearest forest (distance to nearest riparian forest) have both been found to be important predictors of whooping crane use of the Platte River ([Baasch et al. 2019](#)). Unobstructed channel widths at riverine use sites ranged from 217 - 1146 feet (average = 762 feet) (Table 3). Nearest forest ranged from 90 - 1823 feet (average = 601 feet).

Table 3. Unobstructed channel width and nearest forest at each in-channel crane use location.

Unique Group Icon	Crane Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Unobstructed Channel Width (ft)	Nearest Forest (ft)
	2021FA01	1	508376	4501948	937	250
	2021FA02	2	469474	4503641	1146	505
	2021FA03	3	444091	4504240	863	374
	Radio Group	4	458038	4503695	560	230
	2021FA05A	5	539612	4511406	864	90
	2021FA06	6	534186	4510594	503	778
	2021FA07A	7	504576	4501168	217	342
	2021FA08B	8	504258	4500981	466	444
	2021FA09	9	547985	4515221	655	532
	2021FA10	10	550259	4515855	687	550
	2021FA11	11	517686	4505528	501	570
	2021FA05B	12	540680	4512346	1136	706
	2021FA06,16	13	533904	4510591	785	634
	2021FA07B	14	505450	4501149	632	749
	2021FA08	15	505165	4501182	863	372
	2021FA12,42	16	517494	4505438	805	373
	2021FA13,14	17	505188	4501036	883	841
	2021FA15	18	540864	4512534	995	1145
	2021FA18.5	19	507497	4501842	671	817
	2021FA19, 35/36B	20	544450	4514380	1106	920
	2021FA22	21	540455	4512232	1145	763
	2021FA24,24.5	22	505687	4501206	712	594
	2021FA25	23	539765	4511582	988	374
	2021FA28,28.5	24	508262	4501886	914	416
	2021FA29	25	540100	4511907	610	611
	2021FA30	26	540252	4511949	888	615
	2021FA32	27	516315	4504924	776	358
	2021FA33,45	28	505514	4501227	657	498
	2021FA34	29	505664	4501268	715	771
	2021FA37,38	30	541655	4512889	728	670
	2021FA39	31	540029	4511730	359	393
	2021FA40,41	32	538012	4511441	535	508
	2021FA43	33	507560	4501919	906	526
	2021FA46	34	542167	4513160	836	574
	2021FA47	35	516297	4504895	815	354
	2021FA48,56	36	505907	4501414	681	999
	2021FA54	37	505812	4501246	772	767
	2021FA55	38	506196	4501453	647	1823

Figures 8-19 provide maps of crane group use locations in relation to PRRIP and other conservation lands. Figures 20-28 provide photographs of whooping crane groups observed during systematic and opportunistic monitoring.

Monitoring Effort and Detection Probabilities

Systematic effort

A total of 42 whooping crane observations were made while conducting systematic aerial monitoring (Appendix A). Of the 76 regularly scheduled flights, there were 53 instances when crews were able to depart the airport, of which 52 were completed, resulting in completion of 68.4% of scheduled flights (Table 4). One flight was initiated, but not completed and twenty-three flights were cancelled due to weather. This season was extended four days resulting in seven additional systematic flights being completed (3 east; 4 west) to make a total of 59 for the fall 2021 season (27 east and 32 west).

Considering the transects individually (river channel and off-channel primary/secondary return transects), 148 (70.8%) of the 209 scheduled systematic transects were completed. Additionally, 19 of 22 systematic transects were completed in the four-day season extension.

Table 4. Systematic flight completion rates.

	East	West	Totals
Regularly Scheduled			
Systematic Completed	24	28	52
Cancelled/Incomplete	14	10	24
Scheduled Season Total	38	38	76
% Regularly Scheduled Completed	63.2%	73.7%	68.4%
Additionally Flown			
Systematic Completed	3	4	7
Cancelled/Incomplete	1	0	1
Additional Total	4	4	8
% Additional Completed	75%	100%	87.5%
OVERALL % COMPLETED	64.3%	76.2%	70.2%













Opportunistic effort

Opportunistic efforts were important for obtaining more complete whooping crane counts this fall when systematic efforts were limited by weather conditions while large numbers of cranes were spread throughout the reach. All observations made outside of the systematic aerial monitoring protocol were considered opportunistic. Twenty-six opportunistic observations were recorded this

season. Of those 26 observations, 14 were aerial observations and 12 were made by ground crews independently without the aid of aerial support (Appendix A).

Table 5 shows the effort made by ground crews. The “miles driven” column indicates the total miles driven in the effort to locate a potential crane group, starting from the location of the last reported sighting or known location based on previous days’ observations, then continuing until the crane group or white object was located and identified or a reasonable amount of effort has been put forth.

Table 5. Ground search effort for whooping cranes (WC) in response to an information source (aerial sighting by plane (plane), found based upon previous known locations (known), or sighting with no prior knowledge of whooping crane presence in the area (no information). Sighting resulted from effort by aerial and ground crew working together (both) or ground crew sighting alone (ground). Efforts that resulted in no WC found, are recorded as None.

Unique Group Icon	Date	Source	WC Confirmed Ad:Juv	Miles Driven	Aerial/Ground Effort
	11/3	Known	13:2	2	Ground
	11/3	Known	4:0	15	Ground
	11/3	Known	4:1	1	Ground
	11/3	Known	2:1	1	Ground
	11/4	Known	2:1	4	Ground
	11/4	Known	2:1	10	Ground
	11/4	Known	4:1	1	Ground
	11/4	Known	13:2	12	Ground
	11/4	Known	4:0	9	Ground
	11/4	Known	4:2	25	Ground
	11/4	Known	2:1	25	Ground
	11/5	Known	18:4	0	Ground
NA	11/7	Known	None	23	Ground
NA	11/17	Known	None	36	Ground

This season, 12 observations were made during 2 opportunistic evening flights that were conducted to count whooping cranes present within the east half of the reach, when systematic morning flights had been cancelled due to weather. These flights were initiated because ground crews had confirmed multiple groups intermingling between Shelton bridge and Hwy 281. The speed of an aerial survey vastly reduces the chances of double counting. The west half was not flown at this time because whooping crane presence was not found by the ground crew that morning or observed the day prior. Some of the crane groups observed in the evening were second observations of groups observed by ground crew earlier the same day. All evening observations are indicated in red text within Appendix A.

Two additional aerial observations (Radio Group and 2021FA04) were considered opportunistic because both observations occurred when a flight deviated from the systematic transect to observe the telemetry marked crane that was reported to PRRIP while conducting the aerial survey. Table

329 6 summarizes both opportunistic and systematic efforts and observations resulting from each
330 during the Fall 2021 monitoring season.

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331 **Table 6.** Systematic and opportunistic monitoring effort including transect completions, hours, and mileage and resulting whooping crane (WC) sightings.

Systematic			Flight Transects	WC Group Sightings ^a	Completed	Incomplete	Cancelled	Total Scheduled	Hours	Miles
	Scheduled Flights	On Channel	0SE, 0SW ^b	27	55	1	20	76	27:00:00	6,689
		Off Channel	PWRTE, PWRTW ^c	13	55	1	20	76	24:22:00	
			WSRT, CSRT, ESRT ^d	0	38	1	18	57	5:34:00	
	Additional Flights ^e	On-Channel	0SE, 0SW ^b PWRTE, PWRTW ^c WSRT, CSRT, ESRT ^d	2	7	0	1	8	3:51:00	813
		Off-Channel		0	7	0	1	8	2:44:00	
				0	5	0	1	6	0:58:00	
Opportunistic	Flight ^f			14					1:48:00	238
	Ground ^g			12					8:59:00	164
	TOTALS			68	167	3	61	231	72:23:00	7,904

332 ^aSee Appendix A for crane group sighting details.

