

Breeding Birds of LaCreek National Wildlife Refuge: 2002

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Introduction

LaCreek National Wildlife Refuge (LNWR) was established in 1935 as a 3,790-hectare (9,362 acres) Migratory Waterfowl Refuge for migratory and breeding waterfowl and other wildlife in the shallow Lake Creek Valley of Bennett County in southwestern South Dakota. Over time, additions to the original refuge including the Brown Ranch (2,697 ha [6,662 acres]), Little White River Recreation Area (90 ha [223 acres]; co-managed with South Dakota Game, Fish and Parks), and Emley inholding (65 ha [160 acres]) have created what is now a 6,643-hectare (16,407 acres) National Wildlife Refuge. As a part of the National Wildlife Refuge System, the mission of LNWR is to help “administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.” (U. S. Fish and Wildlife Service 1999).

As a result of the National Wildlife Refuge Improvement Act of 1997, each National Wildlife Refuge is required to create a Comprehensive Conservation Plan (CCP). The 15-year plan geared towards ecosystem-based management of migratory and resident wildlife species is suited to fit each individual refuge. In order to help provide baseline biological data needed to create a CCP plan for LNWR, Northern Prairie Wildlife Research Center, in coordination with the refuge, developed a study to survey the breeding birds throughout the refuge.

Methods

The refuge is characterized by mixed-grass prairie, Sandhills prairie, introduced grasses, sub-irrigated wet meadows, and impounded freshwater wetlands. We classified these habitats in two ways. 1) Based on the National Vegetation Classification System (NVCS) and refuge-specific requirements, habitats were classified into eight vegetative ecotypes, including dry mixed-grass prairie, dry plains shrubland, forested wetland, introduced grassland, mesic plains shrubland, provisional land use, restoration areas (areas of exotic grass being restored to native grasses), and wet meadow eco-types. A grid of points 450 m apart was generated using TNTMIPS® (MIPS) Geographical Information System (GIS) software to determine locations for point count surveys. This grid was overlaid with digital NVCS eco-type data supplied by LNWR and the Bureau of Reclamation. Each point was then classified according to eco-type (Tables 1, 2). The 59 points classified as provisional land use were later described according to the major habitat within the point count radius (Table 3). Three of the six points not given an eco-type classification by MIPS (other) were later determined to be exotic grass and the remaining three were Sandhills grass. 2) The habitat within each point count circle was further broken down and classified by visual estimation. See Table 4 for codes and descriptions of habitat classes used.

Table 1. Major eco-types on LaCreek NWR and number of points in each at which bird surveys were conducted in 2002.

Eco-type	Number of points
Dry mixed-grass prairie (DMP)	71
Dry plains shrubland (DPS)	28
Introduced grassland (IG)	58
Restoration area (RA)	18
Mesic plains shrubland (MPS)	3
Wet meadow (WM)	81
Forested wetland (FW)	3
Provisional land use (PLU)	59
Other (O)	6
Total	327

Table 2. Total area (ha) of each eco-type surveyed on LaCreek NWR, 2002.

Eco-type	Area surveyed (ha)
Dry mixed-grass prairie (DMP)	222.9
Dry plains shrubland (DPS)	87.9
Introduced grassland (IG)	182.1
Restoration area (RA)	56.5
Mesic plains shrubland (MPS)	7.1
Wet meadow (WM)	207.2
Forested wetland (FW)	4.7
Provisional land use (PLU)	152.3
Other (O)	18.8
Total	939.5

Table 3. Descriptions of 59 point count locations classified as Provisional Land Use eco-type at LaCreek NWR.

Habitat	Number of points
Crop	5
Cattail	10
Exotic grass	26
Other emergent vegetation	4
Open water	4
Woodland	4
Wet meadow	2
Other	4
Total	59

Table 4. Habitat classes used to describe breeding bird habitat use at LaCreek NWR during point count surveys in 2002.

Habitat	
Classification	Description
Gn	Native Grass
Ge	Exotic Grass
Gs	Sandhills grass
Pd	Prairie dog colony
Wm	Wet meadow-areas with little to no standing water; vegetation generally was prairie cordgrass or sedges.
Ct	Cattail
Ev	Other emergent vegetation-generally areas with standing water; vegetation generally was bulrush; excludes cattail.
W	Open water
Wi	Willow-generally wetland-associated willow species
Wd	Woodland-shelterbelts or lone trees such as cottonwoods
St	Structures-buildings
Rd	Road-well-traveled gravel roads; this does not include two-track dirt roads.
Cr	Cropland-corn or alfalfa
Ot	Outside the refuge boundary-if heterogeneous, this was further described in the habitat description section of the data sheet.
X	Other-exposed soil such as mudflats, excavated holes or bare cultivated soil. This also included four points with dense sweet clover, three points with miscellaneous wooden structures (windmills, large posts), and one point each that contained bee boxes, a large pipe, and old cars.

Note: areas that were burned, grazed or hayed within the point count radius were indicated in the comments section of the data sheet.

Using Geographical Positioning System (GPS) units, grid points were located using Universal Transverse Mercator (UTM) coordinates, and then marked with pink surveyor flags. Point number and respective coordinates were on each flag. Points that fell just outside of the refuge boundary 25 m or less were reassigned coordinates just within the refuge boundary.

Selected distinct habitats including three prairie dog colonies (Cowboys, Big City, and Fantasy Island), a riparian area (Elm Creek), and a large block of planted trees in the Sandhills (Sandhills Trees) were chosen to conduct area searches. Area was determined by using a Digital Orthophoto Quadrangle and MIPS to delineate the areas searched (Table 5).

Table 5. Area (ha) of selected habitats where intensive surveys were conducted at LaCreek NWR, 2002.

Prairie Dog Colonies	Area (ha)
Cowboys	54.7
Big City	45.0
Fantasy Island	13.0
Wooded Areas	
Elm Creek	7.0
Sandhills Trees	7.1

Point counts

Three hundred and twenty-seven points were surveyed once between 17 May and 4 June (round one) and again between 6 June and 1 July (round two). We excluded points that were located in open water (35), one point located on a colonial waterbird nesting island, and one point that was on land, but not accessible by foot. Birds were surveyed within a 100-m radius in open habitats with unrestricted visibility (grasslands). Restrictive habitats (woodlands and cattails) were surveyed within a 50-m radius. Locations of indicated breeding pairs were recorded in visually estimated 25-m intervals. Raptors were recorded in an unlimited distance category. Indicated breeding pairs were based upon the number of territorial males (singing, calling, or visually observed), observed pairs, and nests within the point count radius. Sexual composition of Brown-headed Cowbirds observed was recorded and indicated breeding pairs were based upon the number of females. For polyandrous species (Wilson's Phalarope) segregated pairs and lone females indicated breeding pairs. Pairs or lone individuals of Northern Harriers and Ring-necked Pheasants were used to indicate breeding pairs. For colonial sexually monomorphic species (swallows [Hirundinidae]), indicated pairs were determined by dividing the total number of birds observed by two and rounding up to the nearest integer. For sexually monomorphic raptor (Accipitridae) and owl (Strigidae) species, indicated pairs were based upon observed individuals or pairs. Indicated breeding waterfowl pairs were determined according to Hammond (1969).

