PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

Least Tern and Piping Plover Monitoring Protocol Implementation Report for 2007

Prepared for:
Technical Advisory Committee

Prepared by:
Executive Director's Office

June 18, 2008

INTRODUCTION

The Platte River Recovery Implementation Program's Technical Advisory Committee agreed to implement the protocol for "Monitoring Reproductive Success and Reproductive Habitat Parameters of Least Terns and Piping Plovers in the Central Platte River valley" (Tern and Plover Monitoring Protocol) dated May 1, 2002 in 2007 for the purpose of documenting the reproductive efforts of least terns and piping plovers. Existing cooperator staff and equipment was used to conduct the fieldwork. The Executive Director's Office (EDO) was tasked to compile data and write the report. This report summarizes the data collected in the 2007 season.

METHODS

Surveys of the central Platte River were conducted in 2007 to locate active nests and individual birds (Component 1 of the protocol design). Surveys were conducted of all channels wider than 75m that could safely be navigated. Two airboats were used during the survey. Personnel from the Grand Island Field Office, U.S. Fish and Wildlife Service (USFWS) conducted the river survey from Chapman upstream to the Kearney Canal headgates (near Elm Creek) on May 14, 15 and 16; June 19, 20 and 21; and July 11, 12, and 13. Nebraska Public Power District (NPPD), Central Nebraska Public Power and Irrigation District (Central), and Central Platte Natural Resources District (CPNRD) personnel conducted the river survey from the Kearney Canal headgates upstream to Lexington on May 21, June 15, and July 11. The lengths of river surveyed for each of the surveys are in Table 1. The daily average in-stream flows and stage levels for the Overton, Kearney and Grand Island gages during the river surveys are in Table 2 and during the months of May, June and July are in Figures 1-6.

Sandpits and islands constructed for tern and plover reproductive habitat were surveyed either two or three times to locate active nests and individual birds (component 2 of the protocol). NPPD personnel surveyed 5 sandpits and 4 constructed islands from the Lexington bridge to the Odessa bridge. CPNRD personnel surveyed 10 sandpits from the Gibbon bridge to the Chapman bridge, as well as the Broadfoot pits near Kearney and Newark, Nebraska

With the exception of two sites (see below), nests located during the river survey, or sandpit and constructed island survey were monitored throughout the nesting period. Nests were visited every 3 days until the nest failed or until the nestlings fledged. Nest level habitat characteristics were measured at nests after the birds had left the colony area. Colony level characteristics will be measured in a geographic information system using the most recent spatially referenced color photographs during a future analysis. Access to two pits owned by Broadfoot Sand and Gravel in the Kearney area (Broadfoot Newark and Broadfoot Kearney

South) was granted to conduct the three monthly surveys to count adult birds and document nesting, though access was not granted to monitor nests every three days.

The data were entered into the Program's Microsoft Access database. The database contains 11 data tables. Three tables contain information about the river survey, 4 tables document the nest monitoring, 1 table documents the nest habitat, 1 table lists the names and phone numbers for observers cited in the data tables, and 1 table documents all the sandpit and constructed islands considered for the survey. The database also contains 4 data entry forms corresponding to the 4 datasheets. Raw data sheets are housed at the EDO.

RESULTS

Survey Results

River surveys required 4 days to complete in May, 4 days in June, and 3 days in July. There were 12 least tern nests, 3 piping plover nests, and 1 piping plover brood detected during the river surveys. The most birds detected during one river survey period in 2007 were 51 least tern adults and 10 piping plover adults (Table 3). Counts of birds detected during the river survey were not adjusted to account for the birds assumed to be reproducing at the nearby sandpits. The locations of each river survey observation and the distance to the closest known nesting colony are in Tables 4 and 5.

Fourteen sandpits and six constructed islands were surveyed during both the May and June survey. Thirteen sandpits and five constructed islands were surveyed during the July survey. There were 40 least tern and 23 piping plover nests located on sandpits in 2007. There were 13 least tern and 4 piping plover nests were observed on constructed islands in 2007. The number of adults, nests, chicks and fledglings detected on the site visit nearest to May 15, June 15, and July 15 were summed across the sites surveyed (Table 6). The most birds detected during one of these surveys to sandpits and constructed islands were 105 least tern adults, 50 piping plover adults, 21 least tern fledglings, and 9 piping plover fledglings.

Least tern and piping plover nests were located at 7 of the 15 sandpits/constructed islands surveyed (Table 7; Figures 7 and 8). Six of these sites were monitored every three days while nests were active.

There were 53 least tern nests located in 2007; 16 nests at Blue Hole Pit, 2 nests at Broadfoot-Kearney South Pit, 2 nests at Broadfoot-Newark Pit, 11 nests at Dinan Tract, 1 nest at Dipple Tract Colony A, 1 nest at Dipple Tract Colony B, 6 nests at Johnson Pit, and 14 nests at Lexington Pit (Table 8). Seventeen of the 49 nests monitored successfully fledged at least 1 least tern for a total of 40 least tern fledglings.

There were 27 piping plover nests located in 2007; 6 nests at Blue Hole Pit, 6 nests at Broadfoot-Kearney South Pit, 1 nest at Broadfoot-Newark Pit, 3 nests at Dinan Tract, 1 nest at Dipple Tract Colony A, 4 nests at Johnson Pit, and 6 nests at Lexington Pit (Table 9). Twelve of the 20 nests monitored successfully fledged at least 1 piping plover for a total of 27 piping plover fledglings.

The numbers of piping plover and least tern individuals and nests documented at the Broadfoot-Kearney South Pit and the Broadfoot-Newark Pit represent minimums present. Surveys to determine exact counts of birds were hindered by the large number of birds present at these sites, the size of the area and the availability of hiding cover for fledglings.

Reproductive Parameters

Reproductive parameters listed in the protocol were estimated with the data collected in 2007. Formulas for reproductive habitat calculations are located in the protocol. The reproductive parameters calculated for this report were based only on the nests monitored in 2007.

Total Nests Initiated

The total nests initiated are the number of nests detected during the site surveys. There were 53 least tern and 27 piping plover nest initiations documented in 2007. There were 49 least tern nests and 20 piping plover nests monitored until the nest failed or the fledglings departed the colony (Tables 10 - 13).

Nest-based Hatching Success

For sandpit locations nest-based hatching success was estimated to be 1.22 for least terns (44 eggs/36 nests) and 2.31 for piping plovers (37 eggs/16 nests) monitored in 2007. For constructed island locations nest-based hatching success was estimated to be 0.38 for least terns (5 eggs/13 nests) and 2.00 for piping plovers (8 eggs/4 nests) monitored in 2007. This estimate is calculated as the number of hatched eggs divided by the number of nests initiated. The number of eggs that hatched was estimated as the maximum of number of chicks initially observed or number of chicks 15 days old (fledged by protocol definition).

Nesting Loss

For sandpit locations nesting loss was estimated to be 0.44 for least terns (16 nests lost/36 nests) and 0.19 for piping plovers (3 nests lost/16 nests) monitored in 2007. For constructed island locations nesting loss was estimated to be 0.85 for least terns (11 nests lost/13 nests) and 0.50 for piping plovers (2 nests lost/4 nests) monitored in 2007. This estimate is calculated as the number of unsuccessful nests divided by the number of nests initiated. A nest is defined as unsuccessful if no eggs hatch.

Nesting Success

For sandpit locations nesting success was estimated to be 0.56 for least terns (20 successful nests/36 nests) and 0.81 for piping plovers (13 successful nests/16 nests) monitored in 2007. For constructed island locations nesting success was estimated to be 0.15 for least terns (2 successful nests/13 nests) and 0.50 for piping plovers (2 successful nests/4 nests) monitored in 2007. This estimate is calculated as the number of successful nests divided by the number of nests initiated. A nest is successful if at least one chick is observed initially or one 15 day old chick is observed.

Number of Pairs

For sand pit locations number of pairs was estimated to be 32 for least terns and 15 for piping plovers at sites monitored in 2007 for reproductive success (every 3 days). This estimate is calculated as the maximum number of nests and number of broods detected during one survey. An alternative estimate is one-half of the number of adults detected during one survey. Using this method, the number of pairs was estimated to be 30 for least terns and 12.5 for piping plovers for sites monitored in 2007.

For constructed island locations number of pairs was estimated to be 12 for least terns and 3 for piping plovers at sites monitored in 2007 for reproductive success (every 3 days). This estimate is calculated as the maximum number of nests and number of broods detected during one survey. An alternative estimate is one-half of the number of adults detected during one survey. Using this method, the number of pairs was estimated to be 13 for least terns and 3.5 for piping plovers for sites monitored in 2007.

Nest-based Fledgling Success

For sandpit locations nest-based fledgling success was estimated to be 1.06 for least terns (38 fledglings/36 nests) and 1.25 for piping plovers (20 fledglings/16 nests) monitored in 2007. For constructed island locations nest-based fledgling success was estimated to be 0.15 for least terns (2 fledglings/13 nests) and 1.75 for piping plovers (7 fledglings/4 nests) monitored in 2007. This estimate is calculated as the number of fledglings divided by the number of nests initiated. The number of fledglings for each nest was estimated as the maximum of the number of chicks 15 days old or observed flying.

Pair-based Fledgling Success

For sandpit locations pair-based fledgling success for 2007 was estimated to be 1.19 for least terns (38 fledglings/32 pair) and 1.33 for piping plovers (20 fledglings/15 pair) using the first estimate of pairs above and 1.27 for least terns (38 fledglings/30 pair) and 1.60 for piping plovers (20 fledglings/12.5 pair) using the second estimate of pairs above. This estimate is calculated as the number of fledglings divided by the number of pairs.