^bPrimary Transect (Riverine), (East – 0SE, West – 0SW) (Figs. 1-2)

^cPrimary Return transect, (East – PWRTE, West – PWRTW) (Figs. 1-2)

^dSecondary Return transect, (East – WSRT and CSRT, West – ESRT) (Figs. 1-2)

^eSystematic-Additional: includes the 4-days of systematic monitoring effort added at the end of the monitoring season from Nov. 16-19 to collect data on whooping cranes remaining within the reach.

^fOpportunistic-Flight: includes observations during the two evening flights made outside the protocol when morning systematic flights were cancelled and observations made when flights deviated outside systematic transects.

^gOpportunistic-Ground: includes efforts made by motorized vehicle outside of systematic flight transects to confirm or deny unconfirmed crane groups or to independently search for previous day groups when flights were cancelled.

Detection probability trials

A total of 20 whooping crane decoy sets (1-3 decoys per set) were placed by the EDO in 20 unique locations along the aerial transects to evaluate ability of aerial observers to detect potential whooping cranes. Ten decoy sets were placed at randomly selected locations within the channel and ten decoy sets were placed at randomly selected locations along off-channel conservation lands within 500 feet of the channel. Flight crews spotted 8 of the 10 decoy sets placed in a wetted channel (80.0%) and 2 of the 10 decoy sets placed at off-channel locations (20.0%) (Table 7).

Table 7. Observation efficiency trials using whooping crane decoys.

Date Placed	Date Tested	UTMx	UTMy	# of Decoys	Habitat Type	Detected
10/8	10/9	503011	4501241	3	Channel	Yes
10/15	10/15	540538	4512620	3	Wet-meadow	No
10/18	10/19	471216	4503996	3	Channel	Yes
10/18	10/19	502178	4501410	3	Wet-meadow	No
10/19	10/21	471084	4503784	2	Wet-meadow	No
10/21	10/22	471475	4503665	2	Wet-meadow	No
10/22	10/23	551782	4517925	1	Wet-meadow	No
10/25	10/29	571837	4537204	2	Channel	Yes
10/25	10/29	549411	4517164	3	Wet-meadow	No
10/29	10/30	544105	4513952	2	Wet-meadow	Yes
10/29	10/30	509949	4502392	1	Wet-meadow	No
10/29	10/30	473503	4503130	2	Wet-meadow	No
10/30	10/31	508158	4501688	3	Channel	No
11/3	11/4	509941	4502678	3	Channel	Yes
11/5	11/6	453140	4503559	3	Channel	Yes
11/9	11/10	442420	4506134	1	Channel	No
11/9	11/10	446795	4504793	1	Wet-meadow	Yes
11/10	11/11	447717	4504155	1	Channel	Yes
11/12	11/13	564953	4530234	1	Channel	Yes
11/12	11/14	564953	4530234	1	Channel	Yes

Comparatively, observation efficiency in the fall of 2021 was above the average of 63% since 2011 for channel decoys and off-channel observation efficiency was right at the average of 21% since 2013. Observation efficiency will likely continue to be above historic averages prior to 2020 when only single decoys were placed. In 2020, decoy placements were adjusted to groups of 1-3 decoys per set to better replicate whooping crane detectability.

Incidental take

The USFWS requires documentation of any human activity that occurred in the proximity of whooping cranes that could constitute “take” as defined by the Endangered Species Act (i.e., “...to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect, or attempt to engage in any

such conduct”). Because harassment interrupts essential feeding or sheltering behaviors, the definition includes disturbance of whooping cranes sufficient to result in cranes taking flight. During the monitoring period, PRRIP documented no instances of take as defined above. Specifically:

- *Lethal or crippling take*

There were no observations of crippling or lethal take of whooping cranes this season resulting from the monitoring conducted by PRRIP.

- *Harassment*

PRRIP staff did not observe or engage in any activity that could be construed as harassment as defined by USFWS.

- *Public disturbance*

PRRIP staff did not observe any incident of public disturbance of whooping cranes.

Supplements

QA/QC of database was performed by PRRIP EDO staff.

Original datasheets – Retained at PRRIP EDO office.

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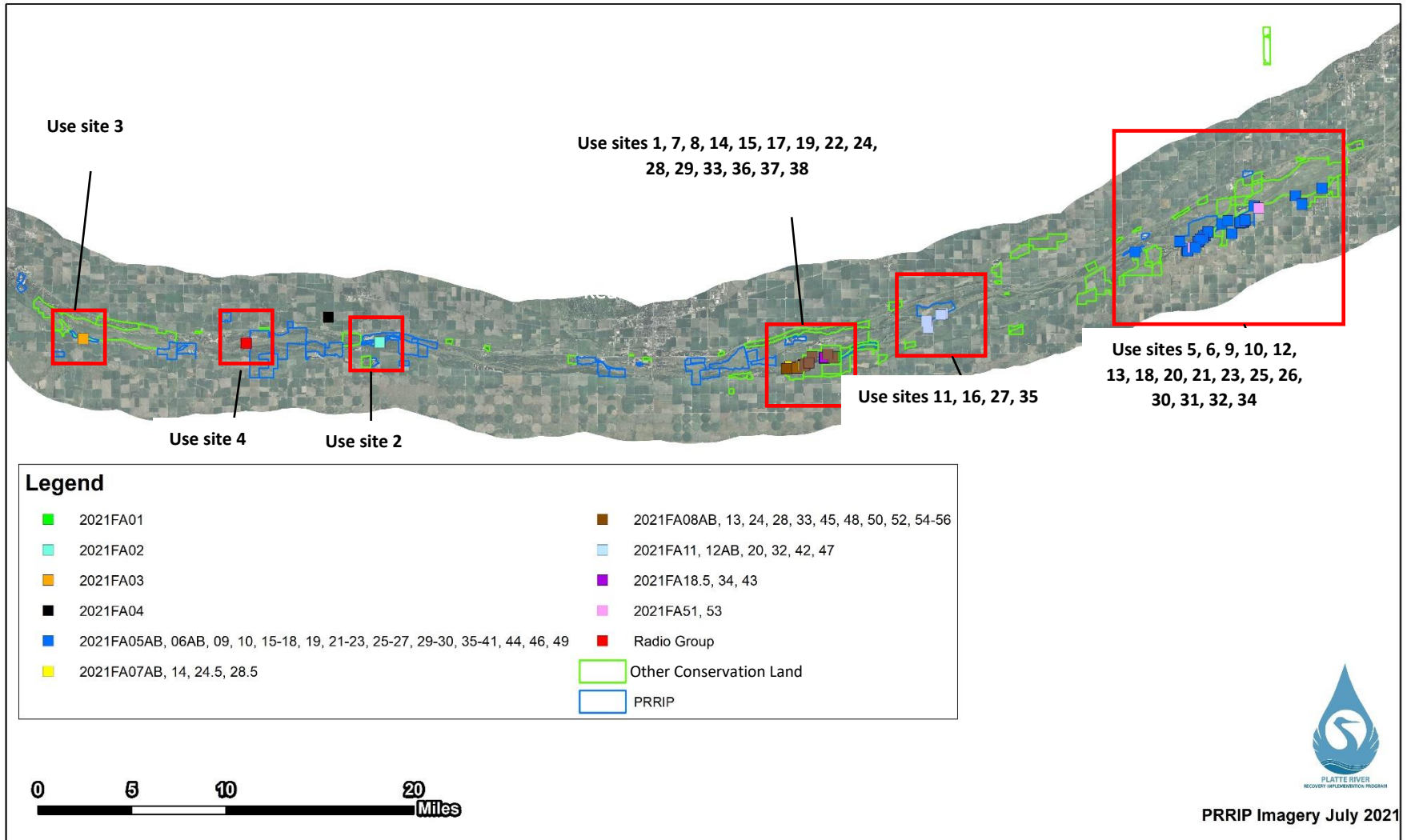
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429 **Figure 8.** Distribution of whooping crane group observations within the AHR during the 2021 fall survey in relation to PRRIP lands (outlined in blue) and all
 430 other conservation lands (outlined in green).