Upon approaching the point count station, location and identification of birds flushed from within the point count circle were estimated (flush location) and recorded. Immediately before surveying, a pre-marked flag was placed at the survey location and habitat within the point count circle was visually estimated (Table 4). Pairs were assigned to the habitat type in which they were first identified. Land management activities such as burning, grazing, or haying also were noted. Percent cloud cover within the air column over point count circle, wind velocity and direction, and temperature were estimated and recorded. Birds were surveyed for a total of five minutes, divided into three-minute and two-minute segments. Observations of birds flying overhead were excluded except for those determined to be foraging (swallows and raptors) in the air column over the point count circle. Migrant and vagrant species were not included, but at times notes were made. All nests encountered were recorded (Appendix A). Record was kept of any incidental biological observations (Appendix B).

Area Searches

In distinct habitats (Table 5), birds were surveyed using belt transects. Transects were positioned to begin 100 m from the edge of the area border and birds were surveyed 100 m on either side of the transect until the surveyor reached the end. Subsequent transects were placed 200 m away and parallel to the first transect until the entire area was surveyed. Starting and ending coordinates of each transect were marked with pink surveyor flags and GPS coordinates were collected. Survey start and stop times were recorded.

Double-observer Surveys

During the first round of surveys, a modified double-observer point count method (Nichols et al. 2000) was used. At these points two observers conducted independent point counts at the same point and time. The secondary observer kept time and announced the three-minute break in the survey period. Emphasis was placed on reducing influence from the other observer by attempting to keep them “out-of-sight” by standing back-to-back and remaining as unbiased as possible. After the point count was completed, observers compared the species and number of individuals, distances, and habitats in which birds were recorded. If the secondary observer recorded any individuals that were not detected by the primary observer, these birds were marked as the total numbers observed by the secondary observer. In some instances, detection time (within the first three minutes or last two minutes) and location of individual birds varied and were recorded differently by each observer. Discussion immediately following the survey regarding the differences helped track individual birds and their movements. As points were surveyed throughout the morning, primary and secondary observer roles were alternated. Habitat information was estimated and recorded by the primary observer.

Playback calls

Playback calls for secretive waterbirds were used at points with suitable habitat, such as cattails, other emergent vegetation, open water, or a combination of these habitats that constituted about 20% or more of the point count circle. After completion of the 5-minute point count, an audio tape consisting of 10-20 seconds of calls, alternated three times with 5 seconds of silence, for a total of 30-60 seconds of calls per species, was broadcast using a handheld tape recorder. Species calls were played in the following order: Least Bittern, Sora, Virginia Rail, American Bittern, and Pied-billed Grebe, with 30 seconds of silence between species. A one-minute listening period followed the series of calls. Recorders were held at about 1-1.5 m height, kept at maximum volume and directed towards suitable habitat for selected species. Record was kept of which species call(s) a specific individual responded to or if an individual was detected during the final one-minute listening period. Habitat use and location of each individual were estimated and recorded in 25-m intervals within the point count radius.

Survey Conditions

Surveys were conducted between one-half hour before sunrise and 1340 h. Visits to each station or area were alternated between early (before 0900 h) and late (after 0900 h) morning. No person served as the primary observer at any individual point or area twice. However, two observers surveyed the Sandhills Trees and Fantasy Island together during round one. An additional visit was made to Elm Creek with three observers on 5 June. Birds were not surveyed in winds > 24 mph (Beaufort scale 5), steady rain, or any other condition determined by the observer to hinder visual and/or aural detectability.

Results and Discussion

Point Counts

Eco-type (Tables 6,7): The maximum number of breeding pairs recorded at each point from the two surveys and densities were determined for each eco-type vegetation classification.

Of the 48 species recorded in dry mixed grass prairie, Western Meadowlark (47.1 pairs/100 ha), Grasshopper Sparrow (29.6 pairs/100 ha), and Bobolink (9.0 pairs/100 ha) were the most common species recorded.

Seventeen species were recorded in dry plains shrubland, of which the Western Meadowlark (54.6 pairs/100 ha), Lark Sparrow (20.5 pairs/100 ha), and Grasshopper Sparrow (8.0 pairs/100 ha) were most common.

The most common of the 47 species recorded in introduced grasslands were Western Meadowlark (43.4 pairs/100 ha), Red-winged Blackbird (25.3 pairs/100 ha), and Grasshopper Sparrow (23.1 pairs/100 ha).

Of the 34 species recorded in restoration areas, Western Meadowlark (46.0 pairs/100 ha), Red-winged Blackbird (33.6 pairs/100 ha), and Bobolinks (19.5 pairs/100 ha) were most common.

Red-winged Blackbird (184.0 pairs/100 ha), Common Yellowthroat (70.8 pairs/100 ha), and Yellow Warbler (42.5 pairs/100 ha) were the most common species of the 20 recorded in mesic plains shrubland.

Wet meadows had the highest species richness (66), with Red-winged Blackbird (84.0 pairs/100 ha), Marsh Wren (49.2 pairs/100 ha), and Common Yellowthroat (36.2 pairs/100 ha) being the most common.

Of the 27 species that were recorded in forested wetlands, several species were common including Red-winged Blackbird (127.4 pairs/100 ha), Northern Rough-winged Swallow (127.4 pairs/100 ha), Common Yellowthroat (106.2 pairs/100 ha), Tree Swallow (106.2 pairs/100 ha), and Willow Flycatcher (106.2 pairs/100 ha).

Wetland and grassland associated species were both recorded in provisional land use areas. Of the 65 species recorded, Red-winged Blackbird (55.2 pairs/100 ha), Cliff Swallow (37.4 pairs/100 ha), and Western Meadowlark (36.8 pairs/100 ha) were most common.