For constructed island locations pair-based fledgling success for 2007 was estimated to be 0.17 for least terns (2 fledglings/12 pair) and 2.33 for piping plovers (7 fledglings/3 pair) using the first estimate of pairs above and 0.15 for least terns (2 fledglings/13 pair) and 2.00 for piping plovers (7 fledglings/3.5 pair) using the second estimate of pairs above. This estimate is calculated as the number of fledglings divided by the number of pairs.

Mayfield Daily Survival Rate

For sandpit locations Mayfield daily nest survival rate was estimated to be 0.98 (95% CI: 0.97, 0.99) for least terns (1-(36 nests/697 days)) and 0.99 (95% CI: 0.98, 1.00) for piping plovers (1-(16 nests/356 days)) monitored in 2007 (Tables 14 and 15). This estimate is calculated as one minus the quantity: number of nest failures divided by the number of days nests were monitored (exposure days).

For constructed island locations Mayfield daily nest survival rate was estimated to be 0.96 (95% CI: 0.93, 0.98) for least terns (1-(13 nests/258 days)) and 0.96 (95% CI: 0.91, 1.01) for piping plovers (1-(4 nests/54 days)) monitored in 2007 (Tables 16 and 17). This estimate is calculated as one minus the quantity: number of nest failures divided by the number of days nests were monitored (exposure days).

Trend Detection

Trends of reproductive parameters through time were not estimated with the data. As the monitoring data is accumulated throughout the Program's first increment, these analyses will be possible.

Before-After Program Analysis

A before-after analysis of reproductive parameters was not estimated for this year of monitoring data. As the monitoring data is accumulated throughout the Program's first increment, these analyses will be possible.

Nest-level Habitat Characteristics

Nest characteristics were visually estimated at 16 of the least tern and 9 piping plover nests located in 2007 (Tables 18 -21).

Distance to Nearest Bank

The distance to nearest bank for least tern nests monitored in the river channel was 100 meters (95% CI: 80.40, 119.60). The distance to nearest bank was not recorded for piping plover nests monitored in the river channel.

Nest Elevation

For nests on sandpits, the nest elevation above the water surface averaged 1.58 meters (95% CI: 1.43, 1.72) over the 4 least tern nests and 1.46 meters (95% CI: 1.02, 1.89) over the 7 piping plover nests.

For nests on constructed riverine islands, the nest elevation above the water surface averaged 0.30 meters (95% CI: 0, 0.69) over the 2 least tern nests.

Nest Management

There were no nest enclosures placed on nests and no other nest specific management activities.

Vegetation Composition

For nests on sandpits, the average vegetation cover visually estimated within the 1 m^2 area over the 4 least tern nests was 0% grass, 0.25% forb, and 0% woody. The average vegetation cover estimated within the 1 m^2 area over the 7 piping plover nests was 0% grass, 0.07% forb, and 0% woody. The average vegetation cover estimated within the 5 m^2 area over the 4 least tern nests was 1.25% grass, 0.50% forb, and 0% woody. The average vegetation cover estimated within the 5 m^2 area over the 7 piping plover nests was 0% grass, 1.71% forb, and 0% woody.

For nests on constructed riverine islands, the average vegetation cover visually estimated within the 1 m^2 area over the 12 least tern nests was 1.25% grass, 0.67% forb, and 0% woody. The average vegetation cover estimated within the 1 m^2 area over the 2 piping plover nests was 0% grass, 0% forb, and 0% woody. The average vegetation cover estimated within the 5 m^2 area over the 12 least tern nests was 1.67% grass, 0.83% forb, and 0.67% woody. The average vegetation cover estimated within the 5 m^2 area over the 2 piping plover nests was 2.50% grass, 5.00% forb, and 0% woody.

Vegetation Density

For nests on sandpits, the average density of stems visually estimated within the 1 m^2 area over the 4 least tern nests was 0 stems of grass per m^2, 1.25 stems of forb per m^2, and 0 stems of woody per m^2. The average density estimated within the 1 m^2 area over the 7 piping

plover nests was 0 stems of grass per m^2, 2.57 stems of forb per m^2, and 0 stems of woody per m^2. The average density estimated within the 5 m^2 area over the 4 least tern nests was 2.50 stems of grass per 5 m^2, 2.50 stems of forb per 5 m^2, and 0 stems of woody per 5 m^2. The average density estimated within the 5 m^2 area over the 7 piping plover nests was 0 stems of grass per 5 m^2, 9.43 stems of forb per 5 m^2, and 0 stems of woody per 5 m^2.

For nests on constructed riverine islands, the average density of stems visually estimated within the 1 m^2 area over the 12 least tern nests was 14.17 stems of grass per m^2, 1.50 stems of forb per m^2, and 0 stems of woody per m^2. The average density estimated within the 1 m^2 area over the 2 piping plover nests was 0 stems of grass per m^2, 0 stems of forb per m^2, and 0 stems of woody per m^2. The average density estimated within the 5 m^2 area over the 11 least tern nests was 0 stems of grass per 5 m^2, 0 stems of forb per 5 m^2, and 0 stems of woody per 5 m^2. The average density estimated within the 5 m^2 area over the 2 piping plover nests was 10.00 stems of grass per 5 m^2, 1.50 stems of forb per 5 m^2, and 0 stems of woody per 5 m^2.

Vegetation Height

For nests on sandpits, the average height of stems visually estimated within the 1 m^2 area over the 4 least tern nests was 0.03 meters. The average height estimated within the 1 m^2 area over the 7 piping plover nests was 0.09 meters. The average height estimated within the 5 m^2 area over the 4 least tern nests was 0.08 meters. The average height estimated within the 5 m^2 area over the 7 piping plover nests was 0.09 meters.

For nests on constructed riverine islands, the average height of stems visually estimated within the 1 m^2 area over the 12 least tern nests was 0.01 meters. The average height estimated within the 1 m^2 area over the 2 piping plover nests was 0 meters. The average height estimated within the 5 m^2 area over the 12 least tern nests was 0.06 meters. The average height estimated within the 5 m^2 area over the 2 piping plover nests was 0.10 meters.

Colony-level Habitat Characteristics

Nesting colony characteristics were measured at the 6 pits and 3 constructed islands with active nests in 2007 (Table 22).

Colony management

Three of the pits with active least tern or piping plover nests (Johnson pit, Lexington pit and Blue Hole pit) were managed for nesting activities through the use of electric predator fences, predator trapping by USDA from late May to August and pre-emergent herbicide application in March. One of the constructed islands with active least tern or piping plover nests (Dinan Tract) was managed for nesting activities as above, and two constructed islands (Dipple Tract Colony A and Colony B) were managed by removal of mature trees from islands in the channel and the channel bed was disced in 2006. The other pits received no management for nesting activities.

Adjacent Land Use

Two of the six pits with active least tern or piping plover nests were adjacent to active sandpits in 2007. Other land uses adjacent to these pits included residential, interstate, river, grassland, and riparian woodland.

Bare Sand Area

This colony habitat characteristic was not estimated for any colonies in 2007.

Pond Size

Pond size will be calculated with the most recent photos during a GIS analysis of the data.

Distance from Colony to River

Distance from the colony to the river will be calculated with the most recent photos during a GIS analysis of the data.

Sandbar/Island Height

This colony habitat characteristic was not estimated for any colonies in 2007.

Channel Width

This colony habitat characteristic was not estimated for any colonies in 2007.

INCIDENTAL OBSERVATIONS

There were no incidental observations of least terns or piping plovers reported in the study area for 2007.

TABLES

Table 1. Length of river surveyed in 2007 based on river miles.

Survey	From	To	River Miles
May 2007	Chapman	Kearney Diversion	70
May 2007	Kearney Diversion	J2 Return	18
		Total	88
June 2007	Chapman	Kearney Diversion	72
June 2007	Kearney Diversion	J2 Return	18
		Total	90
July 2007	Chapman	Kearney Diversion	68
July 2007	Kearney Diversion	J2 Return	18
		Total	86

Table 2. Daily average discharge (cfs) and stage (feet) at Overton, Nebraska (USGS Gage No. 06768000), Kearney, Nebraska (USGS Gage No. 06770200) and Grand Island, Nebraska (USGS Gage No. 06770500) during river survey dates.

	Overton		Kearney		Grand Island	
Date	Discharge	Stage	Discharge	Stage	Discharge	Stage
5/14/2007	843	3.35	412	2.34	1300	3.79
5/15/2007	600	3.04	768	2.86	1140	3.66
5/16/2007	435	2.74	437	2.38	1110	3.65
5/21/2007	508	2.89	460	2.42	887	3.46
6/15/2007	1830	4.54	1730	3.73	1880	4.13
6/19/2007	1500	4.18	2130	3.99	2690	4.54
6/20/2007	1340	3.98	1540	3.58	2570	4.48
6/21/2007	1210	3.81	1280	3.34	2150	4.28
7/11/2007	1900	4.62	1560	3.62	979	3.51
7/12/2007	1410	4.09	1610	3.65	1350	3.79
7/13/2007	1640	4.34	1210	3.35	1580	3.95

Table 3. The number of adults, nests, chicks, and fledgling least terns and piping plovers observed during each monthly airboat survey of the river, 2001-2007.