Figure 9. Whooping crane group 2021FA01 observed on 10/23/21 at use site 1 north of Minden, NE.

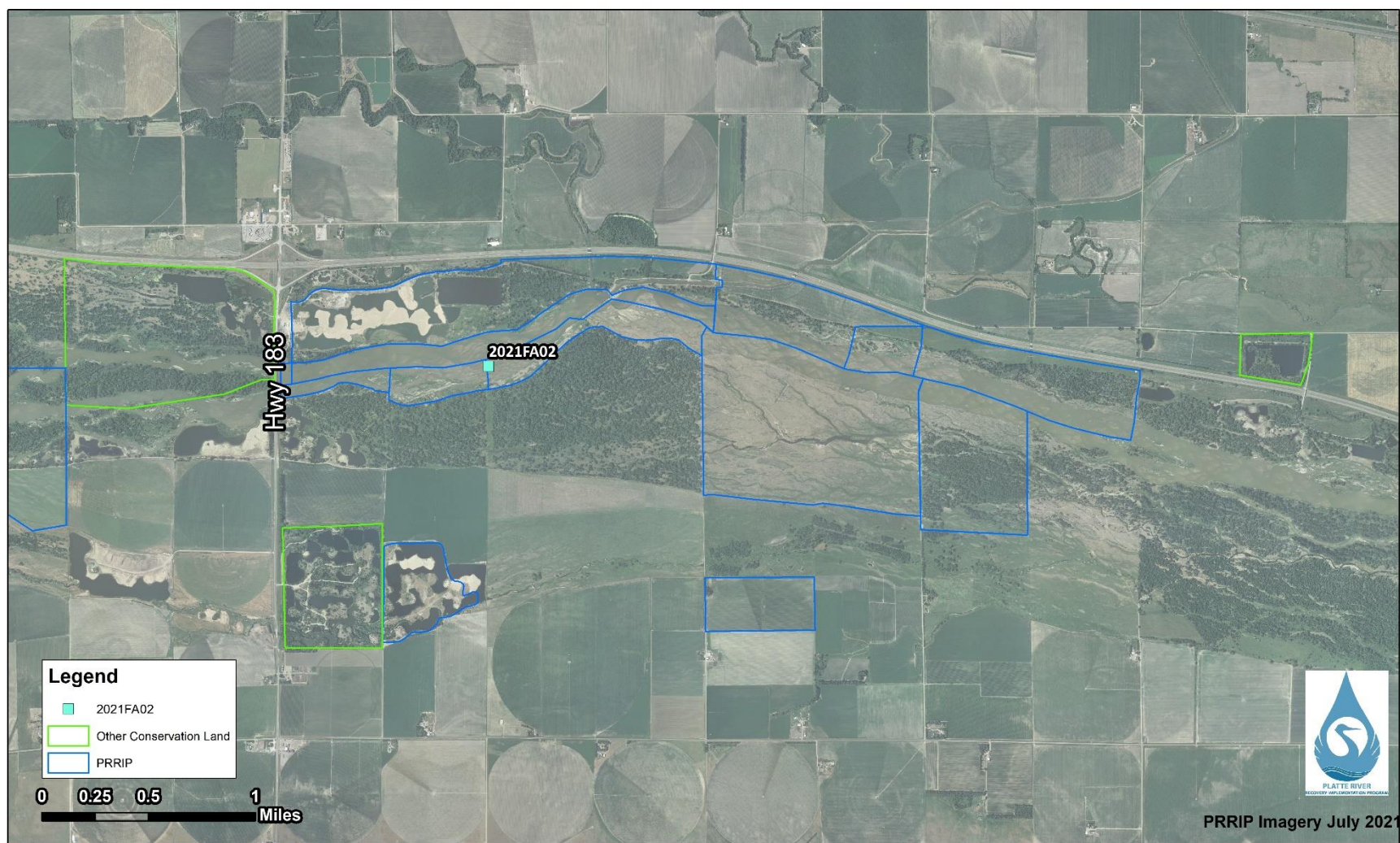


Figure 10. Whooping crane group 2021FA02 observed on 10/31/21 at use site 2 south of Elm Creek, NE.



Figure 11. Whooping crane group 2021FA03 observed on 10/31/21 at use site 3 southeast of Lexington, NE.