Twenty-one species were recorded in the “other” eco-type. Western Meadowlark (63.7 pairs/100 ha), Red-winged Blackbird (42.5 pairs/100 ha), Lark Sparrow (15.9 pairs/100 ha) and Common Yellowthroat (15.9 pairs/100 ha) were the most common species.

Habitat Classes: The maximum number of breeding pairs recorded at each point from the two surveys was determined for habitat classes. For discussion purposes, habitat classes were grouped into grasslands (exotic, native, Sandhills, and prairie dog towns), wetlands (wet meadow, cattail, other emergent vegetation, open water, and willow), woodlands, human-influenced habitats (structure, road, crop, and out), and other.

The Western Meadowlark, Grasshopper Sparrow, and Bobolink were the most commonly recorded species of the 50 bird species observed in grassland habitats (Table 8). Exotic grasslands had the highest species richness of the grassland habitats, with a total of 43 species observed. Of the five species observed in prairie dog colonies, Burrowing Owl and Western Meadowlark were the most common species recorded. Of the four grassland habitat types, the Lark Sparrow was most commonly recorded only in Sandhills grasslands.

Of the 65 species observed in wetland habitats, the Red-winged Blackbird, Common Yellowthroat, and Marsh Wren were the three most commonly recorded species in all wetland categories (Table 9). A slight deviation from this occurred in the willow habitat class where Yellow Warblers were more common than Marsh Wrens. However, aside from Red-winged Blackbirds, Bobolinks and Western Meadowlarks were most common in wet meadow habitats. Mallards, Cliff Swallows and Killdeers were the three most common species in open water.

The Mourning Dove, Orchard Oriole, and Yellow Warbler were the most common species in woodland habitats. A total of 41 species were observed in these habitats (Table 10).

Of the 41 species observed in human-influenced habitats, the Western Meadowlark, Red-winged Blackbird, and Ring-necked Pheasant were the most common (Table 11). Killdeer, Common Yellowthroat, and Red-winged Blackbirds were the most common species in other types of habitat (Table 12).

Area Searches

The maximum number of breeding pairs (Tables 13, 14) and densities (Table 15) were determined for the wooded areas and prairie dog colonies. Species commonly recorded in the Elm Creek riparian area were Mourning Doves (142.9 pairs/100 ha), Common Grackles (128.6 pairs/100 ha), Tree Swallows (128.6 pairs/100 ha), and House Wrens (114.3 pairs/100 ha). Scarlet Tanager and Red-eyed Vireo were species uniquely found at Elm Creek. The only red-shafted Northern Flicker observed during the survey period was recorded during the 5 June area search of Elm Creek. Two pairs of Great Horned Owls and a pair of Common Nighthawks also were noteworthy observations from this riparian area. The most common species recorded in the Sandhills Trees area were Common Grackles (98.6 pairs/100 ha), Mourning Doves (84.5 pairs/100 ha), House Wrens (70.4 pairs/100 ha), Tree Swallows (70.4 pairs/100 ha), and Yellow Warblers (70.4 pairs/100 ha). Great Crested Flycatcher and Yellow-billed Cuckoo species were observed in only the Sandhills Trees area.

Of the 14 species observed on prairie dog colonies, Western Meadowlarks, Burrowing Owls, and Common Grackles were the most common species recorded. Cowboys, the largest prairie dog colony (54.7 ha), had a high density of Common Grackles (12.8 pairs/100 ha). Burrowing Owl density in this colony was 9.1 pairs/100 ha. Of all three prairie dog towns, Big City (45.0 ha) had the highest density of Western Meadowlarks (17.8 pairs/100 ha). Burrowing Owl density was low (2.2 pairs/100 ha) in this town. One of only two indicated pairs of Swainson's Hawks observed during the survey period was recorded over Big City. The smallest colony, Fantasy Island (13.0 ha), had the highest density of Burrowing Owls (23.1 pairs/100 ha). Western Meadowlarks also were frequently recorded (15.4 pairs/100 ha) here.

A total of 94 species were recorded on the refuge. Western Meadowlarks and Red-winged Blackbirds were the most common species breeding at LaCreek NWR.

Waterbird Playback

Based on observations, playback calls seemed to elicit a response from Virginia Rails and to a lesser degree from Soras and American Bitterns. Pied-billed Grebes appeared to have little or no response to the calls. We had no record of Least Bitterns on the refuge during either the point counts or playbacks, but refuge staff observed one Least Bittern in June 2002.

Nests

A total of 58 nests were found on the refuge incidental to the surveys (Appendix A). Most common were Red-winged Blackbird, Meadowlark, and Mourning Dove nests. Due to difficulty in distinguish Eastern from Western Meadowlark nests and knowing both species were present on the refuge, nest data for the two species were grouped. One instance of brood parasitism was recorded in a Red-winged Blackbird nest with one Brown-headed Cowbird and three host eggs. Although there were no confirmed observations of Burrowing Owl young, one burrow west of Fantasy Island prairie dog town was suspected to be active during the survey period. One Red-tailed Hawk nest was observed in the Sandhills Trees area but it's fate was not determined. One possible Trumpeter Swan nest was observed during the first round of surveys, but no additional confirmations of this nest were made.

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Table 6. Counts of breeding birds according to eco-type recorded during point count surveys at LaCreek NWR from 17 May to 1 July 2002.