	Least Tern				Piping Plover			
Survey	# Adults	# Nests	# Chicks	# Fledglings	# Adults	# Nests	# Chicks	# Fledglings
May 2007	26	0	0	0	7	0	0	0
June 2007	51	11	0	0	10	2	3	0
July 2007	23	1	0	0	6	1	2	0
May 2006	16	0	0	0	10	0	0	0
June 2006	3	0	0	0	2	0	0	0
May 2005	18	0	0	0	1	0	0	0
June 2005	27	0	0	0	10	0	0	0
July 2005	3	0	0	0	0	0	0	2
May 2004	26	0	0	0	5	0	0	0
June 2004	6	0	0	0	3	0	0	0
May 2003	28	0	0	0	10	0	0	0
June 2003	17	0	0	0	9	0	0	0
May 2002	4	0	0	0	0	0	0	0
June 2002	18	0	0	0	1	0	0	0
July 2002	31	0	0	7	5	0	0	5
May 2001	16	0	0	0	2	0	0	0
June 2001	23	0	0	0	5	0	0	0
July 2001	16	0	0	5	17	0	0	12

Table 4. Locations of least terns observed during the river survey. The distance to nearest constructed island or sandpit with nesting least terns was estimated as the straight-line distance using the location reported for each site.

Date	UTM x	UTM y	# Adults	# Juveniles	Activity	Distance to Closest Known Nesting Area (miles)
5/15/2007	514919	4503923	2	0	Courting	1.36
5/15/2007	542008	4512982	2	0	Foraging	16.13
5/16/2007	470872	4503980	2	0	Flying	1.33
5/16/2007	471447	4503804	4	0	Flying, courting	1.69
5/16/2007	473441	4503218	3	0	1 flying, pr loafing	2.92
5/16/2007	484811	4501409	5	0	Flying, foraging, courting	4.88
5/16/2007	489104	4501178	1	0	Foraging	2.21
5/16/2007	490045	4500906	1	0	Foraging	1.64
5/16/2007	492541	4500777	1	0	Flying	0.32
5/21/2007	448344	4503819	2	0	Loafing	6.85
5/21/2007	463974	4503854	1	0	Foraging	2.96
5/21/2007	469467	4503752	2	0	Flying	0.49
6/15/2007	461646	4503909	2	0	Courting	4.41
6/19/2007	560695	4525049	2	0	Foraging	29.68
6/20/2007	513102	4502926	1	0	Foraging	2.65
6/20/2007	515330	4504088	1	0	Foraging	1.09
6/20/2007	516775	4505089	2	0	Defending nest	0.00
6/20/2007	535399	4511045	1	0	Foraging	11.85
6/21/2007	470430	4504076	2	0	Foraging	1.05
6/21/2007	471388	4503840	6	0	Foraging	1.65
6/21/2007	471818	4503709	3	0	Foraging	1.93
6/21/2007	472213	4503574	2	0	Foraging	2.18
6/21/2007	473200	4503424	2	0	Flying	2.80
6/21/2007	473796	4503157	1	0	Foraging	3.13
6/21/2007	485122	4501507	2	0	Foraging	4.69
6/21/2007	488982	4501215	2	0	Foraging	2.29
6/21/2007	490474	4500794	1	0	Flying	1.39
6/21/2007	504408	4501083	1	0	Foraging	1.49
6/21/2007	507389	4501794	10	0		0.00
7/11/2007	451554	4503055	2	0	Foraging	8.84
7/11/2007	461646	4503909	2	0	Foraging	4.41
7/11/2007	544010	4514180	1	0	Foraging	17.55
7/12/2007	507017	4501722	1	0	Foraging	0.24
7/12/2007	507389	4501794	7	0	Feeding/flying	0.00
7/12/2007	516320	4505003	1	0	Foraging	0.29
7/12/2007	517210	4505290	2	0	Nesting, defensive	0.00
7/12/2007	517243	4505313	2	0	Foraging	0.02
7/13/2007	506129	4501412	1	0	Foraging	0.82
7/13/2007	506519	4501662	1	0	Flying	0.55
7/13/2007	506548	4501530	3	0	Loafing	0.55

Table 5. Locations of piping plovers observed during the river survey. The distance to nearest constructed island or sandpit with nesting piping plovers was estimated as the straight-line distance using the location reported for each site.

Date	UTM x	UTM y	# Adults	# Juveniles	Activity	Distance to Closest Known Nesting Area (miles)
5/16/2007	470903	4503930	1	0	Foraging	1.35
5/16/2007	484811	4501409	3	0	Foraging	4.88
5/16/2007	492540	4500791	1	0	Foraging	0.32
5/16/2007	492541	4500777	2	0	Foraging	0.32
6/20/2007	505868	4501333	2	0	Foraging	0.99
6/20/2007	516775	4505089	2	0	Foraging	0.00
6/20/2007	516775	4505089	2	3	Foraging, hiding	0.00
6/21/2007	507389	4501794	4	0		0.00
7/12/2007	507389	4501794	1	2	Nesting	0.00
7/13/2007	501474	4501308	1	0	Foraging	2.13
7/13/2007	505305	4501158	1	0	Foraging	1.35
7/13/2007	506191	4501513	1	0	Foraging	0.76
7/13/2007	506548	4501530	1	0	Foraging	0.55
7/13/2007	506614	4501753	1	0	Foraging	0.48

Table 6. The number of adults, nests, chicks, and fledgling least terns and piping plovers observed during each monthly survey at sand pits and constructed islands, 2001-2007.

Survey	# Sites	Least Tern				Piping Plover			
		# Adults	# Nests	# Chicks	# Fledglings	# Adults	# Nests	# Chicks	# Fledglings
May 2007	20	35	0	0	0	40	16	0	0
June 2007	21	105	39	0	0	50	4	22	0
July 2007	20	88	6	17	21	20	2	4	9
May 2006	18	45	0	0	0	31	15	0	0
June 2006	18	110	35	0	0	34	3	17	11
July 2006	17	87	13	2	36	5	1	0	9
May 2005	19	30	0	0	0	36	14	0	0
June 2005	19	125	40	10	0	35	3	22	9
July 2005	15	136	21	8	20	19	2	7	7
May 2004	20	21	0	0	0	21	12	0	0
June 2004	19	111	39	8	0	35	5	15	2
July 2004	13	86	7	20	41	16	0	4	5
May 2003	20	40	0	0	0	22	10	0	0
June 2003	20	87	46	0	0	23	6	23	0
July 2003	17	79	15	16	33	9	1	0	6
May 2002	22	3	0	0	0	18	4	0	0
June 2002	22	90	41	3	0	34	7	22	2
July 2002	22	82	9	22	29	16	0	0	5
May 2001	23	6	0	0	0	11	3	0	0
June 2001	23	27	14	0	0	15	1	20	0
July 2001	23	21	0	15	14	2	1	0	1

Table 7. Sandpits and constructed islands monitored for least tern and piping plover reproduction in 2007. Number of adults, pairs, and nests is the maximum observed on one day for all the surveys at the site.

Site	Site type	# Surveys	UTM x	UTM y	Least Tern			Piping Plover			Site management
					# adults	# pairs	# nests	# adults	# pairs	# nests	
Blue Hole	sandpit	32	468736	4504032	25	14	11	10	6	5	Portable predator fence, trapping, pre-emergent herbicide.
Lexington Pit	sandpit	30	438763	4509268	27	14	10	8	5	5	Permanent predator fence, trapping, pre-emergent herbicide.
Johnson Pit	sandpit	26	468881	4502069	8	4	4	7	4	2	Permanent predator fence, trapping, pre-emergent herbicide.
Dinan Tract	constructed island	19	507389	4501794	20	10	10	5	2	2	Mechanical clearing surrounding coarse gravel/cobble on surfaces. Permanent predator fence, trapping, pre-emergent herbicide.
Elm Creek Island	constructed island	11	469434	4503790	2	0	0	1	0	0	Spring application of pre-emergent herbicide, fall discing and mowing in the adjacent channel areas.
Cottonwood Ranch	constructed island	11	460254	4503961	3	0	0	1	0	0	Spring application of pre-emergent herbicide, fall discing and mowing in the adjacent channel areas.
Lexington Island	constructed island	8	438770	4508453	0	0	0	0	0	0	Spring application of pre-emergent herbicide, fall discing and mowing in the adjacent channel areas.
Dipple Tract Colony A	constructed island	5	516775	4505089	4	1	1	2	1	0	Mature trees removed from islands in the channel and from 90 acres on N side of river and 26 acres on the S side in 2006. Channel bed disced in Fall 2006
OSG Overton Pit	sandpit	3	454962	4503998	0	0	0	2	0	0	None
Paulsen's Lexington Pit	sandpit	3	434039	5409125	0	0	0	0	0	0	None
Broadfoot-Kearney South	sandpit	3	492659	4501284	38	4	2	28	5	5	
Hooker Bros -GI East	sandpit	3	560444	4530378	0	0	0	0	0	0	none
Broadfoot-Newark	sandpit	3	504135	4503466	4	2	2	2	1	1	
Mid-Nebraska Aggregate-Minden	sandpit	3	507224	4502961	0	0	0	0	0	0	None
Lilley-Wood River	sandpit	3	536428	4509875	0	0	0	0	0	0	None

Deweese-Alda	sandpit	3	548759	4521648	0	0	0	0	0	0	None
Island Landhandlers- GI	sandpit	3	552343	4524639	0	0	0	0	0	0	None
Hooker Bros -GI South	sandpit	3	555613	4525340	0	0	0	0	0	0	None
Hooker Bros - GI West	sandpit	3	551433	4526439	0	0	0	0	0	0	None
Central Sand &Gravel -GI	sandpit	3	555873	4527165	0	0	0	0	0	0	None
Overton Island	constructed island	3	452604	4503365	0	0	0	0	0	0	Spring application of pre-emergent herbicide, fall discing and mowing in the adjacent channel areas.
Dipple Tract Colony B	constructed island	2	517210	4505290	2	1	1	0	0	0	Mature trees removed from islands in the channel and from 90 ac on N side and 26 ac on the S side in 2006. Channel bed disced Fall 2006.
Blue Hole	sandpit	32	468736	4504032	25	14	11	10	6	5	Portable predator fence, trapping, pre-emergent herbicide.
Lexington Pit	sandpit	30	438763	4509268	27	14	10	8	5	5	Permanent predator fence, trapping, pre-emergent herbicide.
Johnson Pit	sandpit	26	468881	4502069	8	4	4	7	4	2	Permanent predator fence, trapping, pre-emergent herbicide.
Dinan Tract	constructed island	19	507389	4501794	20	10	10	5	2	2	Mechanical clearing surrounding coarse gravel/cobble on surfaces. Permanent predator fence, trapping, pre-emergent herbicide.
Elm Creek Island	constructed island	11	469434	4503790	2	0	0	1	0	0	Spring application of pre-emergent herbicide, fall discing and mowing in the adjacent channel areas.