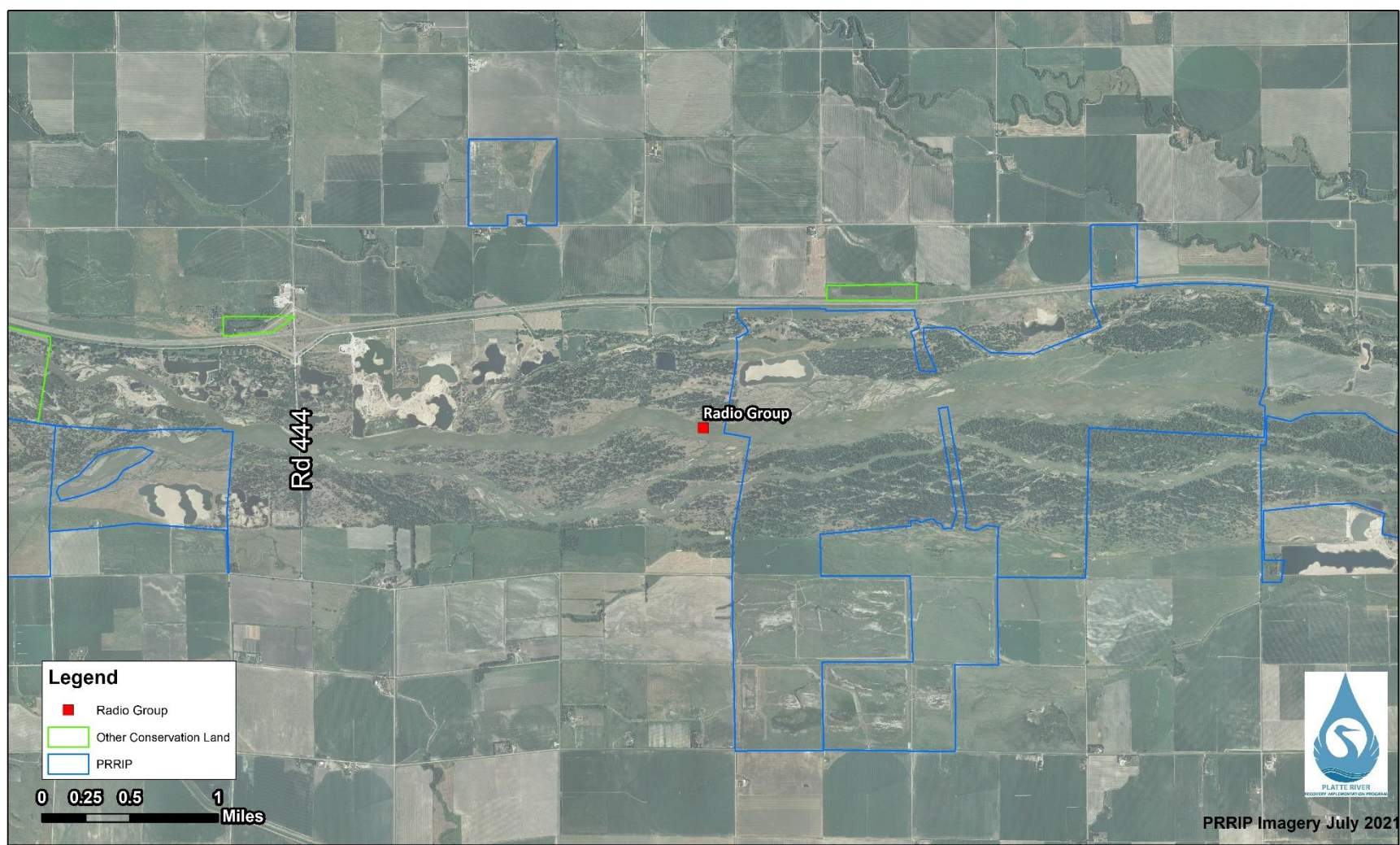


Figure 12. Whooping crane group “Radio Group” observed on 10/31/21 at use site 4 southeast of Overton, NE.

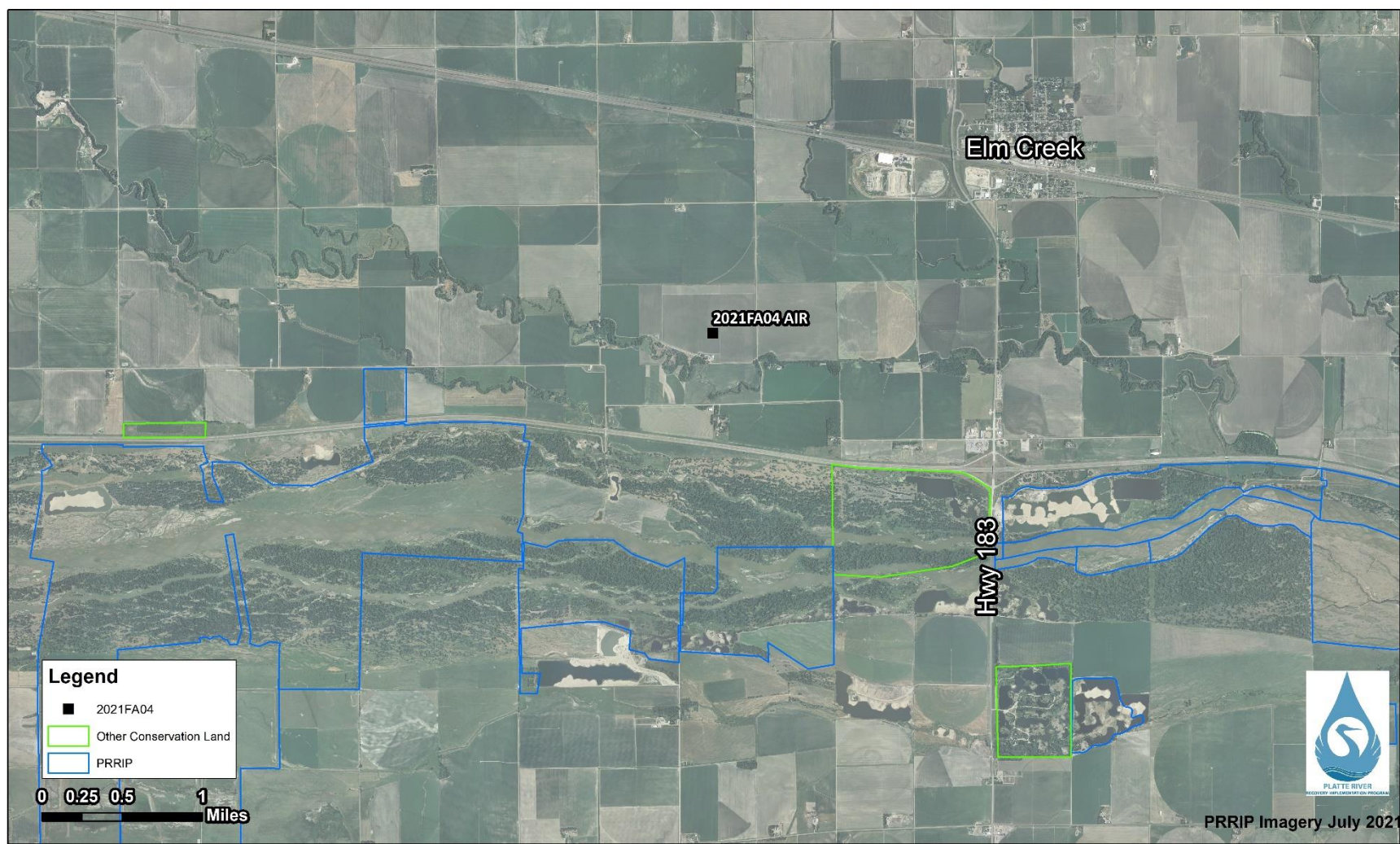


Figure 13. Whooping crane group 2021FA04 observed on 10/31/21 in flight southwest of Elm Creek, NE.