	Vegetative eco-type ¹									
Species	DMP	DPS	IG	RA	MPS	WM	FW	PLU	O	Total
AGWT	0	0	0	0	0	1	0	0	0	1
AMAV	0	0	0	0	0	1	0	2	0	3
AMBI	0	0	3	1	0	7	1	3	0	15
AMCO	0	0	0	0	0	0	0	2	0	2
AMCR	0	0	0	1	0	0	0	1	0	2
AMGO	4	1	2	2	0	1	1	2	0	13
AMKE	3	0	0	0	0	0	0	1	0	4
AMRO	1	0	0	1	0	3	0	5	1	11
AWPE	0	0	0	0	0	1	0	2	0	3
BANS	1	0	2	1	0	1	3	2	0	10
BARS	3	0	1	2	1	7	0	1	0	15
BCNH	0	0	0	0	0	1	0	0	0	1
BEVI	0	0	1	0	0	0	0	6	0	7
BHCO/F	3	4	4	0	1	5	1	1	2	21
BLJA	0	0	0	1	0	0	0	1	0	2
BLTE	1	0	0	1	0	1	0	3	0	6
BOBO	20	1	33	11	1	28	0	22	1	117
BRTH	1	0	1	1	0	1	1	4	0	9
BUOW	2	0	3	0	0	0	0	0	0	5
BWTE	1	0	2	3	0	12	3	6	1	28
CAGO	2	0	1	0	0	8	0	4	0	15
CEDW	0	0	0	0	2	0	0	0	0	2
CHSP	2	1	0	0	0	1	0	0	0	4
CLSW	6	0	31	1	0	10	2	57	0	107
COGR	2	0	0	0	0	3	1	1	0	7
CONI	4	1	0	0	0	1	0	1	0	7
COSN	3	0	3	0	1	4	0	1	1	13
COYE	12	1	12	1	5	75	5	40	3	154
DCCO	0	0	0	0	0	2	0	0	0	2
DICK	2	0	5	1	0	11	0	5	0	24
EABL	0	0	1	0	0	0	0	0	0	1
EAKI	7	2	12	6	0	13	2	10	2	54
EAME	11	0	21	5	2	11	0	9	1	60
EUST	0	0	0	0	0	0	1	2	0	3
FOTE	0	0	1	0	0	1	1	1	0	4
GADW	0	0	0	0	0	1	0	0	0	1
GBHE	0	0	1	0	0	1	0	2	0	4
GHOW	0	0	2	0	0	1	0	2	0	5
GRCA	0	0	0	0	1	0	0	0	0	1
GRSP	66	7	42	10	0	30	0	13	2	170
GTGR	0	0	0	0	0	0	0	1	0	1
HAWO	0	0	0	0	0	0	1	0	0	1

	Vegetative eco-type									
Species cont.	DMP	DPS	IG	RA	MPS	WM	FW	PLU	O	Total
HOLA	1	0	1	0	0	0	0	2	0	4
HOWR	0	0	1	0	0	1	3	6	0	11
KILL	3	0	3	5	0	13	2	18	0	44
LARB	4	1	9	2	0	5	0	0	1	22
LASP	12.5	18	0	0	0	2	0	0	3	35.5
LBCU	1	0	0	1	0	1	0	0	0	3
LOSH	0	0	3	0	0	1	0	1	0	5
MAGO	3	0	1	0	0	4	0	0	1	9
MALL	1	0	3	1	1	11	4	8	2	31
MAWR	3	0	8	5	2	102	0	35	2	157
MODO	7	1	7	3	1	13	3	14	0	49
NOFL	0	0	1	0	2	3	0	3	0	9
NOHA	1	1	4	1	0	7	0	3	1	18
NOPI	0	0	0	0	0	0	0	2	1	3
NRWS	5	0	13	2	2	7	6	6	0	41
NSHO	0	0	0	0	0	8	1	0	0	9
OROR	3	0	3	0	1	4	3	9	0	23
PBGR	0	0	0	0	0	2	0	2	0	4
REDH	0	0	0	1	0	0	0	0	0	1
RHWO	0	0	1	0	0	2	0	0	0	3
RPHE	3	1	9	3	2	10	0	11	0	39
RTHA	2	0	1	0	0	2	0	4	1	10
RWBL	12	1	46	19	13	174	6	84	8	363
SAVS	1	0	0	0	0	0	0	0	0	1
SEWR	0	0	0	0	0	5	1	5	0	11
SORA	0	0	0	0	0	0	0	1	0	1
SOSP	2	0	0	0	0	1	0	1	0	4
STGR	0	0	0	0	0	0	0	2	0	2
SWHA	2	0	0	0	0	0	0	0	0	2
SWSP	0	0	2	0	2	15	0	1	0	20
SWTH	0	0	0	0	0	0	0	0	0	0
TRES	5	0	9	2	1	12	5	4	0	38
TUVU	0	0	1	0	0	1	0	1	0	3
UPSA	6	1	6	3	0	2	0	3	0	21
VESP	3	3	0	0	0	0	0	1	0	7
VIRA	0	0	0	0	0	2	0	2	0	4
WAVI	0	0	0	0	0	0	0	0	0	0
WEKI	2	0	2	2	0	2	1	7	0	16
WEME	105	48	79	26	0	60	0	56	12	386
WIFL	2	0	0	0	1	3	5	2	0	13
WILL	8	0	0	1	0	3	0	3	1	16
WIPH	0	0	0	0	0	6	0	2	0	8
WITU	0	0	0	0	0	1	0	0	0	1
WODU	0	0	0	0	0	1	0	0	0	1
YBCU	0	0	0	0	0	0	0	0	0	0

	Vegetative eco-type									
Species cont.	DMP	DPS	IG	RA	MPS	WM	FW	PLU	O	Total
YSFL	0	0	2	0	0	1	1	1	0	5
YWAR	5	0	3	0	3	9	2	12	1	35
Total	359.5	93	409	130	45	759	66	558	48	2,468
Number of spp.	48	17	47	34	20	66	27	65	21	

¹ DMP=Dry mixed prairie; DPS=Dry plains shrubland; IG=Introduced grassland; RA=Restoration area; MPS=Mesic plains shrubland; WM=Wet meadow; FW=Forested wetland; PLU=Provisional land use; O=Other.

Table 7. Breeding pair densities (per 100 ha) by eco-type at LaCreek NWR from 17 May to 1 July 2002.

	Vegetative eco-type ¹								
Species	DMP	DPS	IG	RA	MPS	WM	FW	PLU	O
AGWT						0.5			
AMAV						0.5		1.3	
AMBI			1.6	1.8		3.4	21.2	2.0	
AMCO								1.3	
AMCR				1.8				0.7	
AMGO	1.8	1.1	1.1	3.5		0.5	21.2	1.3	
AMKE	1.3							0.7	
AMRO	0.4			1.8		1.4		3.3	5.3
AWPE						0.5		1.3	
BANS	0.4		1.1	1.8		0.5	63.7	1.3	
BARS	1.3		0.5	3.5	14.2	3.4		0.7	
BCNH						0.5			
BEVI			0.5					3.9	
BHCO/F	1.3	4.5	2.2		14.2	2.4	21.2	0.7	10.6
BLJA				1.8				0.7	
BLTE	0.4			1.8		0.5		2.0	
BOBO	9.0	1.1	18.1	19.5	14.2	13.5		14.4	5.3
BRTH	0.4		0.5	1.8		0.5	21.2	2.6	
BUOW	0.9		1.6						
BWTE	0.4		1.1	5.3		5.8	63.7	3.9	5.3
CAGO	0.9		0.5			3.9		2.6	
CEDW					28.3				
CHSP	0.9	1.1				0.5			
CLSW	2.7		17.0	1.8		4.8	42.5	37.4	
COGR	0.9					1.4	21.2	0.7	
CONI	1.8	1.1				0.5		0.7	
COSN	1.3		1.6		14.2	1.9		0.7	5.3
COYE	5.4	1.1	6.6	1.8	70.8	36.2	106.2	26.3	15.9
DCCO						1.0			
DICK	0.9		2.7	1.8		5.3		3.3	
EABL			0.5						
EAKI	3.1	2.3	6.6	10.6		6.3	42.5	6.6	10.6
EAME	4.9		11.5	8.8	28.3	5.3		5.9	5.3
EUST							21.2	1.3	
FOTE			0.5			0.5	21.2	0.7	
GADW						0.5			
GBHE			0.5			0.5		1.3	
GHOW			1.1			0.5		1.3	
GRCA					14.2				
GRSP	29.6	8.0	23.1	17.7		14.5		8.5	10.6
GTGR								0.7	