Table 8. Least tern nests located in the Cooperative Agreement study area in 2007. Nests at all sites except the Broadfoot-Kearney S. and Broadfoot-Newark sites were monitored every three days.

Site	Nest #	First Date Observed	# Eggs	Date Hatched	# Chicks Initially Observed	# Chicks Fledged	Date Fledged	Final Status	Nest Management
Blue Hole	6	5/24/2007		6/16/2007	2	2	7/2/2007	Fledged	
Blue Hole	7	5/24/2007		6/16/2007	1	2	7/5/2007	Fledged	
Blue Hole	8	5/29/2007		6/17/2007	3	3	7/5/2007	Fledged	
Blue Hole	9	5/29/2007		6/21/2007	3	3	7/12/2007	Fledged	
Blue Hole	10	5/31/2007		6/25/2007	2			Failed- Predated	
Blue Hole	11	5/31/2007		6/20/2007	1			Failed- Predated	
Blue Hole	12	5/31/2007		6/22/2007	2	2	7/12/2007	Fledged	
Blue Hole	13	5/31/2007						Failed- Predated	
Blue Hole	14	5/31/2007		6/18/2007	2			Failed- Predated	
Blue Hole	15	6/8/2007						Failed- Predated	
Blue Hole	16	6/8/2007						Failed- Predated	
Blue Hole	17	6/20/2007						Failed- Predated	
Blue Hole	18	6/20/2007		7/12/2007				Failed- Unknown	
Blue Hole	19	6/29/2007						Failed- Predated	
Blue Hole	20	7/12/2007						Failed- Predated	
Blue Hole	22	7/12/2007						Failed- Predated	
Broadfoot-Kearney South	7	6/15/2007	2					Unknown Outcome	
Broadfoot-Kearney South	8	6/15/2007	3					Unknown Outcome	
Broadfoot-Newark	2	6/15/2007	1					Unknown Outcome	
Broadfoot-Newark	3	6/15/2007	3					Unknown Outcome	
Dinan Tract	1	6/1/2007						Failed- Unknown	
Dinan Tract	3	6/5/2007	3					Unknown Outcome	
Dinan Tract	4	6/5/2007	3		3			Unknown Outcome	
Dinan Tract	5	6/8/2007	3		2	2	7/22/2007	Fledged	
Dinan Tract	6	6/15/2007	1					Unknown Outcome	
Dinan Tract	7	6/15/2007	2					Unknown Outcome	
Dinan Tract	8	6/5/2007	2					Unknown Outcome	

Dinan Tract	9	6/5/2007	2					Failed- Predated	
Dinan Tract	10	6/15/2007	3					Failed- Predated	
Dinan Tract	11	6/21/2007	3					Unknown Outcome	
Dinan Tract	14	6/15/2007	3					Failed- Abandoned	
Dipple Tract Colony A	1	6/20/200	3					Failed- Unknown	
Dipple Tract Colony B	1	7/12/2007	3					Failed- Predated	
Johnson Pit	3	5/24/2007		6/13/2007	2			Failed- Unknown	
Johnson Pit	4	5/24/2007						Failed- Other	
Johnson Pit	7	6/4/2007						Failed- Abandoned	
Johnson Pit	8	6/4/2007						Failed- Other	
Johnson Pit	9	6/20/2007		7/12/2007				Failed- Predated	
Johnson Pit	10	7/5/2007						Failed- Predated	
Lexington Pit	6	5/28/2007						Failed- Unknown	
Lexington Pit	7	6/4/2007		6/20/2007	3	3	7/16/2007	Fledged	
Lexington Pit	8	6/4/2007						Failed- Other	
Lexington Pit	9	6/4/2007		6/25/2007	2	2	7/12/2007	Fledged	
Lexington Pit	10	6/4/2007		6/25/2007	3	3	7/12/2007	Fledged	
Lexington Pit	11	6/4/2007		6/18/2007	3	3	7/9/2007	Fledged	
Lexington Pit	12	6/8/2007		6/30/2007	2	2	7/16/2007	Fledged	
Lexington Pit	13	6/11/2007		6/25/2007	3	3	7/12/2007	Fledged	
Lexington Pit	14	6/13/2007		6/28/2007	2	2	7/16/2007	Fledged	
Lexington Pit	15	6/15/2007		7/4/2007	2	2	7/23/2007	Fledged	
Lexington Pit	16	6/20/2007		7/2/2007	2	2	7/20/2007	Fledged	
Lexington Pit	17	6/26/2007		7/13/2007	2	2	8/2/2007	Fledged	
Lexington Pit	19	6/29/2007		7/20/2007	2	2	8/6/2007	Fledged	
Lexington Pit	20	7/2/2007	2					Failed- Abandoned	

Table 9. Piping plover nests located in the Cooperative Agreement study area in 2007. Nests at all sites except the Broadfoot-Kearney S. and Broadfoot-Newark sites were monitored every three days.

Site	Nest #	First Date Observed	# Eggs	Date Hatched	# Chicks Initially Observed	# Chicks Fledged	Date Fledged	Final Status	Nest Management
Blue Hole	1	5/4/2007	4	5/29/2007	4	2	6/20/2007	Fledged	
Blue Hole	2	5/4/2007	4	5/29/2007	3	2	6/26/2007	Fledged	
Blue Hole	3	5/4/2007	4	5/29/2007	1			Failed- Other	
Blue Hole	4	5/11/2007		5/30/2007	3	1	6/18/2007	Fledged	
Blue Hole	5	5/14/2007		6/14/2007	4	1	7/5/2007	Fledged	
Blue Hole	21	7/12/2007						Failed- Predated	
Broadfoot-Kearney South	1	5/14/2007	3					Unknown Outcome	
Broadfoot-Kearney South	2	5/14/2007	3					Unknown Outcome	
Broadfoot-Kearney South	3	5/14/2007	4					Unknown Outcome	
Broadfoot-Kearney South	4	5/14/2007	4					Unknown Outcome	
Broadfoot-Kearney South	5	5/14/2007	4					Unknown Outcome	
Broadfoot-Kearney South	6	6/15/2007	4					Unknown Outcome	
Broadfoot-Newark	1	5/14/2007	4					Unknown Outcome	
Dinan Tract	2	6/8/2007						Failed- Unknown	
Dinan Tract	12	6/15/2007	4	6/12/2007	4	3	7/27/2007	Fledged	
Dinan Tract	13	6/21/2007	2					Failed- Unknown	
Dipple Tract Colony A	2	6/20/2007			4	4	7/3/2007	Fledged	
Johnson Pit	1	5/4/2007	2	5/31/2007	2	1	6/20/2007	Fledged	
Johnson Pit	2	5/14/2007		5/24/2007	4	4	6/15/2007	Fledged	
Johnson Pit	5	5/29/2007		6/7/2007	4			Failed- Other	
Johnson Pit	6	5/30/2007	4	6/29/2007	2	2		Unknown Outcome	
Lexington Pit	1	5/4/2007		5/29/2007	1	1	6/20/2007	Fledged	
Lexington Pit	2	5/11/2007		5/29/2007				Failed- Other	
Lexington Pit	3	5/11/2007		6/11/2007	4	4	7/5/2007	Fledged	
Lexington Pit	4	5/11/2007		6/5/2007	4	1	6/26/2007	Fledged	

Lexington Pit	5	5/25/2007		6/15/2007	1	1	7/9/2007	Fledged	
Lexington Pit	18	6/26/2007						Unknown Outcome	

Table 10. Least tern reproductive parameter estimates for sandpits during the 2007 nesting season. These estimates are based on nests monitored.

Site	# Pairs[1]	# Pairs[2]	# Nests Initiated	# Chicks Initially Observed	# Successful Nests	# Unsuccessful Nests	# Eggs Hatched	# Fledglings	Nest-based Hatch Success	Nesting Loss	Nesting Success	Nest-based Fledging Success	Pair-based[1] Fledging Success	Pair-based[2] Fledging Success
Blue Hole	14	12.5	16	16	8	8	16	12	1.00	0.50	0.50	0.75	0.86	0.96
Johnson Pit	4	4	6	2	1	5	2	0	0.33	0.83	0.17	0.00	0.00	0.00
Lexington Pit	14	13.5	14	26	11	3	26	26	1.86	0.21	0.79	1.86	1.86	1.93
All Sites	32	30	36	44	20	16	44	38	1.22	0.44	0.56	1.06	1.19	1.27

1. Pair defined as the maximum number of nests and number of broods detected during one survey.
2. Pair defined as one-half of the maximum number of adults detected during one survey.

Table 11. Piping plover reproductive parameter estimates for sandpits during the 2007 nesting season. These estimates are based on nests monitored.