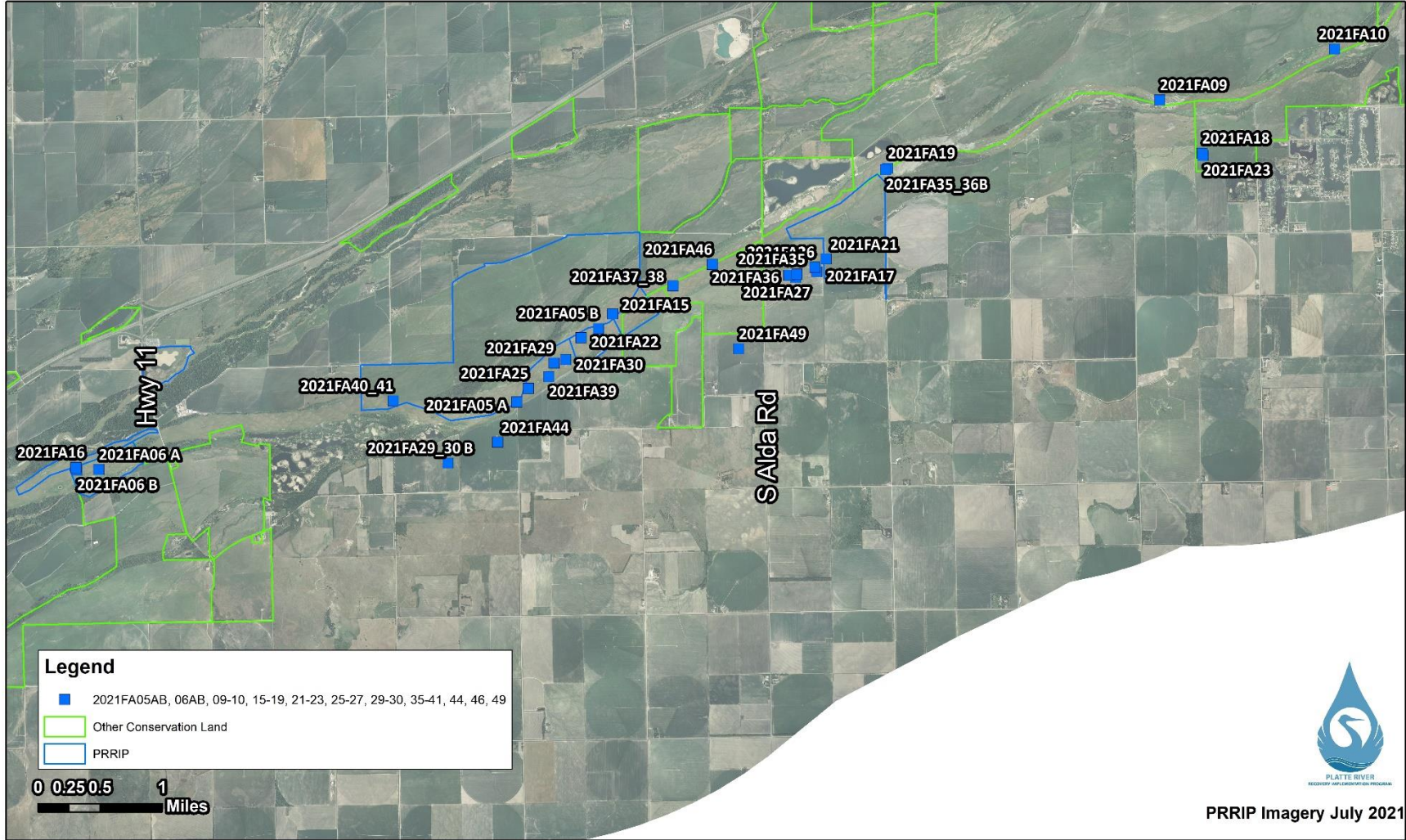
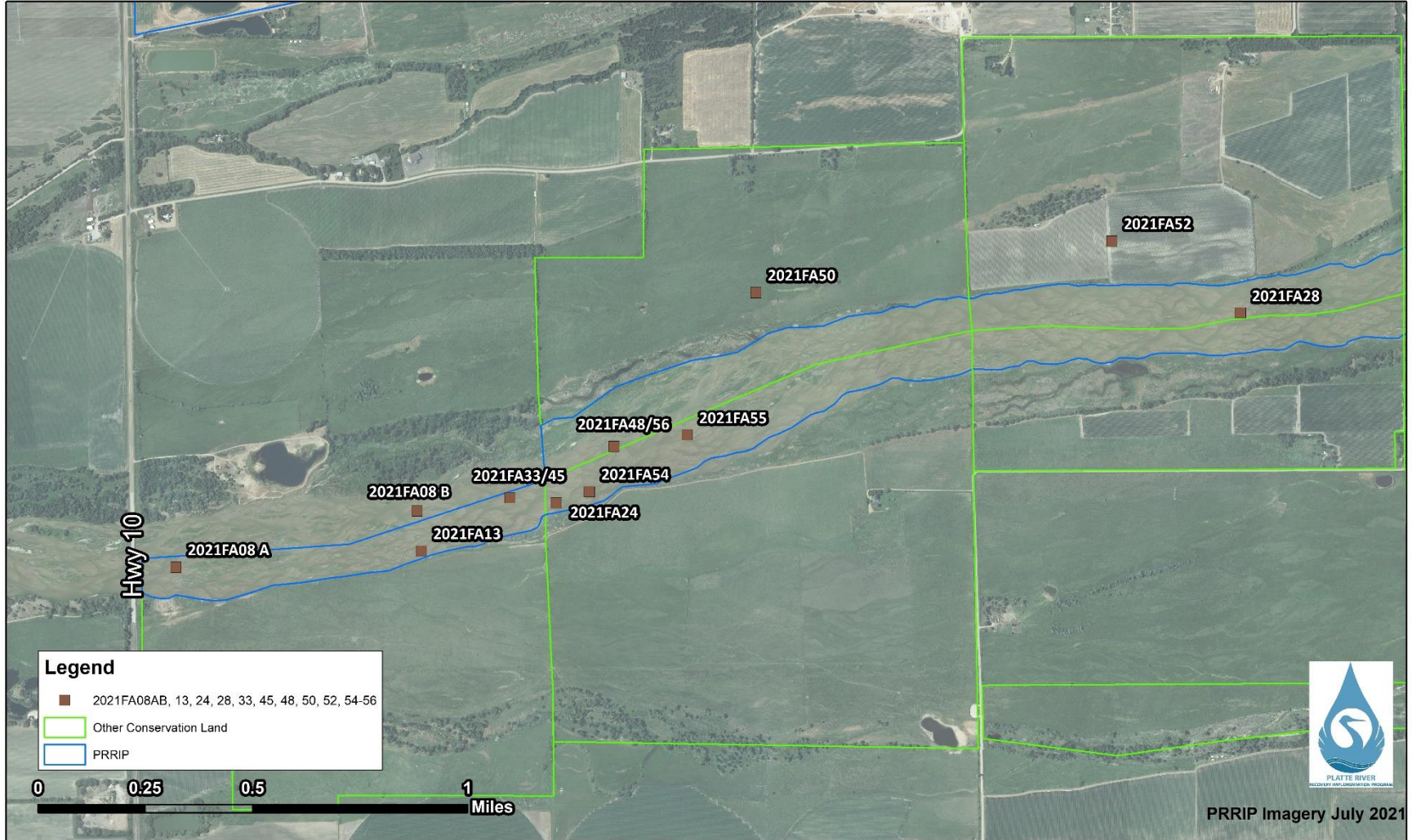


Figure 14. Whooping crane groups 2021FA05-06, 09-10, 15-19, 21-23, 25-27, 29-30, 35-41, 44, 46, and 49 observed on 11/3/21-11/11/21 (including use sites 5, 6, 9, 10, 12, 13, 18, 20, 21, 23, 25, 26, 30, 31, 32, and 34) south of Alda, NE.