	Vegetative eco-type								
Species cont.	DMP	DPS	IG	RA	MPS	WM	FW	PLU	O
HOLA	0.4		0.5					1.3	
HOWR			0.5			0.5	63.7	3.9	
KILL	1.3		1.6	8.8		6.3	42.5	11.8	
LARB	1.8	1.1	4.9	3.5		2.4			5.3
LASP	5.6	20.5				1.0			15.9
LBCU	0.4			1.8		0.5			
LOSH			1.6			0.5		0.7	
MAGO	1.3		0.5			1.9			5.3
MALL	0.4		1.6	1.8	14.2	5.3	84.9	5.3	10.6
MAWR	1.3		4.4	8.8	28.3	49.2		23.0	10.6
MODO	3.1	1.1	3.8	5.3	14.2	6.3	63.7	9.2	
NOFL			0.5		28.3	1.4		2.0	
NOHA	0.4	1.1	2.2	1.8		3.4		2.0	5.3
NOPI								1.3	5.3
NRWS	2.2		7.1	3.5	28.3	3.4	127.4	3.9	
NSHO						3.9	21.2		
OROR	1.3		1.6		14.2	1.9	63.7	5.9	
PBGR						1.0		1.3	
REDH				1.8					
RHWO			0.5			1.0			
RPHE	1.3	1.1	4.9	5.3	28.3	4.8		7.2	
RTHA	0.9		0.5			1.0		2.6	5.3
RWBL	5.4	1.1	25.3	33.6	184.0	84.0	127.4	55.2	42.5
SAVS	0.4								
SEWR						2.4	21.2	3.3	
SORA								0.7	
SOSP	0.9					0.5		0.7	
STGR								1.3	
SWHA	0.9								
SWSP			1.1		28.3	7.2		0.7	
SWTH									
TRES	2.2		4.9	3.5	14.2	5.8	106.2	2.6	
TUVU			0.5			0.5		0.7	
UPSA	2.7	1.1	3.3	5.3		1.0		2.0	
VESP	1.3	3.4						0.7	
VIRA						1.0		1.3	
WEKI	0.9		1.1	3.5		1.0	21.2	4.6	
WEME	47.1	54.6	43.4	46.0		29.0		36.8	63.7
WIFL	0.9				14.2	1.4	106.2	1.3	
WILL	3.6			1.8		1.4		2.0	5.3
WIPH						2.9		1.3	
WITU						0.5			
WODU						0.5			
YHBL			3.8	7.1		9.7		21.7	

	Vegetative eco-type								
Species cont.	DMP	DPS	IG	RA	MPS	WM	FW	PLU	O
YSFL			1.1			0.5	21.2	0.7	
YWAR	2.2		1.6		42.5	4.3	42.5	7.9	5.3

¹ DMP=Dry mixed prairie; DPS=Dry plains shrubland; IG=Introduced grassland;
RA=Restoration area; MPS=Mesic plains shrubland; WM=Wet meadow;
FW=Forested wetland; PLU =Provisional land use; O=Other.

Table 8. Counts of breeding birds recorded during point count surveys in grassland habitats at LaCreek NWR from 17 May to 1 July 2002.

	Grassland Habitat Type				
Species	Native Grass	Exotic Grass	Sandhills Grass	Prairie Dog Colony	Total
AMBI	0	1	0	0	1
AMGO	0	3	3	0	6
AMKE	0	0	1	0	1
AMRO	0.5	3	0.5	0	4
BANS	0	5	0	0	5
BARS	0	7	1	1	9
BHCO/F	0	5	6	0	11
BHCO/M	3	19	25	0	47
BLTE	0	3	0	0	3
BOBO	9	90.5	1	0	100.5
BRTH	0	1	0	0	1
BUOW	0	1	0	8	9
BWTE	0	1	0	0	1
CAGO	0	4	0	0	4
CHSP	0	0	3	0	3
CLSW	6	42	3	0	51
COGR	0	3	0	0	3
CONI	0	2	2	0	4
COSN	0	2	0	0	2
COYE	0	7	1	0	8
DICK	1.5	20.5	0	0	22
EAKI	1	19.5	2.5	0	23
EAME	1	46.5	0	0	47.5
GHOW	0	1	0	0	1
GRSP	37	90	29	0	156
HOLA	5	0	1	0	6
KILL	0	9	0	0	9

	Grassland Habitat Type				
Species cont.	Native Grass	Exotic Grass	Sandhills Grass	Prairie Dog Colony	Total
LARB	3	8	2.5	0	13.5
LASP	0	1	29	0	30
LBCU	2	0	0	0	2
LOSH	0	1	0	0	1
MAGO	0	2	0	0	2
MALL	0	2	0	0	2
MODO	1	4.5	5.5	0	11
NOHA	0	6	1	2	9
NRWS	0	16	0	0	16
OROR	0	2	1	0	3
RPHE	2	12	1	0	15
RTHA	0	4	0	0	4
RWBL	6	37	3	0	46
SAVS	0	0	1	0	1
SOSP	0	0	2	0	2
TRES	1	17	1	0	19
TUVU	0	2	0	0	2
UPSA	5	7	3	0	15
VESP	0	0	5	0	5
WEKI	0	4	1.5	0	5.5
WEME	16	162.5	91	8	277.5
WILL	0	2	0	0	2
YHBL	0	3	0	1	4
YSFL	0	1	0	0	1
Total	100	680	226.5	20	1,026.5
Number of spp.	17	43	27	5	50

Table 9. Counts of indicated breeding bird pairs recorded during point count surveys in wetland habitats at LaCreek NWR from 17 May to 1 July 2002.