Site	# Pairs[1]	# Pairs[2]	# Nests Initiated	# Chicks Initially Observed	# Successful Nests	# Unsuccessful Nests	# Eggs Hatched	# Fledglings	Nest-based Hatch Success	Nesting Loss	Nesting Success	Nest-based Fledging Success	Pair-based[1] Fledging Success	Pair-based[2] Fledging Success
Blue Hole	6	5	6	15	5	1	15	6	2.50	0.17	0.83	1.00	1.00	1.20
Johnson Pit	4	3.5	4	12	4	0	12	7	3.00	0.00	1.00	1.75	1.75	2.00
Lexington Pit	5	4	6	10	4	2	10	7	1.67	0.33	0.67	1.17	1.40	1.75
All Sites	15	12.5	16	37	13	3	37	20	2.31	0.19	0.81	1.25	1.33	1.60

1. Pair defined as the maximum number of nests and number of broods detected during one survey.
2. Pair defined as one-half of the maximum number of adults detected during one survey.

Table 12. Least tern reproductive parameter estimates for constructed riverine islands during the 2007 nesting season. These estimates are based on nests monitored.

Site	# Pairs[1]	# Pairs[2]	# Nests Initiated	# Chicks Initially Observed	# Successful Nests	# Unsuccessful Nests	# Eggs Hatched	# Fledglings	Nest-based Hatch Success	Nesting Loss	Nesting Success	Nest-based Fledging Success	Pair-based[1] Fledging Success	Pair-based[2] Fledging Success
Dinan Tract	10	10	11	5	2	9	5	2	0.45	0.82	0.18	0.18	0.20	0.20
Dipple Tract Colony A	1	2	1	0	0	1	0	0	0.00	1.00	0.00	0.00	0.00	0.00
Dipple Tract Colony B	1	1	1	0	0	1	0	0	0.00	1.00	0.00	0.00	0.00	0.00
All Sites	12	13	13	5	2	11	5	2	0.38	0.85	0.15	0.15	0.17	0.15

1. Pair defined as the maximum number of nests and number of broods detected during one survey.
2. Pair defined as one-half of the maximum number of adults detected during one survey.

Table 13. Piping plover reproductive parameter estimates for constructed riverine islands during the 2007 nesting season. These estimates are based on nests monitored.

Site	# Pairs[1]	# Pairs[2]	# Nests Initiated	# Chicks Initially Observed	# Successful Nests	# Unsuccessful Nests	# Eggs Hatched	# Fledglings	Nest-based Hatch Success	Nesting Loss	Nesting Success	Nest-based Fledging Success	Pair-based[1] Fledging Success	Pair-based[2] Fledging Success
Dinan Tract	2	2.5	3	4	1	2	4	3	1.33	0.67	0.33	1.00	1.50	1.20
Dipple Tract Colony A	1	1	1	4	1	0	4	4	4.00	0.00	1.00	4.00	4.00	4.00
All Sites	3	3.5	4	8	2	2	8	7	2.00	0.50	0.50	1.75	2.33	2.00

1. Pair defined as the maximum number of nests and number of broods detected during one survey.
2. Pair defined as one-half of the maximum number of adults detected during one survey.

Table 14. Mayfield daily nest survival rate and incubation survival rate for least terns on sandpits in 2007. Incubation survival rate is the daily rate times itself for every day of incubation (21 times). These estimates are based on nests monitored.

Site	# Nests	# Nests Lost	Exposure Days	Mayfield Daily Nest Survival Rate	Mayfield Daily Nest Survival Rate Variance	Mayfield Daily Nest Survival Rate 95% CI		Incubation Period Survival Rate	Incubation Period Survival Rate 95% CI	
						Lower	Upper		Lower	Upper
Blue Hole	16	8	327	0.9755	0.0001	0.9584	0.9926	0.5944	0.4102	0.8560
Johnson Pit	6	5	99	0.9495	0.0005	0.9055	0.9935	0.3368	0.1243	0.8722
Lexington Pit	14	3	271	0.9889	<0.0001	0.9762	1.0016	0.7915	0.6032	1.0350
All Sites	36	16	697	0.9770	0.0000	0.9657	0.9884	0.6140	0.4805	0.7825

Table 15. Mayfield daily nest survival rate and incubation survival rate for piping plovers on sandpits in 2007. Incubation survival rate is the daily rate times itself for every day of incubation (28 times). These estimates are based on nests monitored.

Site	# Nests	# Nests Lost	Exposure Days	Mayfield Daily Nest Survival Rate	Mayfield Daily Nest Survival Rate Variance	Mayfield Daily Nest Survival Rate 95% CI		Incubation Period Survival Rate	Incubation Period Survival Rate 95% CI	
						Lower	Upper		Lower	Upper
Blue Hole	6	1	136	0.9926	0.0001	0.9780	1.0073	0.8133	0.5363	1.2258
Johnson Pit	4	0	76	1.0000				1.0000		
Lexington Pit	6	2	144	0.9861	0.0001	0.9666	1.0056	0.6760	0.3864	1.1698
All Sites	16	3	356	0.9916	0.0000	0.9819	1.0013	0.7890	0.5993	1.0360

Table 16. Mayfield daily nest survival rate and incubation survival rate for least terns on constructed riverine islands in 2007. Incubation survival rate is the daily rate times itself for every day of incubation (21 times). These estimates are based on nests monitored.

Site	# Nests	# Nests Lost	Exposure Days	Mayfield Daily Nest Survival Rate	Mayfield Daily Nest Survival Rate Variance	Mayfield Daily Nest Survival Rate 95% CI		Incubation Period Survival Rate	Incubation Period Survival Rate 95% CI	
						Lower	Upper		Lower	Upper
Dinan Tract	11	9	241	0.9627	0.0001	0.9382	0.9871	0.4497	0.2621	0.7611
Dipple Tract Colony A	1	1	11	0.9091	0.0075	0.7357	1.0824	0.1351	0.0016	5.2789
Dipple Tract Colony B	1	1	6	0.8333	0.0231	0.5290	1.1376	0.0217	0.0000	14.9958
All Sites	13	11	258	0.9574	0.0002	0.9322	0.9825	0.4005	0.2290	0.6905

Table 17. Mayfield daily nest survival rate and incubation survival rate for piping plovers on constructed riverine islands in 2007. Incubation survival rate is the daily rate times itself for every day of incubation (28 times). These estimates are based on nests monitored.

Site	# Nests	# Nests Lost	Exposure Days	Mayfield Daily Nest Survival Rate	Mayfield Daily Nest Survival Rate Variance	Mayfield Daily Nest Survival Rate 95% CI		Incubation Period Survival Rate	Incubation Period Survival Rate 95% CI	
						Lower	Upper		Lower	Upper
Dinan Tract	3	2	41	0.9512	0.0011	0.8839	1.0185	0.2465	0.0316	1.6708
Dipple Tract Colony A	1	0	13	1.0000				1.0000		
All Sites	4	2	54	0.9630	0.0007	0.9116	1.0144	0.3476	0.0748	1.4907

Table 18. Nest level habitat characteristics estimated at least tern nests on sandpits in 2007 (estimations were not made at all nests as indicated by sample size).

Habitat Parameter	Sample Size	Mean	95% CI		Minimum Value	Maximum Value
			Lower Bound	Upper Bound		
Nest Elevation	4	1.58	1.43	1.72	1.50	1.80
Cover of Grass in 1 m2 area	4	0.00	0.00	0.00	0.00	0.00
Cover of Forb in 1 m2 area	4	0.25	0.00	0.74	0.00	1.00
Cover of Woody in 1 m2 area	4	0.00	0.00	0.00	0.00	0.00
Density of Grass in 1 m2 area	4	0.00	0.00	0.00	0.00	0.00
Density of Forb in 1 m2 area	4	1.25	0.00	3.70	0.00	5.00
Density of Woody in 1 m2 area	4	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 1 m2 area	4	0.03	0.00	0.07	0.00	0.10
Cover of Grass in 5 m2 area	4	1.25	0.00	3.70	0.00	5.00
Cover of Forb in 5 m2 area	4	0.50	0.00	1.48	0.00	2.00
Cover of Woody in 5 m2 area	4	0.00	0.00	0.00	0.00	0.00
Density of Grass in 5 m2 area	4	2.50	0.00	7.40	0.00	10.00
Density of Forb in 5 m2 area	4	2.50	0.00	7.40	0.00	10.00
Density of Woody in 5 m2 area	4	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 5 m2 area	4	0.08	0.00	0.17	0.00	0.20

Table 19. Nest level habitat characteristics estimated at least tern nests on constructed riverine islands in 2007 (estimations were not made at all nests as indicated by sample size).

Habitat Parameter	Sample Size	Mean	95% CI		Minimum Value	Maximum Value
			Lower Bound	Upper Bound		
Distance to Bank	2	100.00	80.40	119.60	90.00	110.00
Nest Elevation	2	0.30	0.00	0.69	0.10	0.50
Cover of Grass in 1 m2 area	12	1.25	0.00	3.01	0.00	10.00
Cover of Forb in 1 m2 area	12	0.67	0.00	1.55	0.00	4.00
Cover of Woody in 1 m2 area	12	0.00	0.00	0.00	0.00	0.00
Density of Grass in 1 m2 area	12	14.17	0.00	33.83	0.00	110.00
Density of Forb in 1 m2 area	12	1.50	0.00	3.61	0.00	12.00
Density of Woody in 1 m2 area	12	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 1 m2 area	12	0.01	0.00	0.03	0.00	0.10
Cover of Grass in 5 m2 area	12	1.67	0.00	4.93	0.00	20.00
Cover of Forb in 5 m2 area	12	0.83	0.00	2.47	0.00	10.00
Cover of Woody in 5 m2 area	12	0.67	0.00	1.97	0.00	8.00
Density of Grass in 5 m2 area	11	0.00	0.00	0.00	0.00	0.00
Density of Forb in 5 m2 area	11	0.00	0.00	0.00	0.00	0.00
Density of Woody in 5 m2 area	11	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 5 m2 area	12	0.06	0.00	0.17	0.00	0.70

Table 20. Nest level habitat characteristics estimated at piping plover nests on sandpits in 2007 (estimations were not made at all nests as indicated by sample size).

