PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Monitoring the Reproductive Success and Reproductive Habitat Parameters of Least Terns and Piping Plovers in the Central Platte River

I. INTRODUCTION

The States of Colorado, Nebraska and Wyoming and the Department of the Interior (DOI) agreed to participate in a basin-wide cooperative program relating to four target species (interior least tern, piping plover, whooping crane and pallid sturgeon) and their associated habitats in the Cooperative Agreement for Implementing a Platte River Recovery Implementation Program (Program). One of the primary purposes of the Program is to "implement certain aspects of the FWS' recovery plans for the target species that relate to their associated habitats by providing for the following: 1) securing defined benefits for the target species and their associated habitats to assist in their conservation and recovery through a basin-wide cooperative approach that can be agreed to by the three states and DOI…". The Program builds upon the July 1, 1997 Cooperative Agreement for Platte River Research and Other Efforts Relating to Endangered Species Habitats Along the Central Platte River, Nebraska (July 1997 Cooperative Agreement).

Program implementation will follow a process of adaptive management to address areas of scientific uncertainty. Monitoring is an integral part of the adaptive management process. The adaptive management approach will allow for efficient modification of management actions in response to new and changing environmental conditions. The Program's Technical Advisory Committee will monitor and document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to habitat improvement activities. The Technical Advisory Committee will review monitoring results and make recommendations to the Program's Governance Committee regarding the effects of Program activities on whooping crane habitat use in the study area. The Governance Committee, using the Technical Advisory Committee's input, will evaluate projects and the overall Program to determine what, if any, changes are needed in the management.

This monitoring protocol will be used by the Technical Advisory Committee to gather information on least tern and piping plover reproductive success and reproductive habitat parameters in the study area. It is understood that regardless of survey method not all terns and plovers are certain of being detected and therefore full implementation of this or any other protocol will not represent complete use of the central Platte River valley. Information from this protocol will be used to help evaluate the biological response of terns and plovers and habitat to the land and water management activities of the Program.

This monitoring protocol addresses several July 1997 Cooperative Agreement milestones:
R2-1 – A technical advisory committee appointed by the Governance Committee will develop protocols for and initiate habitat and species monitoring and research

R3-1 – The FWS and TC will identify data needed to ascertain biological response and the time frame required to evaluate those data (R3-1 milestone as revised at the August 2, 2000 TC/GC workshop)

R5-1 – The Nebraska Districts will implement any research and monitoring measures required by new FERC license articles for FERC Projects Nos. 1417 and 1835.

R1-2 and R1-3 – A technical advisory committee will continue monitoring to document, relative to the habitat and species conditions that existed as of the effective date of the Cooperative Agreement, habitat and species responses to activities undertaken pursuant to the Cooperative Agreement.

R3-2 and R3-3 – The Nebraska Districts will continue to implement any research and monitoring measures required by FERC license articles for FERC Projects Nos. 1417 and 1835.

II. PURPOSE

This document describes the conceptual design and study methods for locating tern and plover nests and monitoring the reproductive success and reproductive habitat parameters at least tern and piping plover colonies in the central Platte River valley, Nebraska. The monitoring is designed to document long term trends in reproductive and habitat parameters throughout the time the protocol is implemented.

This protocol will also be used by Nebraska Public Power District (NPPD) and Central Nebraska Public Power and Irrigation District (Central), collectively "the Districts", as part of their compliance with Federal Energy Regulatory Commission (FERC) licensing.

III. DESIGN CONSIDERATIONS AND SPECIFICATIONS

III.A. Area of Interest

The area of interest for monitoring the reproductive success and reproductive habitat of least terns and piping plovers consists of the Platte River beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, Nebraska, and extending eastward to Chapman, Nebraska. This includes approximately 90 miles of the Platte River and sandpits within 3.5 miles of the main channel or 2 miles of a side channel if the side channel extends beyond 3.5 miles of the main channel.