	Wetland Habitat Type					
Species	Wet Meadow	Cattail	Other Emergent Vegetation	Open Water	Willow	Total
AGWT	0	0	0	1	0	1
AMAV	0	2	0	2	0	4
AMBI	1	15	4	1	0	21
AMCO	0	0	0	2	0	2
AMRO	0	0	0	0	8	8
AWPE	0	0	0	3	0	3
BARS	0	1	0	1	0	2
BANS	3	1	0	0	1	5
BCNH	0	0	0	2	0	2
BHCO/F	4	0	0	0	3	7
BHCO/M	4.5	6	3	0	15	28.5
BLTE	1	0	0	5	0	6
BOBO	16	0	2	0	2	20
BWTE	7	3	0	11	0	21
CAGO	1	5	0	5	0	11
CEDW	0	0	0	0	1	1
CLSW	7	3	5	17	0	32
CHSP	0	0	0	0	1	1
COGR	4	1	0	1	1	7
COSN	3	5	4	0	0	12
COYE	13	91	28	4	21	157
DCCO	0	0	0	2	0	2
DICK	1	1	0	0	0	2
EAKI	3	0	5	0	6	14
EAME	8	1	6	0	2	17
FOTE	0	1	0	3	0	4
GADW	0	0	0	1	0	1
GBHE	1	1	0	4	0	6
GRCA	0	0	0	0	2	2
GRSP	6	0	0	0	1	7
GTGR	0	0	0	0	1	1

HAWR	0	0	0	0	5	5
	Wetland Habitat Type					
Species cont.	Wet Meadow	Cattail	Other Emergent Vegetation	Open Water	Willow	Total
KILL	3	7	4	15	0	29
MAGO	0	2	0	1	0	3
MALL	4	6	1	23	0	34
MAWR	3	97	36	0	5	141
MODO	2	0	1	0	10	13
NOFL	0	0	0	0	3	3
NOHA	1	5	1	0	1	8
NOPI	0	1	0	1	0	2
NRWS	13	2	0	3	1	19
NSHO	1	1	0	8	0	10
OROR	0	0	0	0	3	3
PBGR	0	0	0	4	0	4
REDH	1	0	0	0	0	1
RPHE	5	4	7	0	1	17
RTHA	1	0	0	0	0	1
RWBL	32.5	200	43	0	52.5	328
SEWR	1	10	0	0	0	11
SORA	0	1	0	0	0	1
SOSP	0	0	0	0	3	3
SWSP	0	19	4	0	1	24
TRES	5	2	2	2	3	14
TUVU	0	0	0	0	1	1
UPSA	2	0.5	0	0	0	2.5
VESP	0	0	0	0	1	1
VIRA	0	4	0	0	0	4
WEKI	2	1	0	0	0	3
WEME	17	1	0	0	5	23
WFIB	0	0	0	1	0	1
WIFL	0	0	0	0	5	5
WILL	1	7	0	1	3	12

WIPH	5	2	1	5	0	13
WODU	0	0	0	1	0	1
YHBL	1	46	9	0	4	60
YWAR	0	1	2	0	11	14
Total	184	556.5	168	130	183.5	1,222
Number of spp.	35	37	20	29	32	65

Table 10. Counts of breeding bird pairs recorded during point count surveys in woodland habitats at LaCreek NWR from 17 May to 1 July 2002.

	Habitat
Species	Woodland
AMCR	1
AMGO	4
AMKE	1
AMRO	7
BARS	1
BEVI	8
BHCO/F	3
BHCO/M	15
BLJA	2
BRTH	7
CLSW	1
COGR	3
CONI	1
COYE	3
EABL	1
EAKI	12.5
EAME	2
EUST	3
GHOW	3
HAWO	1
HOWR	10
LASP	1
LOSH	6

	Habitat
Species cont.	Woodland
MAWR	0
MODO	21
NOFL	6
NRWS	1
OROR	20
RHWO	3
RPHE	1
RTHA	2
RWBL	15
SWHA	1
SWSP	0
TRES	6
WEKI	7
WEME	15
WIFL	3
WILL	0
YHBL	5
YSFL	3
YWAR	18
Total	223.5
Number of spp.	41

Table 11. Counts of breeding bird pairs recorded during point count surveys in human-influenced habitats at LaCreek NWR from 17 May to 1 July 2002.

	Human-influenced Habitat Type						Human-influenced Habitat Type				
Species	Structures	Road	Crop	Out	Total	Species cont.	Structures	Road	Crop	Out	Total
AMGO	0	0	0	2	2	MODO	0	2	0	2.5	4.5
AMRO	0	0	0	0.5	0.5	NOHA	0	0	0	1	1
AMKE	0	0	0	2	2	NOPI	0	0	0	1	1
BARS	0	0	0	4	4	NRWS	0	0	0	1	1
BEVI	0	0	0	1	1	NSHO	0	0	0	2	2
BHCO/F	0	0	0	3	3	RHOWO	0	0	0	1	1
BHCO/M	0	2	2	9.5	13.5	RPHE	0	1	2	8	11
BOBO	0	0	1	9	10	RTHA	0	0	0	2	2
BWTE	0	0	0	5	5	RWBL	0	1	3	21.5	25.5
CLSW	2	1	0	2	5	STGR	0	0	2	0	2
COSN	0	0	0	2	2	UPSA	0	0	1	5	6
COYE	0	0	4	0	4	VESP	0	0	0	1	1
DICK	0	0	0	5.5	5.5	WEKI	0	0	0	2.5	2.5
EAKI	0	0	0	8.5	8.5	WEME	0	2	7	37	46
EAME	0	0	0	2.5	2.5	WILL	0	0	0	1	1
GRSP	0	0	0	2.5	2.5	WIPH	0	0	0	1	1
HOLA	0	0	1	2	3	WITU	0	0	0	0.5	0.5
KILL	0	1	2	1	4	YHBL	0	0	1	5.5	6.5
LARB	0	0	0	5	5	YWAR	0	0	0	2	2
LASP	0	0	0	4	4	Total	2	10	26	171	208.5
LBCU	0	0	0	1	1	Number of spp.	1	7	11	39	41
MALL	0	0	0	1	1						
MAGO	0	0	0	2	2						

Table 12. Counts of breeding bird pairs recorded during point count surveys in Other habitats at LaCreek NWR from 17 May to 1 July 2002.