Habitat Parameter	Sample Size	Mean	95% CI		Minimum Value	Maximum Value
			Lower Bound	Upper Bound		
Nest Elevation	7	1.46	1.02	1.89	0.60	2.40
Cover of Grass in 1 m2 area	7	0.00	0.00	0.00	0.00	0.00
Cover of Forb in 1 m2 area	7	1.86	0.07	3.64	0.00	5.00
Cover of Woody in 1 m2 area	7	0.00	0.00	0.00	0.00	0.00
Density of Grass in 1 m2 area	7	0.00	0.00	0.00	0.00	0.00
Density of Forb in 1 m2 area	7	2.57	0.00	5.40	0.00	10.00
Density of Woody in 1 m2 area	7	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 1 m2 area	7	0.09	0.00	0.18	0.00	0.30
Cover of Grass in 5 m2 area	7	0.00	0.00	0.00	0.00	0.00
Cover of Forb in 5 m2 area	7	1.71	0.00	3.46	0.00	5.00
Cover of Woody in 5 m2 area	7	0.00	0.00	0.00	0.00	0.00
Density of Grass in 5 m2 area	7	0.00	0.00	0.00	0.00	0.00
Density of Forb in 5 m2 area	7	9.43	0.19	18.67	0.00	30.00
Density of Woody in 5 m2 area	7	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 5 m2 area	7	0.09	0.00	0.18	0.00	0.30

Table 21. Nest level habitat characteristics estimated at piping plover nests on constructed riverine islands in 2007 (estimations were not made at all nests as indicated by sample size).

Habitat Parameter	Sample Size	Mean	95% CI		Minimum Value	Maximum Value
			Lower Bound	Upper Bound		
Distance to Bank	0	.	.	.	.	.
Nest Elevation	0	.	.	.	.	.
Cover of Grass in 1 m2 area	2	0.00	0.00	0.00	0.00	0.00
Cover of Forb in 1 m2 area	2	0.00	0.00	0.00	0.00	0.00
Cover of Woody in 1 m2 area	2	0.00	0.00	0.00	0.00	0.00
Density of Grass in 1 m2 area	2	0.00	0.00	0.00	0.00	0.00
Density of Forb in 1 m2 area	2	0.00	0.00	0.00	0.00	0.00
Density of Woody in 1 m2 area	2	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 1 m2 area	2	0.00	0.00	0.00	0.00	0.00
Cover of Grass in 5 m2 area	2	2.50	0.00	7.40	0.00	5.00
Cover of Forb in 5 m2 area	2	5.00	0.00	14.80	0.00	10.00
Cover of Woody in 5 m2 area	2	0.00	0.00	0.00	0.00	0.00
Density of Grass in 5 m2 area	2	10.00	0.00	29.60	0.00	20.00
Density of Forb in 5 m2 area	2	1.50	0.00	4.44	0.00	3.00
Density of Woody in 5 m2 area	2	0.00	0.00	0.00	0.00	0.00
Height of Vegetation in 5 m2 area	2	0.10	0.00	0.30	0.00	0.20

Table 22. Colony level habitat characteristics for each sandpit with least tern (LETE) or piping plover (PIPL) nests in 2007.

Site name	Nesting Species	Colony Management	Adjacent Land Use
Johnson Pit	LETE PIPL	Permanent predator fence, trapping, pre-emergent herbicide.	
Lexington Pit	LETE PIPL	Permanent predator fence, trapping, pre-emergent herbicide.	
Blue Hole	LETE PIPL	Portable predator fence, trapping, pre-emergent herbicide.	
Dinan Tract	LETE PIPL	Mechanical clearing surrounding coarse gravel/cobble on surfaces. Permanent predator fence, trapping, pre-emergent herbicide.	
Dipple Tract Colony A	LETE PIPL	Mature trees removed from islands in the channel and from 90 acres on N side of river and 26 acres on the S side in 2006. Channel bed disced in Fall 2006	North bank and large islands in the channel cleared of trees in 2006
Dipple Tract Colony B	LETE	Mature trees removed from islands in the channel and from 90 ac on N side and 26 ac on the S side in 2006. Channel bed disced Fall 2006.	North bank and large islands in the channel cleared of trees in 2006
Broadfoot-Newark	LETE PIPL		Active sandpit surrounded by riparian woodland, grassland, and residential.
Broadfoot-Kearney South	LETE PIPL		Large active pit surrounded by river, commercial development, and cultivated crop-ground.

Figure 1. Discharge (cfs) at Overton, Nebraska (USGS Gage No. 06768000) from May 1 through August 31, 2007.

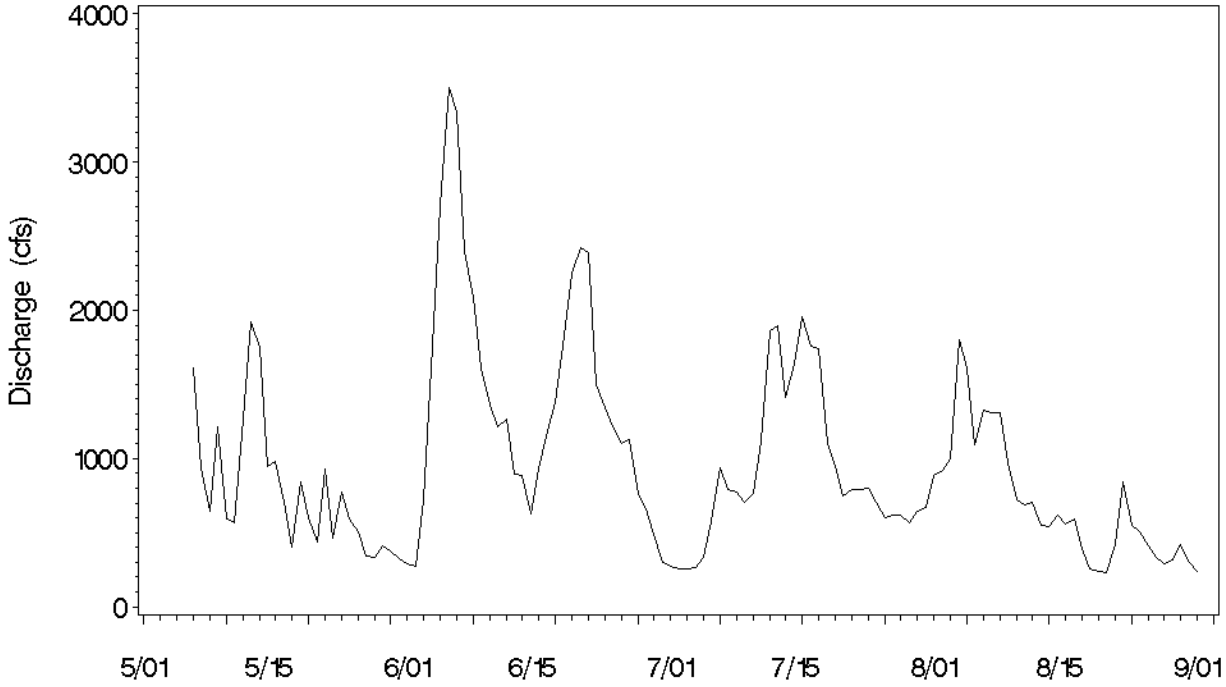


Figure 2. Stage (ft) at Overton, Nebraska (USGS Gage No. 06768000) from May 1 through August 31, 2007.

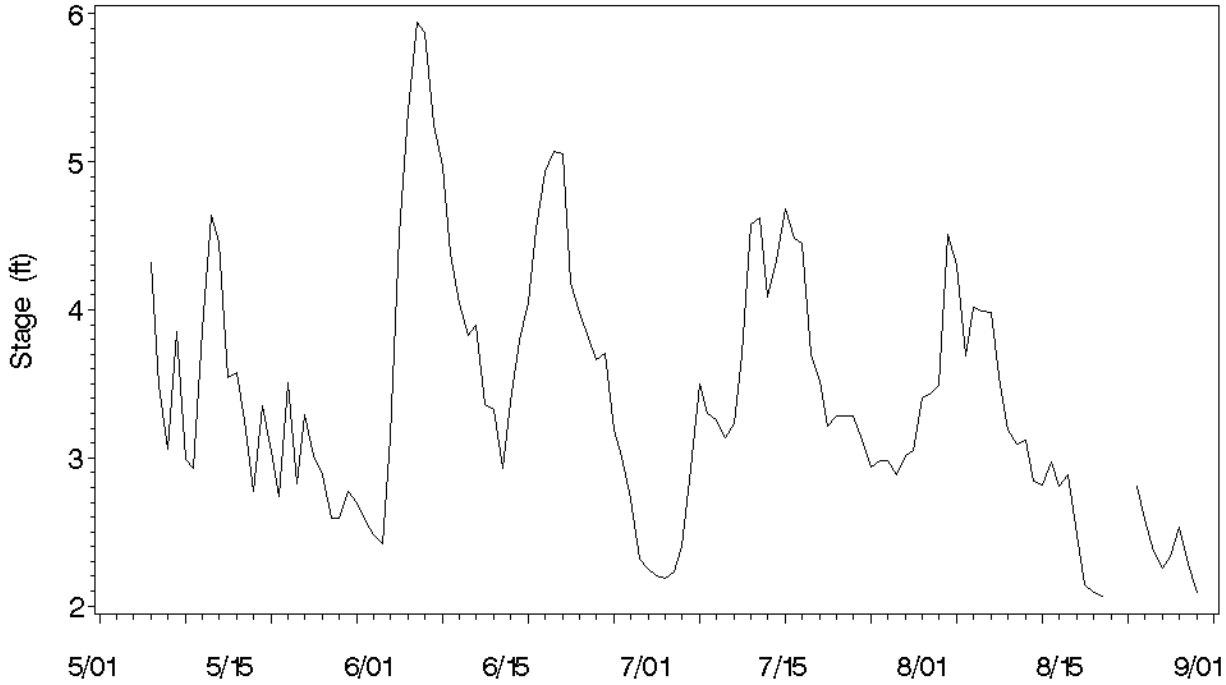


Figure 3. Discharge (cfs) at Kearney, Nebraska (USGS Gage No. 06770200) from May 1 through August 31, 2007.