III.B. Statistical Design

The design consists of two main components: 1) effort-based census of the Platte River between Lexington and Chapman, and 2) census of historic (pre-Program) nesting areas and potential nesting areas on sandpits and constructed islands. These two monitoring components were designed along with a research component that was designed to evaluate the efficiency of each survey. Data will exist both prior to and after Program initiation for some of the 2rd component, with data collected only after Program implementation for the 1st component and the research component. Information from all components will be used to make informed judgments regarding the trends in tern and plover reproductive parameters associated with Program activities. Habitat parameters will be measured at all located nests.

III.B.1. Component 1, Effort-based Census of River (Extensive Survey)

To make statistical inferences to the entire study area, an effort-based survey will be conducted along the entire river corridor. The survey will involve locating nests from an airboat. Every channel with an active width (bare sand and/or water) greater than 75m on the Platte River between Lexington and Chapman, Nebraska will be surveyed. The boat will be directed through the channels in such a manner that observers can view all sand areas, making the total survey time dependant on the amount of sand present (i.e., more sand visible at low flows will require longer survey periods).

The entire river will be searched three times per breeding season (mid May, mid June, and mid July). Windows are provided as guidelines to determine when to survey (10 May-25 May, 10 June-25 June, and 10 July-25 July), but exact timing of the surveys will be dependent on flow and safety conditions. Before each survey an aerial flight will be conducted over the study area to determine the availability of bare sand, if its presence is in doubt. If there is no bare sand visible at the end of the airboat survey window, an airboat survey will not be conducted and the number of nests will be recorded as 0. If any bare sand is visible, regardless of size or condition, the airboat survey will be conducted when it is determined that flows have been at or below flight-day flows for three consecutive days.

III.B.2. Component 2, Census of Sandpits and Constructed Riverine Islands

All sandpits that have areas of bare sand (<20% vegetative cover) greater than one acre, and for which access can be gained, will be surveyed 3 times for active tern and plover colonies. Also, any nesting area constructed and maintained by the Program will be visited weekly between May 15 and July 15 for active tern and plover colonies. Reproductive areas (colonies) that were located and monitored prior to Program initiation will be monitored under this component. Since every accessible sandpit will be monitored we will have a census of colonies and a sample of nests at each colony. The nest is the sample unit for calculation of reproductive parameters, and inference will be to accessible sandpits with areas of bare sand greater than one acre.

Each of these areas will be searched three times per breeding season (mid May, mid June, and mid July) for tern and plover adults and nests. These surveys will be conducted regardless of the survey activity on the river. Nests located during these surveys will be monitored as described below. Monitoring all sandpits and constructed islands will allow unbiased estimation of trends in reproductive parameters at these areas. Only the areas that were monitored prior to Program initiation will be used in analytical comparisons of data collected before and after Program implementation. Areas that were not monitored prior to Program initiation will not be used in the before-after analysis but will be used in the trend analysis. Continuing surveys of these areas using the same methods to locate and monitor nests will facilitate detecting trends in reproduction during the Program.

III.C. Timing

Surveys of the river and sandpits to document nest presence will be conducted three times annually (mid May, mid June, and mid July). Least tern or piping plover nests found in any

survey will be visited every three days to evaluate the nest status. Information to be collected during each site visit is described below.

IV. METHODS

IV.A. Biological, Reproductive, and Habitat Definitions

Biological parameters:

Brood – An active nest or clutch of chicks.

Nesting colony – The area encompassed by multiple nests within which disturbance to one nest results in a disturbance reaction by adults of other nests. In cases where only a single nest is present, the nest will serve as the "colony" for habitat measurements.

Nest Initiation – A nest is initiated when it is constructed and at least one egg is laid.

Nest success – A nest is successful when at least one egg hatches.