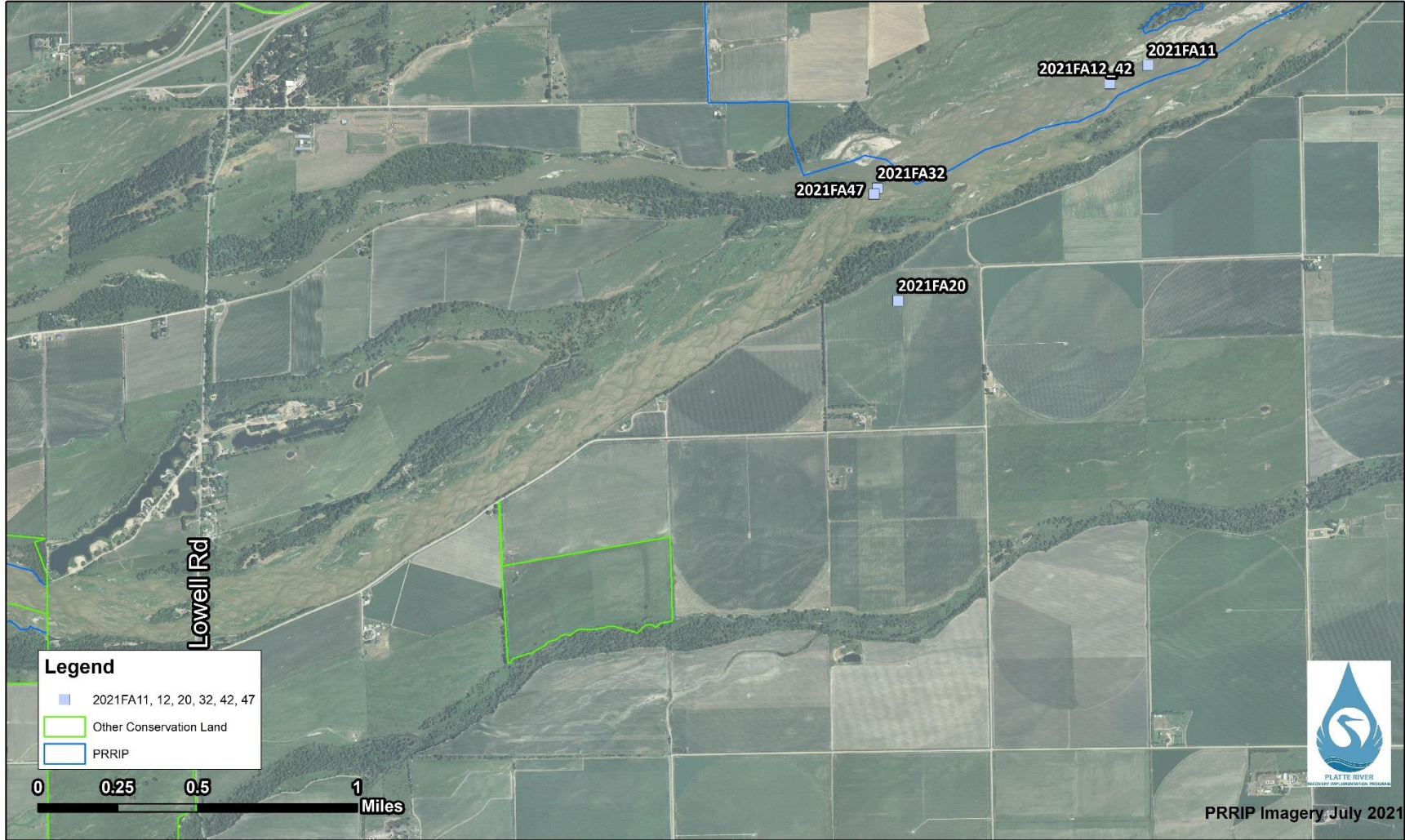


Figure 15. Whooping crane groups 2021FA07, 14, 24.5, and 28.5 observed on 11/3/21 – 11/6/21 (including use sites 7, 14, 17, 22, and 24) north of Minden, NE.



446

447 **Figure 16.** Whooping crane group 2021FA08, 13, 24, 28, 33, 45, 48, 50, 52, and 54- 56 observed on 11/3/21 – 11/17/21 (including use sites 8, 15, 17, 22, 24, 28,
448 and 36-38) north of Minden, NE.



449

450 **Figure 17.** Whooping crane group 2021FA11-12, 20, 32, 42, and 47 observed on 11/3/21 – 11/10/21 (including use sites 11, 16, 27, and 35) south of Gibbon,
 451 NE.

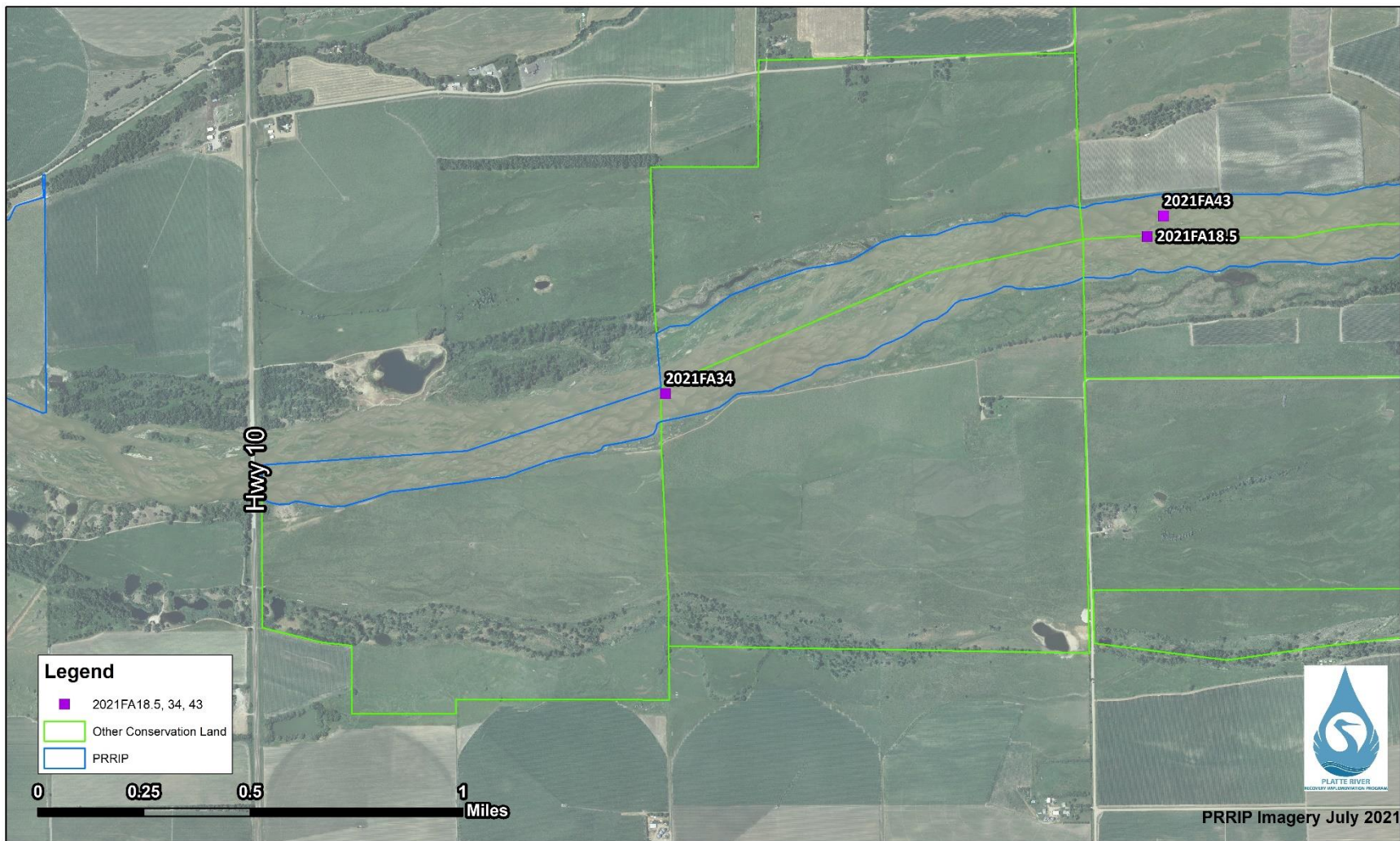


Figure 18. Whooping crane group 2021FA18.5, 34, and 43 observed on 11/4/21 – 11/8/21 (including use sites 19, 29, and 33) north of Minden, NE.