	Habitat type		Habitat type
Species	Other ¹	Species	Other ¹
AMAV	2	MODO	3
BLTE	3	RPHE	2
BOBO	2	RWBL	6
BWTE	1	TRES	1
CLSW	5	WEKI	2
COYE	10	VIRA	2
EAKI	1	WEME	5
FOTE	1	WILL	1
GBHE	1	WIPH	2
GRSP	1	YHBL	5
KILL	10	Total	67
MAWR	1	Number of spp.	22

¹ Exposed soil such as mudflats, excavated holes or bare cultivated soil. This includes four points that contained dense sweet clover, three points with miscellaneous wooden structures (windmills or large posts), and one point each containing a set of bee boxes, a large pipe, and a group of old cars.

Table 13. Counts of breeding bird pairs recorded during area searches of wooded habitats at LaCreek NWR from 17 May to 1 July 2002.

	Wooded Habitat		
Species	Elm Creek	Sandhills Trees	Total
AMBI	0	1	1
AMGO	2	1	3
AMKE	3	1	4
AMRO	6	0	6
BHCO	4	1	5
BAOR	1	0	1
BLJA	1	0	1
BWTE	1	0	1
COGR	9	7	16
CONI	1	0	1
COSN	3	1	4
COYE	7	0	7
DOWO	2	0	2
EAKI	7	4	11
EUST	6	3	9
GCFL	0	2	2
GHOW	2	0	2
HAWO	2	5	7
HOWR	8	0	8
KILL	2	0	2

	Wooded Habitat		
Species	Elm Creek	Sandhills Trees	Total
MALL	4	0	4
MODO	10	6	16
NOFL	5	2	7
OROR	5	5	10
RHWO	6	3	9
REVI	1	0	1
RPHE	0	1	1
RSFL	1	0	1
RWBL	7	1	8
SCTA	1	0	1
SWTH	1	0	1
TRES	9	5	14
WAVI	0	1	1
WEKI	2	3	5
WEME	1	0	1
WIFL	1	0	1
WITU	2	0	2
YBCU	0	1	1
YSFL	1	0	1
YWAR	7	5	12
Total	131	59	190
Number of spp.	33	21	56

Table 14. Counts of breeding bird pairs recorded during area searches of prairie dog colonies at LaCreek NWR from 17 May to 1 July 2002.

	Prairie Dog Colony			
Species	Cowboys	Big City	Fantasy Island	Total
AMRO	1	0	0	1
BARS	2	0	1	3
BOBO	1	2	0	3
BUOW	5	1	3	9
CLSW	2	0	0	2
COGR	7	0	0	7
GRSP	0	1	0	1
KILL	0	1	1	2

	Prairie Dog Colony			
Species cont.	Cowboys	Big City	Fantasy Island	Total
LARB	0	2	0	2
MODO	2	0	0	2
RTHA	1	1	0	2
SWHA	0	1	0	1
WEKI	0	1	1	2
WEME	4	8	2	14
Total	25	18	8	51
Number of spp.	9	9	6	14

Table 15. Breeding pair densities (per 100 ha) of species found in area searches at LaCreek NWR from 17 May to 1 July 2002.

	Wooded Habitats		Prairie Dog Colonies		
Species	Elm Creek	Sandhills Trees	Cowboys	Big City	Fantasy Island
AMBI	0	14.1	0	0	0
AMGO	28.6	14.1	0	0	0
AMKE	42.9	14.1	0	0	0
AMRO	85.7	0	1.8	0	0
BARS	0	0	3.7	0	7.7
BHCO	57.1	14.1	0	0	0
BAOR	14.3	0	0	0	0
BLJA	14.3	0	0	0	0
BOBO	0	0	1.8	4.4	0
BUOW	0	0	9.1	2.2	23.1
BWTE	14.3	0	0	0	0
CLSW	0	0	3.7	0	0
COGR	128.6	98.6	12.8	0	0
CONI	14.3	0	0	0	0
COSN	42.9	14.1	0	0	0
COYE	100.0	0	0	0	0
DOWO	28.6	0	0	0	0
EAKI	100.0	56.3	0	0	0
EUST	85.7	42.3	0	0	0
GCFL	0	28.2	0	0	0
GHOW	28.6	0	0	0	0
GRSP	0	0	0	2.2	0
HAWO	28.6	0	0	0	0
HOWR	114.3	70.4	0	0	0
KILL	28.6	0	0	2.2	7.7

	Wooded Habitats		Prairie Dog Colonies		
Species cont.	Elm Creek	Sandhills Trees	Cowboys	Big City	Fantasy Island
LARB	0	0	0	4.4	0
LOSH	0	0	0	0	0
MALL	57.1	0	0	0	0
MODO	142.9	84.5	3.7	0	0
NOFL	100.0	28.2	0	0	0
OROR	71.4	70.4	0	0	0
RHOW	85.7	42.3	0	0	0
REVI	14.3	0	0	0	0
RPHE	0	14.1	0	0	0
RSFL	14.3	0	0	0	0
RTHA	0	0	1.8	2.2	0
RWBL	100.0	14.1	0	0	0
SCTA	14.3	0	0	0	0
SWHA	0	0	0	2.2	0
SWTH	14.3	0	0	0	0
TRES	128.6	70.4	0	0	0
WAVI	0	14.1	0	0	0
WEKI	28.6	42.3	0	2.2	7.7
WEME	14.3	0	7.3	17.8	15.4
WIFL	14.3	0	0	0	0
WITU	28.6	0	0	0	0
YBCU	0	14.1	0	0	0
YSFL	14.3	0	0	0	0
YWAR	100.0	70.4	0	0	0

Appendix A. Species, number, and status of nests when found at LaCreek NWR between 17 May and 1 July 2002.

	Nest Status					
Species	building	with eggs	nestling	depredated	unknown	Total
AMBI	0	1	0	0	0	1
AMKE	0	0	0	0	1	1
BWTE	0	1	0	0	0	1
CAGO	0	1	1	0	0	2
COSN	0	3	0	0	0	3
EABL	0	0	1	0	0	1
EAKI	1	0	0	0	0	1
GRSP	0	2	0	0	0	2
HOWR	1	0	0	0	0	1
MALL	0	2	0	0	0	2
MAWR	0	0	0	0	4	4
MODO	1	4	0	1	2	8
RHWO	0	0	0	0	1	1
RTHA	0	0	0	0	1	1
RWBL	3	3	1	1	2	10
TRES	1	1	2	0	2	6
TRUS	0	0	0	0	1	1
VIRA	0	0	0	0	1	1
WEME/EAME	0	6	1	1	1	9
YHBL	0	1	0	0	0	1
YWAR	0	0	0	0	1	1
Total						58

Appendix B. Record of incidental biological observations at LaCreek NWR, 6 May-8 July 2002.
Some information included in this appendix also may have been recorded in the point count data. Reference to point numbers under "Location" gives general locations.