Fledge – A least tern chick has fledged when it is covered in unsheathed feathers, has a black eye stripe, and has a short tail, or flight is observed, or nestling is 15 days old. A piping plover chick is fledged when it is covered in unsheathed feathers and has a short tail, or flight is observed, or nestling is 15 days old.

Reproductive Parameters:

Total Nests Initiated – The total number of nests initiated whether successful or not. This total includes first nesting attempts as well as re-nesting attempts.

Nest-based Hatching success – The total number of hatched eggs (chicks) divided by the total number of nests initiated (i.e., if there were 60 chicks and 75 nests, the hatching rate would be 0.80 or 80%). Using the number of nests in the denominator of this statistic recognizes the greater independence of fate between nests than between eggs.

Nesting loss – The total number of unsuccessful nests divided by the total number of nests initiated (i.e., if there were 125 nests initiated and 25 nests were unsuccessful, nest loss would be 0.20 or 20%).

Nesting success – The total number of successful nests divided by the total number of nests initiated (i.e., if there were 125 nests initiated and 100 nests were successful, nest success would be 0.80 or 80%).

Number of Pairs – The number of pairs will be estimated one of two ways; 1) the maximum number of nests and number of broods at any one survey, or 2) half of the maximum number of adults counted at any one survey. Data collection will allow the estimation of the number of pairs using either method.

Nest-based Fledging success – the number of fledged birds per initiated nest (i.e., if 60 chicks were fledged from 50 nests, the fledging success would be 1.2 fledged birds per nest).

Pair-based Fledgling success – the number of fledged birds per bird pair (i.e., if 60 chicks were fledged from 50 pairs, the fledging success would be 1.2 fledged birds per pair).

Nest-level Habitat Parameters:

Nearest bank (riverine) – Distance to the nearest bank across water estimated from a distance.

Nest elevation – The elevation of each nest above the water surface estimated from a distance.

Nest management – Management activities applied specifically to nests (i.e. exclosures).

Vegetation composition – Percentage of vegetation cover in grass, forb, and woody vegetation types in a $1m^2$ and $5m^2$ area around the nest.

Vegetation density – The number of stems of grass, forb, and woody vegetation types in a $1m^2$ and $5m^2$ area around the nest divided by the area.

Vegetation height – Average height of all vegetation in a $1m^2$ and $5m^2$ area around the nest.

Colony-level Habitat Parameters:

Colony management – Management activities applied to the colony (i.e. predator fencing, predator trapping, herbicide, mowing).

Adjacent land use – The general description of land uses immediately next to as well as in close proximity to the colony.

Bare sand area – The total area with <20% vegetative cover at the colony site.

Pond size – Size of pond adjacent to the colony's nesting substrate (sandpits only). This parameter can be measured using aerial photographs or GIS.

Distance from colony to river – Distance between centroid of the colony and closest active river channel. An active river channel is defined as channel carrying water when the entire river has a minimum flow of 1,200 cfs. This parameter can be measured using aerial photographs or GIS.

Sandbar/Island height – The elevation of the sandbar/island recorded three transects perpendicular to the flow of the water and centered on the centroid of the river colony. The survey will be conducted after all terns and plovers leave the colony and with the use of a transit or survey grade GPS unit.

Channel width – Width of entire open-channel, including land, measured at the colony. This measurement will be derived from the elevation transect.

IV.B. Field Techniques

Standard field practices will be followed during each visit to a nesting area. The following information will be recorded: date, time of day, weather conditions (both for previous day and observation day), length of visit, number of adults and chicks, other species of wildlife present in area, and other information as needed. No more than a total of eight visits will be made within any one colony site and activity within the colony areas will be limited to less than 20 minutes in duration. Within colony visits will be conducted no more than once during a seven day period. All observations will be conducted when the temperature is less than 90^{o}F (32^{o}C) to reduce stress and mortality to eggs and chicks. If daily temperatures remain below 75^{o}F, nests may be checked either in the morning or afternoon. If temperatures go above 75^{o}F, nest will only be checked in the morning. If predatory animals (e.g., hawks, raccoons) are visible or fresh sign of predatory animals is observed (e.g., fresh tracks) nests will not be approached.