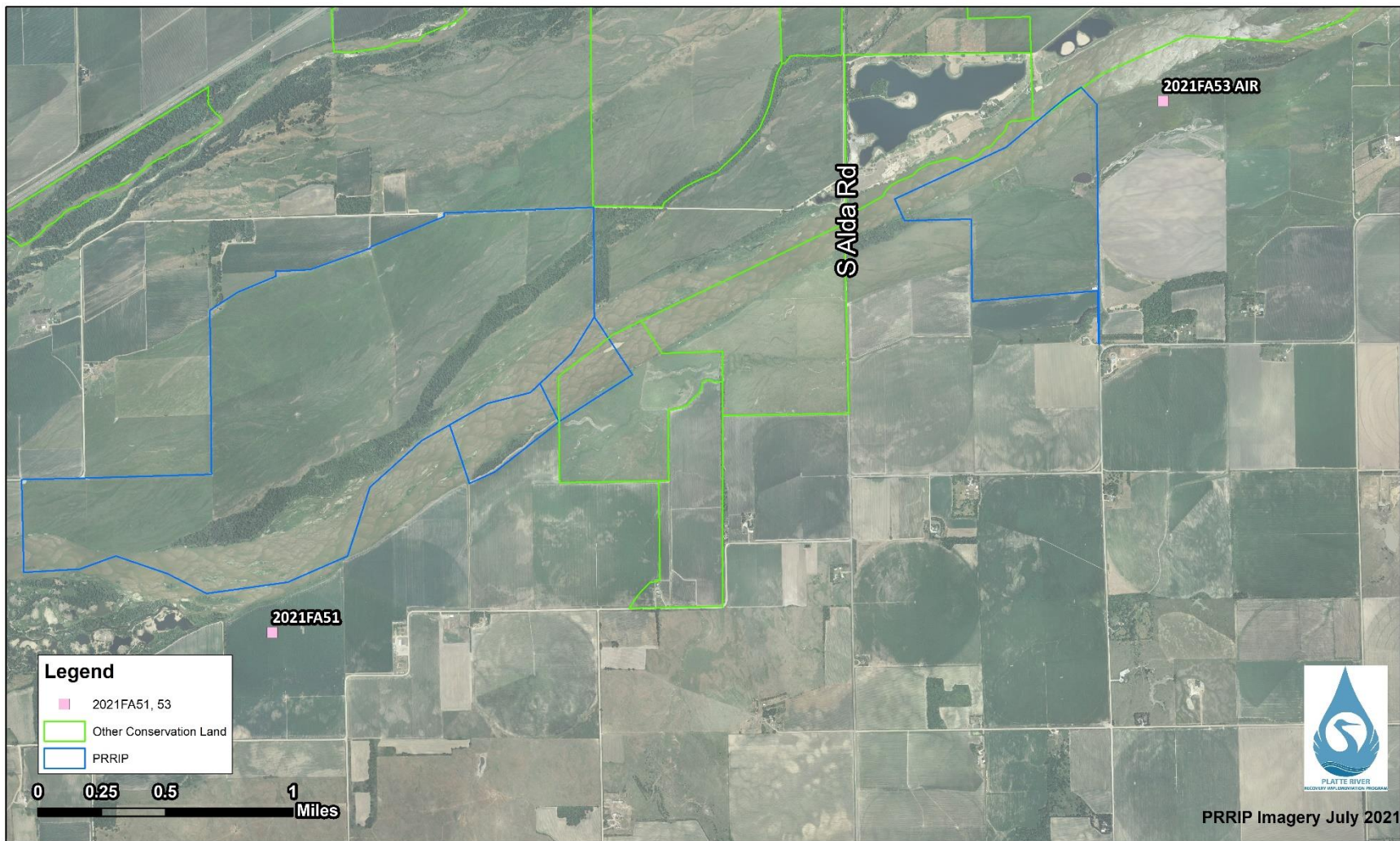


Figure 19. Whooping crane group 2021FA51 and 53 observed on 11/13/21 - 11/14/21 south of Alda, NE.



Figure 20. Photo taken during a systematic observation of crane group 2021FA01 on 10/23/21 at use site 1 in the main channel of the Platte River (see Fig. 9 above for location).



Figure 21. Photo taken during a systematic observation of crane group 2021FA02 on 10/31/21 at use site 2 in the Platte River (see Fig. 10 above for location).



Figure 22. Photo taken during a systematic observation of crane group 2021FA03 on 10/31/21 at use site 3 in the Platte River (see Fig. 11 above for location).



Figure 23. Photo taken during an opportunistic observation of “Radio Group” on 10/31/21 at use site 4 in the Platte River (see Fig. 12 above for location).



Figure 24. Photo taken during a systematic observation of crane group 2021FA35/36 on 11/7/21 at use site 20 in the Platte River (see Fig. 14 above for location).



Figure 25. Photo taken during an opportunistic ground observation of crane group 2021FA07 and 08 on 11/3/21 on use site 7 and 8 in the Platte River (see Fig. 15 and 16 above for locations).



Figure 26. Photo taken during an opportunistic observation of crane group 2021FA11 on 11/3/21 near use site 11 over the Platte River (see Fig. 17 above for location).

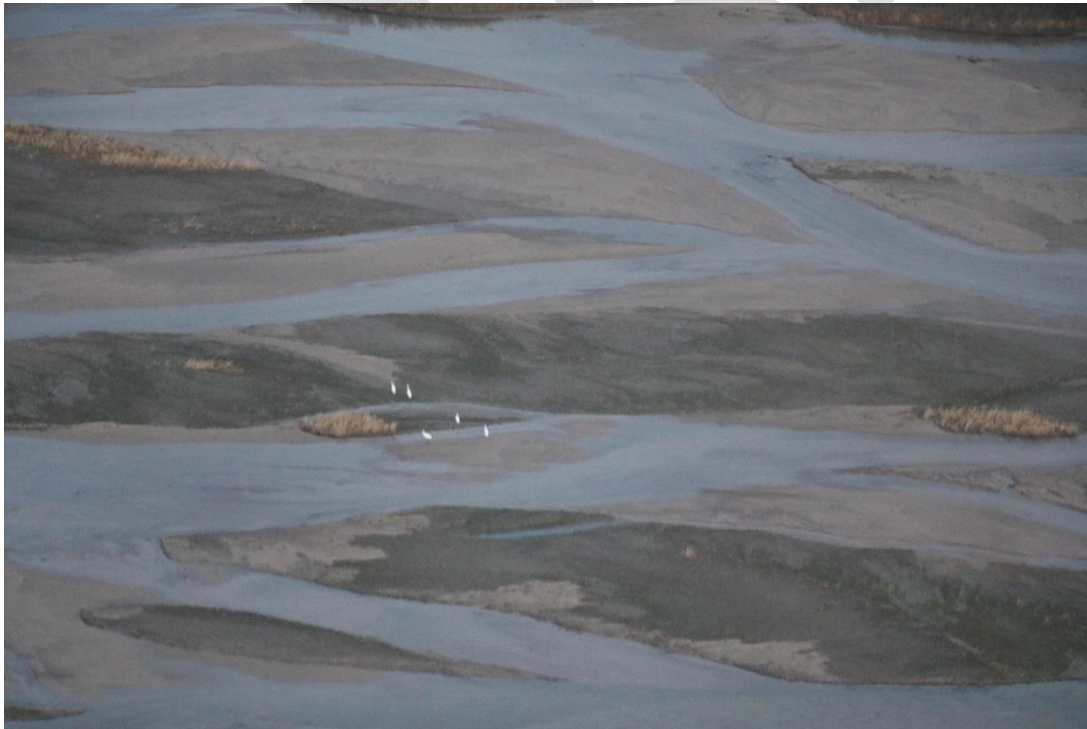


Figure 27. Photo taken during a systematic observation of crane group 2021FA34 on 11/7/21 on use site 29 in the Platte River (see Fig. 18 above for location).