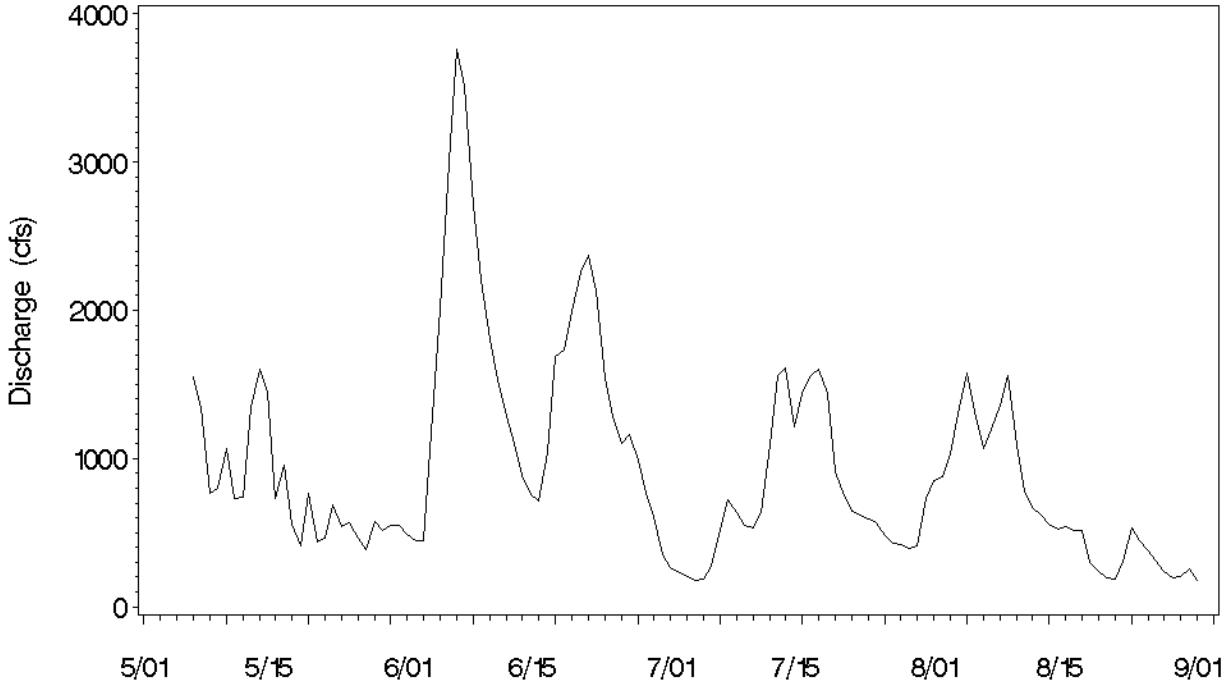


Figure 4. Stage (ft) at Kearney, Nebraska (USGS Gage No. 06770200) from May 1 through August 31, 2007.

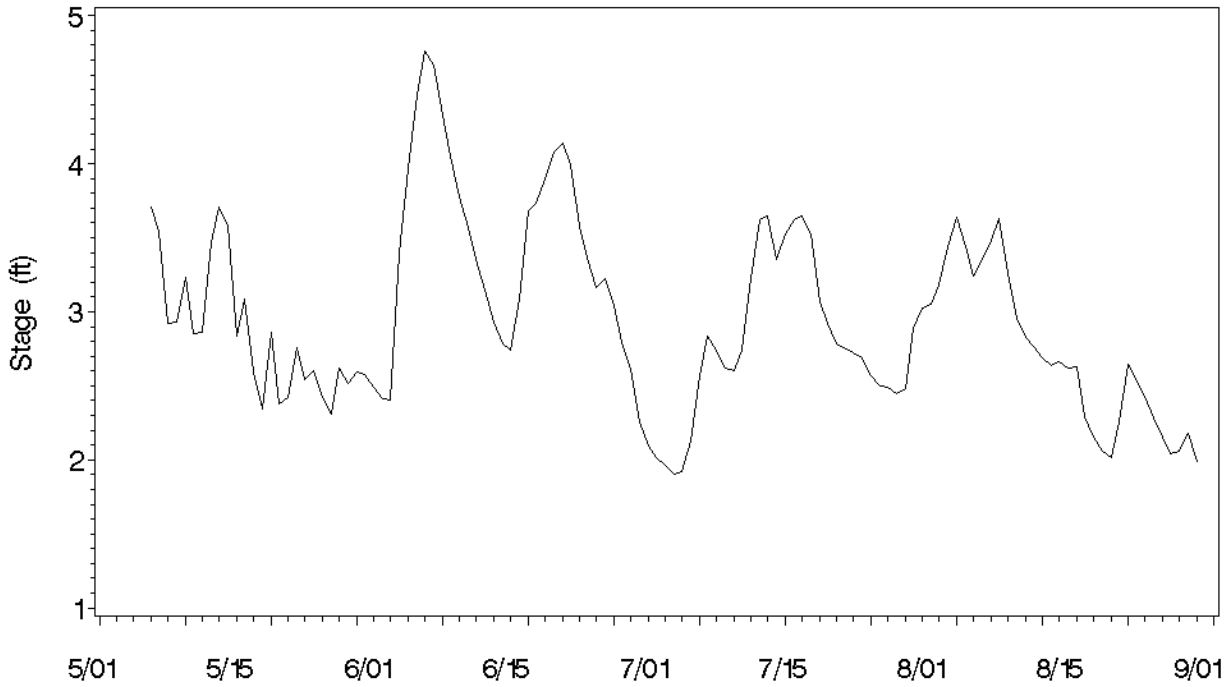


Figure 5. Discharge (cfs) at Grand Island, Nebraska (USGS Gage No. 06770500) from May 1 through August 31, 2007.

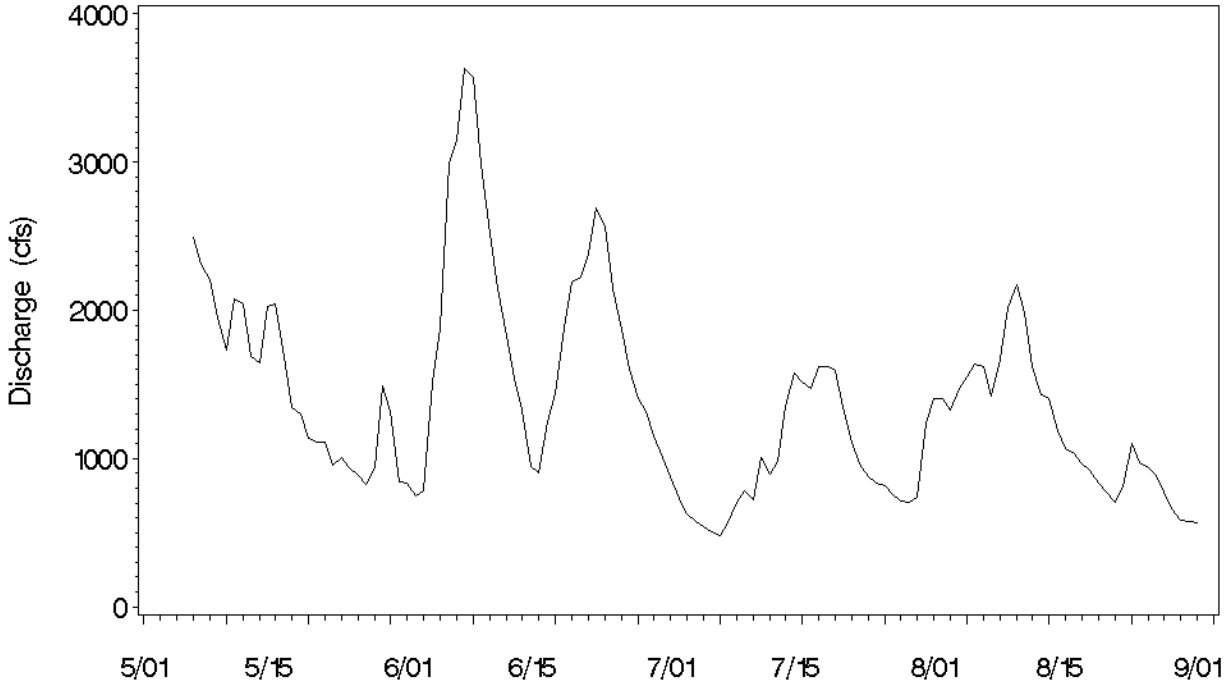


Figure 6. Stage (ft) at Grand Island, Nebraska (USGS Gage No. 06770500) from May 1 through August 31, 2007.