IV.B.1. Nest location

Component 1, Effort-based Census of River (Extensive Survey)

Effort-based census of the river to determine nest initiation will be conducted three times during each breeding season on the central Platte River between Lexington and Chapman, Nebraska. Surveys will be conducted in mid May, mid June, and mid July. An airboat will be used to access the river habitat within each bridge segment. The operator of the boat and a minimum of one observer will cover each active channel greater than 75m (as described above) searching for least tern and piping plover nests. The airboat will be operated such that observations of all bare sand areas can be made. Names of observers and time spent conducting the survey will be recorded on datasheets. GPS units will be used to accurately record surveyed channels.

If an adult piping plover(s) or least tern(s) is observed, the boat will be driven upstream of the location and the motor turned off. As the boat drifts by the location of the bird observation, both observers will attempt to locate the nesting bird. This method will enable the nests to be located without entering land before permission is granted. If the nest is located, or if the observers cannot confirm the absence of a nest, the point will be mapped on an aerial photograph or 7.5-minute quadrangle map and a hand drawn map. The hand drawn map will include vegetative cover, distinguishing features of the area, estimated channel widths, and approximate topography. A GPS unit will be used to determine the UTM coordinates. Subsequent relocation of the nest will use the UTMs for the general location within the river and site maps or photos will be used to locate specific nest sites. After the nest is located the survey will begin from where the bird was first observed. As soon as possible after completion of the survey, the landowner will be contacted in an attempt to gain access to the property for monitoring of the nest. If landowner permission is not obtained, the area will be excluded from estimates of nesting success if monitoring cannot occur from a distance but will be included in estimates of total nests.

The number of terns and plovers detected during each airboat survey will be recorded and their likely association (reproductively) with a river, sandpit, or constructed island nesting colony will be noted. The surveyors will attempt to keep individual birds separated and only counted once.

Component 2, Census of Sandpits and Constructed Riverine Islands

Surveys for tern and plover nests at sandpits will be conducted in mid May, mid June, and mid July. Observations will be made using binoculars and/or spotting scope at a distance great enough to not cause disturbance of nesting birds (usually > 50 m, but closer or further as terrain dictates) and of duration of at least 1/2 hour. The observations will be done from multiple locations to provide complete coverage of the colony. In addition to recording the nests found during the survey, the monthly survey will be used to collect information on the number of adults, active nests, chicks, broods, and fledglings.

Once nests are located locations will be mapped on aerial photographs and hand drawn maps. Nests will not be marked with visible markers. Relocation of nests for monitoring purposes will be based on hand drawn maps and written descriptions. On the visit on which a nest is located, the number of eggs will be counted if viewable from a distance and habitat parameters will be estimated. Subsequent monitoring for hatching success and fledging success is described below. Each colony location will be recorded using a GPS unit and the UTM coordinates recorded.

If a sandpit or constructed island has active nests that are monitored every three days, it will not be necessary to do an additional survey of the area on June 15 or July 15. The information obtained on the visit to the colony nearest the June or July survey date will be used for the monthly survey data. The surveyor will mark the nearest survey date on the datasheet and spend duration of at least 1/2 hour to record the number of adults, active nests, chicks, broods, and fledglings at the site.

IV.B.2. Nest monitoring

Monitoring active nests will begin immediately after the first nests are initiated and will be conducted for nests located in components 1 and 2 described above. When permission is obtained to enter a nest location, the nest will be approached only to determine cause of predation. The number of eggs in each nest will be recorded if viewed using binoculars or spotting scope or if the colony is entered to investigate predation. Active nests will be viewed from a distance great enough not to disturb the birds and at least every third day to confirm nest status. Monitoring will continue until the nest becomes inactive either through nest success or nest failure. Colonies will not be entered more than eight times in any one year and not more than one time in a seven-day period.