477 **Figure 28.** Photo taken during a systematic observation of crane group 2021FA53 on 11/14/21 near
478 the Platte River (see Fig. 19 above for location).

Appendix A

Crane group observations

In tables below red text indicates observations made during opportunistic evening flights that often include second observations of groups observed by ground crew that morning. Letters are placed following crane group ID's when more than one observation of a crane group is made in the same day.

Table A. Data for crane group 21B-07.


Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	10/23/21	3:0	2021FA01	1	508376	4501948	Sys-Flight

Table B. Data for crane group 21B-09.


Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	10/31/21	4:2	2021FA02	2	469474	4503641	Sys-Flight

Table C. Data for crane group 21B-10.


Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	10/31/21	8:2	2021FA03	3	444091	4504240	Sys-Flight

Table D. Data for the opportunistic observation of the “Radio Group”.












Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	10/31/21	2:1	Radio Group	4	458038	4503695	Opp-Flight

Table E. Data for crane group 21B-11.

Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	10/31/21	1:0	2021FA04	AIR	465104	4505821	Opp-Flight

497 **Table F.** Data for crane groups 21B-28, 21B-29, 21B-31, and 21B-32. Crane group includes all groups observed from
 498 Shelton bridge to Hwy 281 bridge from 11/3-11/11.

Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
 Day total 38:7	11/3/21	13:2	2021FA05 A	5	539612	4511406	Opp-Ground
		4:0	2021FA06 A	6	534186	4510594	Opp-Ground
		13:2	2021FA05 B	12	540680	4512346	Opp-Flight
		4:0	2021FA06 B	13	533904	4510591	Opp-Flight
		6:2	2021FA09	9	547985	4515221	Opp-Flight
		15:3	2021FA10	10	550259	4515855	Opp-Flight
 Day total 29:6	11/4/21	13:2	2021FA15	18	540864	4512534	Opp-Ground
		4:0	2021FA16	13	533892	4510625	Opp-Ground
		4:2	2021FA17	Corn	543518	4513049	Opp-Ground
		2:1	2021FA18	Corn	548523	4514525	Opp-Ground
		13:2	2021FA15 B	18	540864	4512534	Opp-Flight
		16:4	2021FA19	20	544450	4514380	Opp-Flight
 Day total 33:7	11/5/21	18:4	2021FA21	Corn	543641	4513214	Opp-Ground
		13:2	2021FA22	21	540455	4512232	Sys-Flight
		2:1	2021FA23	Grass	548537	4514497	Sys-Flight
 Day total 39:7	11/6/21	6:2	2021FA25	23	539765	4511582	Sys-Flight
		7:3	2021FA26	Corn	543490	4513110	Sys-Flight
		2:1	2021FA27	Corn	543242	4512977	Sys-Flight
		2:1	2021FA29	25	540100	4511907	Sys-Flight
		9:1	2021FA30	26	540252	4511949	Sys-Flight
		39:7	2021FA29/30 B	Corn	538660	4510667	Sys-Flight
 Day total 39:7	11/7/21	6:3	2021FA35	Corn	543259	4513020	Sys-Flight
		33:4	2021FA36	Corn	543155	4513008	Sys-Flight
		39:7	2021FA35/36 B	20	544423	4514359	Sys-Flight
 Day total 39:7	11/8/21	10:0	2021FA37	30	541655	4512889	Sys-Flight
		3:2	2021FA38	30	541655	4512889	Sys-Flight
		2:0	2021FA39	31	540029	4511730	Sys-Flight
		17:4	2021FA40	32	538012	4511441	Sys-Flight
		7:1	2021FA41	32	538012	4511441	Sys-Flight
	11/9/21	14:0	2021FA44	Corn	539356	4510891	Sys-Flight
	11/10/21	14:0	2021FA46	34	542167	4513160	Sys-Flight
	11/11/21	14:0	2021FA49	Corn	542492	4512064	Sys-Flight

499 **Table G.** Data for crane group 21B-73.
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Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	11/3/21	4:1	2021FA07 A	7	504576	4501168	Opp-Ground
		4:1	2021FA07 B	14	505450	4501149	Opp-Flight
	11/4/21	4:1	2021FA14	17	505188	4501036	Opp-Ground
	11/5/21	4:1	2021FA24.5	22	505687	4501206	Sys-Flight
	11/6/21	4:1	2021FA28.5	24	508262	4501886	Sys-Flight

Table H. Data for crane group 21B-30.













Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	11/3/21	2:1	2021FA08 A	8	504258	4500981	Opp-Ground
		2:1	2021FA08 B	15	505165	4501182	Opp-Flight
	11/4/21	2:1	2021FA13 A	17	505188	4501036	Opp-Ground
		2:1	2021FA13 B	17	505188	4501036	Opp-Flight
	11/5/21	2:1	2021FA24	22	505687	4501206	Sys-Flight
	11/6/21	2:1	2021FA28	24	508262	4501886	Sys-Flight
	11/7/21	2:1	2021FA33	28	505514	4501227	Sys-Flight
	11/9/21	2:1	2021FA45	28	505514	4501227	Sys-Flight
	11/10/21	2:1	2021FA48	36	505907	4501414	Sys-Flight
	11/13/21	2:1	2021FA50	Corn	506445	4501985	Sys-Flight
	11/14/21	2:1	2021FA52	Corn	507782	4502163	Sys-Flight
	11/15/21	2:1	2021FA54	37	505812	4501246	Sys-Flight
	11/16/21	2:1	2021FA55	38	506196	4501453	Sys-Flight
	11/17/21	2:1	2021FA56	36	505907	4501414	Sys-Flight

Table I. Data for crane group 21B-33.







Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	11/3/21	2:1	2021FA11	11	517686	4505528	Opp-Flight
	11/4/21	2:1	2021FA12 A	16	517494	4505438	Opp-Ground
		2:1	2021FA12 B	16	517494	4505438	Opp-Flight
	11/5/21	2:1	2021FA20	Corn	516413	4504357	Sys-Flight
	11/6/21	2:1	2021FA32	27	516315	4504924	Sys-Flight
	11/8/21	2:1	2021FA42	16	517494	4505438	Sys-Flight
	11/10/21	2:1	2021FA47	35	516297	4504895	Sys-Flight

Table J. Data for crane group 21B-36.






Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	11/4/21	5:0	2021FA18.5	19	507497	4501842	Opp-Flight
	11/7/21	5:0	2021FA34	29	505664	4501268	Sys-Flight
	11/8/21	5:0	2021FA43	33	507560	4501919	Sys-Flight

Table K. Data for crane group 21B-75.

Unique Group Icon	Observation Dates	# of Cranes Adult:Juv	Group ID	Use Site #	Zone 14N UTMx	Zone 14N UTM _y	Observation Type
	11/13/21	2:1	2021FA51	Corn	539164	4510925	Sys-Flight
	11/14/21	2:1	2021FA53	AIR	544830	4514215	Sys-Flight