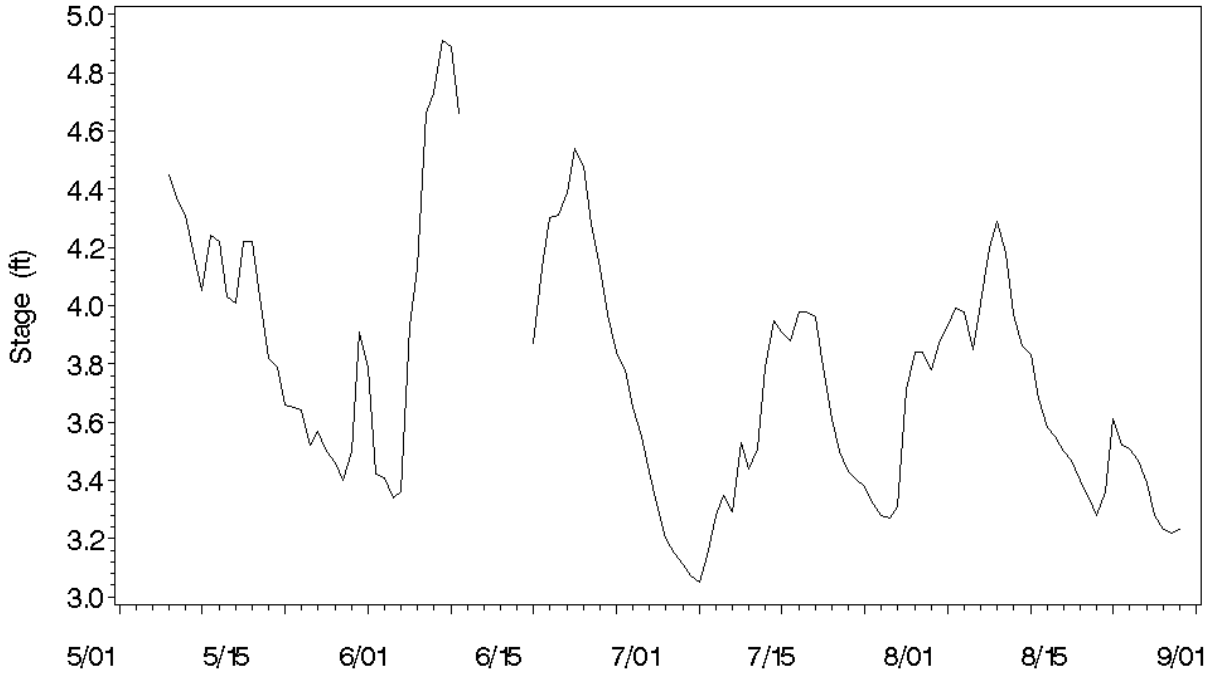


Figure 7. Sandpits and constructed islands surveyed for the 2007 season and locations of least tern sightings and nesting. Background image is the Fall 2003 color infrared photograph.

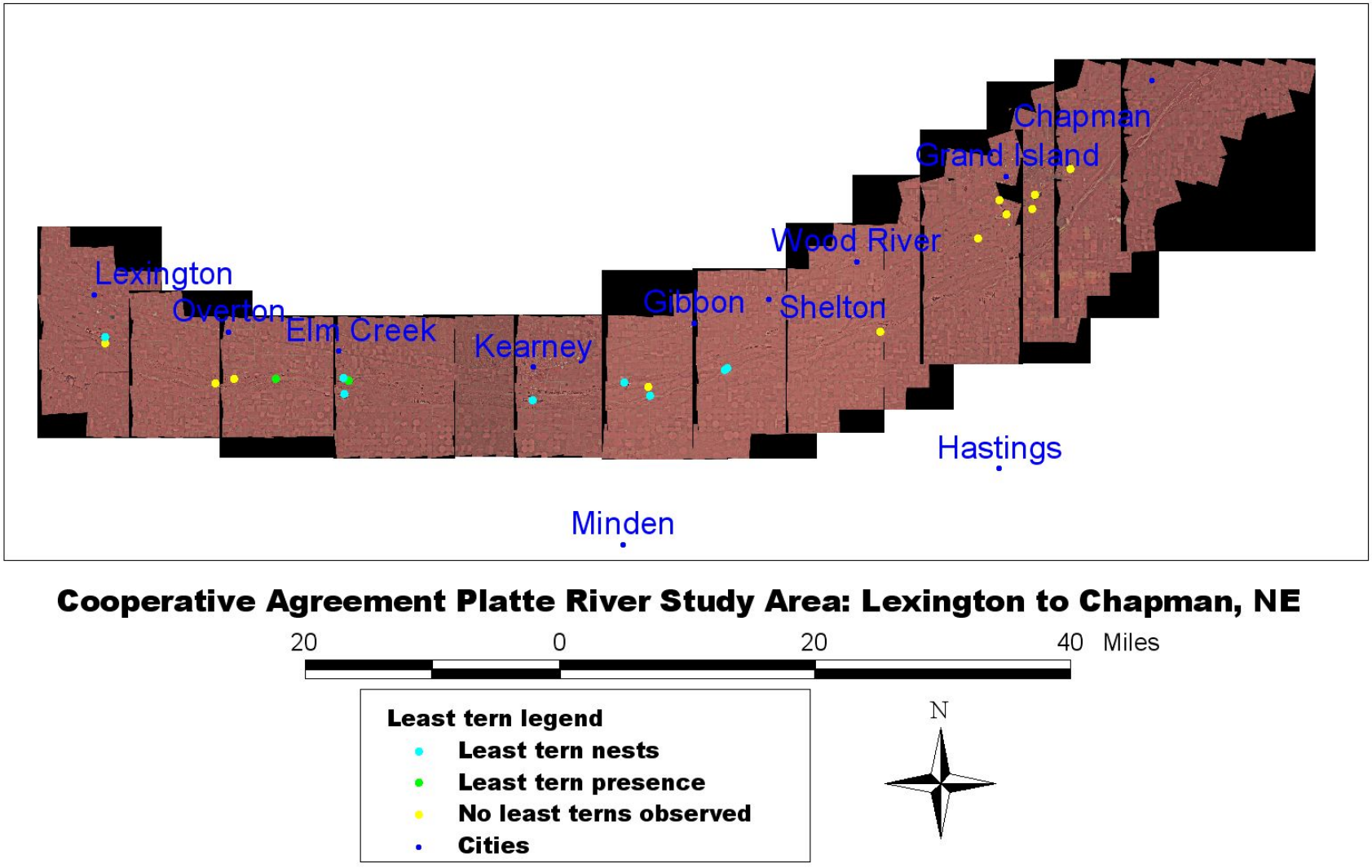
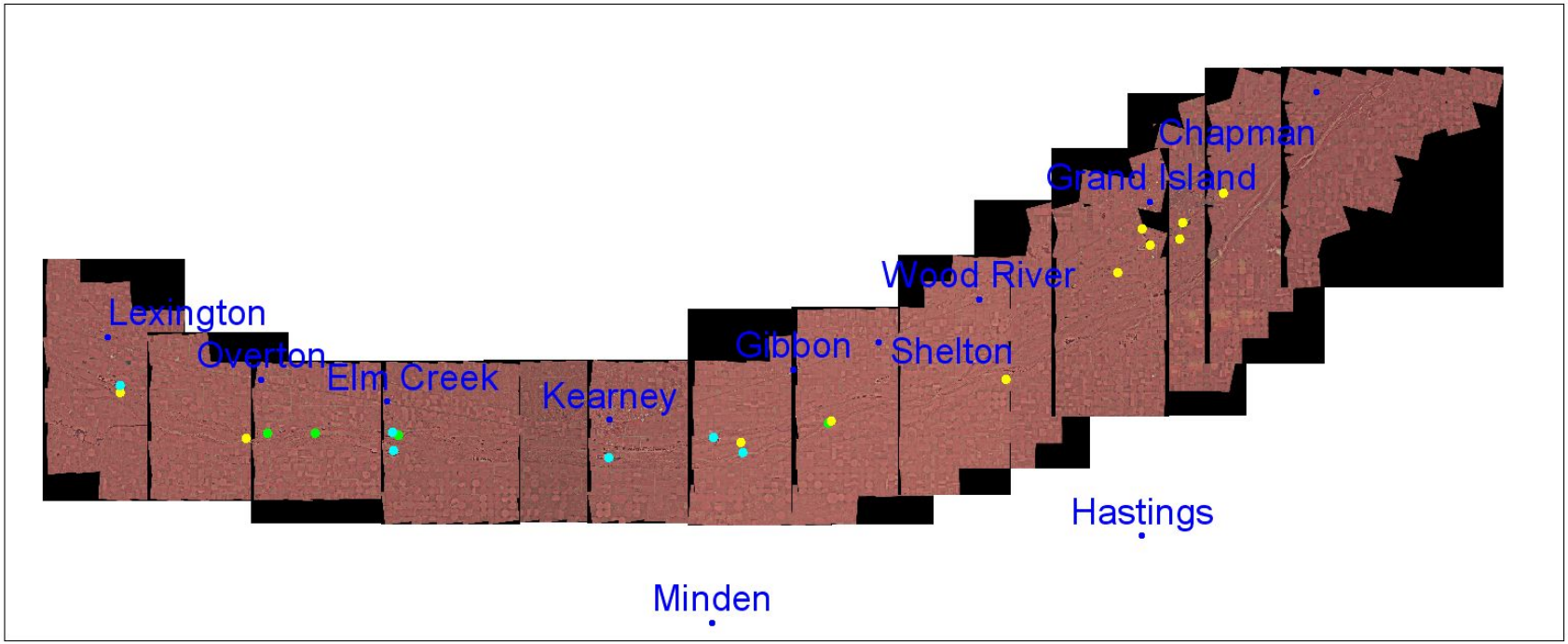


Figure 8. Sandpits and constructed islands surveyed for the 2007 season and locations of piping plover sightings and nesting. Background image is the Fall 2003 color infrared photograph.



Cooperative Agreement Platte River Study Area: Lexington to Chapman, NE

20 0 20 40 Miles

Piping plover legend
- **Piping plover nests**
- **Piping plover presence**
- **No piping plovers observed**
- **Cities**

N