When a nest is no longer active (as observed by using binoculars or spotting scope from a distance), the observer will determine if the nest hatched, was abandoned, or was predated. If the observer suspects nest failure, he/she will enter the colony to check the nest for evidence of the outcome. Indications that the nest was abandoned include no disturbance to the nest, and eggs intact in the nest, intact eggs not at incubation temperature. Evidence that the nest was depredated includes broken eggs, disturbed nest site, and predator tracks. All evidence (type of tracks, condition of egg fragments, scat, and any other sign) relating to potential nest predators will be recorded on data sheets. If the nest was successful, there may be small eggshell fragments in the bottom of the nest but the adult will have removed the larger pieces from the nest. Another indication that the nest was successful is that there will be a chick(s) in the area

with the adults, and fecal material in the immediate vicinity of the nest. The outcome of each nest, including an estimate of the number of hatched eggs, will be documented on data sheets.

Timing of visits to determine fledging success will depend on obtaining date of hatching from nest success monitoring (see above). Because tern and plover chicks require approximately 18-20 days to fledge (Murphy 1999), visits will be timed to begin before chicks leave natal areas.

Fledging status of least terns and piping plovers will be determined by observation of the natal area from a distance great enough to minimize disturbance to adults or chicks (usually > 50 m). The entire natal area will be watched for fledglings and a complete, or nearly complete, count of chicks and adults will be made at each site. The observer will spend a minimum of 0.5 hour at each colony location and will scan the area using binoculars and/or spotting scope a minimum of 5 passes over the area. During each pass of the area the observer will count all adults and chicks and estimate the age of chicks.

Number of adults, nests, chicks, broods, and fledglings, estimated time until fledging for each chick and any other pertinent information for each site will be recorded on data sheets (attached). An estimate of the number of successfully fledged chicks will be based on age and the date chicks were last observed or directly counted if chicks are observed flying from natal areas. Each site will be monitored every 3 days until all chicks are no longer observed at the natal area.

IV.B.3. Habitat Measurements

The colony will not be entered to conduct habitat measurements until after all of the chicks have fledged and all the birds have left the area. Nest-level habitat measurements will be estimated/recorded from outside the colony using binoculars or a spotting scope. Colony-level habitat measurements will be measured after all birds have left the nesting area.

For each nest in the study area, five habitat parameters will be estimated from outside the colony at the time the nest is located: 1) the distance between the nest and the nearest water, including the type of water, 2) the elevation of the nest above the water level, 3) nest specific management activities, 3) estimates of the percentage of grass, forb, or woody vegetation types within $1m^2$ and within $5m^2$ of the nest, 4) number of stems (to get density) within $1m^2$ and within $5m^2$ of the nest, and 5) vegetation height within $1m^2$ and within $5m^2$ of the nest.

For each colony (one or more nests) located in the study area, colony-level management activities will be recorded along with the adjacent land use. The bare sand area, size of adjacent pond, and distance from the colony to the river will be measured in a GIS for each colony. The location of each nest in the colony will be drawn on a copy of an aerial photograph to estimate the centroid of the colony.

For each colony located on the river, three parallel cross-sectional transects will be used to measure a depth profile perpendicular to the flow. The middle transect will pass through the centroid of the colony, the upstream and downstream two transects will pass through the remaining thirds of the colony. For areas with only one nest, the middle transect will pass

through the nest location, one transect 25 m upstream and one transect 25 m downstream. A survey grade GPS unit or transit/rod will be used to record distance and elevation at 3 m intervals, slope breaks, and water lines from permanent bank to permanent bank or permanent obstruction (e.g., woody vegetation, bank) greater than 1.5m. The colony location will be noted on the data sheet or on the computer used to capture the cross sectional data. Estimates of active channel width will be obtained from the elevation transect data.

IV.C. Analysis Methods

Estimates of reproductive parameters will be summarized separately for the river survey (component 1) and for the sandpit and constructed island surveys (component 2) because the different methods used to locate nests will most likely result in different probabilities of inclusion of a nest in each sample. In both cases, the nest will be the sample unit for the calculation of reproductive parameters by colony, river segment, bridge segment or the entire river. Associations between reproductive parameters and habitat variables will use the nest or the colony as the experimental unit depending on the habitat variable. Inference for these analyses will be to the sandpits within the study area or colonies on the Platte River within the study area. For the trend analysis on sandpits and constructed islands, the experimental unit will be the colonies because the location of the colony will be the same every year. For the trend analysis on the river, the experimental unit will be the river segment because colonies will not be in the same location of the river every year.

The total number of nests initiated will be calculated for each site (riverine, sandpit or constructed island). The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992).

Hatching Success

The total number of hatched eggs will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The nest-based hatching success will be calculated as the ratio of the total number of hatched eggs to the total number of nests initiated.

Nesting Loss

The total number of unsuccessful nests will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The estimate of nesting loss will be calculated as the ratio of the total number of unsuccessful nests to the total number of nests initiated. The variance will be calculated by the variance of the ratio of totals (Cochran 1977).

Nesting Success

The total number of successful nests will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The estimate of nesting success will be calculated as the ratio of the total number of successful nests to the total number of nests initiated. The variance will be calculated by the variance of the ratio of totals (Cochran 1977).

Fledging Success

The total number of fledglings will be calculated for each site. The variance will be calculated using the variance of a total from a simple random sample (Thompson 1992). The estimate of fledging success will be calculated two ways. Nest-based fledgling success will be calculated as the ratio of the total number of fledglings to the total number of nests initiated. Pair-based fledgling success will be calculated as the ratio of the total number of fledglings to the total number of breeding pairs. The variance of each estimate will be calculated by the variance of the ratio of totals (Cochran 1977).

Mayfield Estimators

The Mayfield estimate of daily mortality rate will be calculated as the ratio of total number of unsuccessful nests to the total number of exposure days. The variance of the daily mortality rate will be calculated as the variance of a maximum likelihood estimator (Johnson 1979). Daily survival rate will be calculated as one minus the daily mortality rate, and hatching success will be calculated as the daily survival rate raised to the power of the length of the incubation period.

Associations with Reproductive Parameters

Physical habitat measurements made at the colony level can be used in regression equations to predict reproductive parameters (hatching success, nesting success, fledgling success). One scale of this analysis will be a regression of the habitat covariates measured on each site to the mean parameters calculated by site. The sample unit for this analysis will be the site (riverine, sandpit, or constructed islands). Possible covariates include the size of the site (water) and the distance to the river. This analysis will be conducted within and across years (using site averages).

A second scale of analysis would be to use regression to relate habitat covariates measured at a nest to the reproductive parameters for the corresponding nest. The sample unit for this analysis would be the nest. We can determine the association of changes in habitat variables with changes in response variables. These regressions will include a site indicator variable to detect site influences on the reproductive parameters. The number of chicks from a nest can be related to habitat using normal linear regression, while success of a nest (yes or no) can be related to habitat using logistic regression. This analysis will be conducted within and across years.

Trend Detection

Using both the historic data from monitoring these colonies and data collected under this protocol, the slope of the least squares regression line against time will be estimated for each colony. The average and standard error of the slope statistic across colonies will provide an estimate and confidence interval of average trend.

Note that without a reference area there will be a tendency for the effects of the increased flows and habitat management to be confounded with trends in the reproductive parameters due to other factors not measured. For example, the reproductive success may increase immediately after Program initiation because the weather was more conducive to the birds successfully fledging young for those years. With data collected over time, the effects of other factors will diminish and the inferences regarding the effects of the Program will get stronger.

Before-After Analyses

Data from sites (colonies) that were monitored before Program initiation can be compared to data collected under this protocol in the same areas. Since the Program influences all colonies in the study area, cause and effect relationships cannot be established by this analysis. Reproductive parameters will be calculated without adjustments for comparison with pre-Program survey data.

Before-after analyses will be conducted by averaging the values of the reproductive parameters before and after Program implementation for each sandpit. The slope between these two numbers will be calculated and the average slope (over sandpits) will be an estimate of the before to after change in the parameter. Inferences are to the sandpits involved in this analysis.

Nest Habitat Characteristics

Habitat measurements made at the nests will be summarized using means across nests and normal based confidence intervals (Zar 1984). Colony level habitat measurements will be summarized using means across colonies and normal based confidence intervals (Zar 1984).

V. RESEARCH ASSOCIATED WITH THIS MONITORING PROTOCOL

An intensive nest survey of portions of the river will be conducted to augment the monitoring activities *(CITE RESEARCH PROTOCOL)*. This research is intended to determine the effectiveness of the riverine survey by documenting habitat characteristics associated with nests located under component 1 of this protocol and nests not located (double sampling). The data will enable the development of an adjustment factor for river survey data to accurately estimate the number of nests on the river. This research will be conducted during the implementation of the monitoring protocol for duration necessary to adequately model the sampling effectiveness. The intensive survey will be most useful if it is implemented after the river survey has detected nests on the river.

VI. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC measures will be implemented at all stages of the study, including field data collection, data entry, data analysis, and report preparation. Observers will be trained in the methods used and tested on their ability to locate and identify nests. At the end of each survey day, each observer will be responsible for inspecting his or her data forms for completeness, accuracy, and legibility. The study team leader will review data forms to insure completeness and legibility, and any problems detected will be corrected. Any changes made to the data forms will be initialized by the person making the change.

Data will be entered into electronic files at a centralized database by qualified technicians. These files will be compared to the raw data forms and any errors detected will be corrected. Any irregular codes or any unclear or ambiguous data will be discussed with the observer and study team leader. All changes made to the raw data must be documented for future reference.

After the data have been keyed and verified, the study team leader or QA/QC technician will check a five percent sample of data forms against the final computer file. Any problems

identified in later stages of analysis will be traced back to the raw data forms, and appropriate changes in all steps will be made.

VII. DATA COMPILATION AND STORAGE

A centralized database will be established to store, retrieve and organize field observations. Data from field forms will be keyed into electronic data files using a pre-defined format that will make subsequent data analysis straightforward. All field data forms, field notebooks, and electronic data files will be retained for ready reference.

VIII. REPORT FORMAT

A draft and final report will be produced each year describing the methods employed, results, and any conclusions that can be drawn. The report will have both written and graphical components. Graphs will show trends from year to year in such things as number of nests initiated, nesting success, and fledging success. The report will also contain maps showing areas searched for nests and areas that contained nests.

IX. ADMINISTRATION

The Program will be responsible for protocol implementation and permit acquisition.

X. EXISTING DATA EVALUATION

Nebraska Public Power District (NPPD) collected least tern and piping plover reproduction data on 3 islands (Elm Creek, Lexington, and Overton) and 3 sandpits (Johnson's, Lexington, and Blue Hole) from 1991 to 2000. This data is located in a Microsoft excel file *t&p tables00.xls* house in the Kearney office. The file contains the number of initiated nests, number of hatched nests, number of hatched chicks, and the number of fledged chicks at each of the 6 sites for each year. Various forms of reproductive success statistics can be created from this data.

As a check on the existing data, trends through time were estimated for hatching success defined as the ratio of the number of hatched chicks to the number of nests, and for fledging success defined as the ratio of the number of fledglings to the number of nests. The slope of the regression of success parameters on year (estimate of trend) were graphed and averaged by species to get an average trend; 95% confidence intervals included zero.

XI. DATA SHEET

(Excel spreadsheet attached)

XII. BIBLIOGRAPHY

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