Observation	Date	Location	Notes and Comments
WFIB	05/07/2002	Near pool 6	Flock of 7-10
BLPW	05/12/2002	Bird walk	Small flock
Western box turtle	05/12/2002	pt. 81, near Jay's house	Found in wet meadow
2 TRUS	05/24/2002	S of pt. 48	1-green neck band, 2-no neck band; possible green leg band on R leg of 1
11 STSA	05/24/2002	Pt. 89; Elm Creek	Flocked with WIPH
2 TRUS	05/25/2002	SW part of pool 7	1 with green neck band
GOEA	05/25/2002	Near pool 1	Solitary individual perched in snag
1 WFIB	05/27/2002	Pt. 353	Flushed from cattails
INBU	05/29/2002	pt. 77, near shelterbelt	One individual
1 CONI	05/30/2002	Near pt. 273, E of pool 10	Perched in black locust tree
LEYE	06/02/2002	S of pool 8	Only 1 leg
EAKI nest	06/04/2002	Near pt. 273, E of pool 10	Female bringing nest material, almost complete. Female still sitting 6/27.
CONI	06/05/2002	Elm Creek	2 pairs flying
SCTA	06/05/2002	Elm Creek	One male
REVI	06/05/2002	Elm Creek	One male
AMAV nest	06/05/2002	S of pool 8	Female sitting on nesting material
SWTH	06/05/2002	Elm Creek	Did not sing
BBPL	06/05/2002	E of pool 8	2+ feeding on mudflats
White-tailed deer fawn	06/05/2002	Elm Creek	Sleeping near base of tree
Mink	06/05/2002	Near pools 7 & 4	Ran across auto trail road
Short-tailed weasel	06/05/2002	Quarters 2	Ran into burrow in bunkhouse yard
3 coyote pups	06/06/2002	Pt. 118, in Sandhills	Playing alone without adult
EABL and 4 fledglings	06/07/2002	Pt. 47	Near beehives, adults protecting fledglings
2 mice	06/19/2002	pt. 17	Under styrofoam square
LBCU pair, possible young	06/19/2002	pt. 17	Parents were calling, diving, and circling me
2 SEOW	06/19/2002	Pt. 124	One consuming snake
LOSH with fledglings	06/19/2002	Quarters 2	2 chicks growing adult plumage, in tree and on ground with adult nearby.
BAEA	06/19/2002	N on refuge border	Sitting on telephone pole
13 lined ground squirrel	06/20/2002	Quarters 2	
White-tailed Jackrabbit	06/20/2002	Pt. 38	Possibly a jackalope:)
LBCU sub adults	06/25/2002	Pt. 198	
Coyote pup	06/25/2002	Pt. 192	Near den, no adults, possibly 1 month
SEOW	06/26/2002	Pt. 296	Flushed from ground, circled overhead.
VIRA adult with 2 chicks	06/26/2002	Pt. 53	Crossed 2-track calling
5 SNEG	06/26/2002	Pt. 319	Flew over when approaching point
3 VIRA chicks	06/26/2002	Pt. 61	Young chicks with down
2 VIRA chicks	06/26/2002	Pool 9 loop road	Flushed, flew to cover while calling
COYE	06/26/2002	Pt. 359	Male and female with insects in beak, chipping while in area.
SWSP	06/26/2002	Pt. 359	Male and female with insects in beak, chipping while in area.

Appendix B-cont.

Observation	Date	Location	Notes and Comments
NOHA display	06/26/2002	Pt. 360	Male caught small mammal, dropped it to female during flight.
MALL and 7 ducklings	06/26/2002	Pt. 361	Swimming in small creek
HOME	06/27/2002	E side of Pelican Island	Single female
		loop road	
GTGR	06/27/2002	Pt. 279	Male "clanking" in willow near water edge
CEDW	06/27/2002	Little White River Rec. Area	Male and female with nesting material
GREG	06/27/2002	Little White River Rec. Area	In water
Coyote pup	07/01/2002	Pt. 92	Pup ran into cattail
BWTE and ducklings	07/01/2002	Near Pelican Island	Crossing road
GHOW	07/02/2002	Quarters 2	Family group of 4; 2 downy young
KILL with young	mid-late May	Trout ponds	Adult performed broken-wing display
1 pair LBCU-with young	NR	N of refuge border-cropland	
1 TRUS	NR		Without neck band
BEVI	see survey data	refuge headquarters	North of bunkhouse in shelterbelt
SWSP	see survey data		First seen in pools 1 & 7, also in pools 6 & 9

Appendix C. GPS coordinates of point count stations at LaCreek NWR (UTM, NAD27).

<u>Point #</u>	<u>Easting</u>	<u>Northing</u>	<u>Point #</u>	<u>Easting</u>	<u>Northing</u>	<u>Point #</u>	<u>Easting</u>	<u>Northing</u>
1	286809	4773471	53	293559	4773921	114	283659	4770771
2	286809	4773921	54	291309	4773471	115	283659	4771221
3	285009	4770771	55	291309	4773921	116	284559	4772571
4	285459	4770771	56	290409	4773471	117	284559	4773021
5	285459	4773471	57	290409	4773921	118	281409	4772121
6	285459	4773909	58	292209	4773471	119	281409	4770826
7	285009	4771221	60	295359	4780221	120	280959	4770846
8	285459	4771221	61	294009	4773921	121	283209	4773021
9	295359	4776621	62	294009	4777971	122	283659	4773021
10	291759	4777071	63	294459	4777971	123	284109	4773021
11	287259	4773471	64	290417	4774371	124	284559	4770771
12	287259	4773921	65	290859	4774371	125	284559	4771221
13	285009	4772571	66	290409	4774821	126	295359	4775721
14	285459	4772571	67	290859	4774821	127	295349	4775271
15	292209	4776621	68	290409	4775271	128	283659	4772571
16	292659	4776621	69	290859	4775271	129	284109	4772571
17	285009	4775271	70	293109	4773471	130	281859	4771221
18	285459	4775271	71	293109	4773921	131	281859	4771671
19	285009	4772121	74	294909	4780221	132	293539	4774821
20	285459	4772121	75	290859	4773921	133	283209	4770771
21	286359	4773471	77	292659	4779771	134	294459	4774821
22	286359	4773921	78	290409	4772133	135	292659	4774821
23	285009	4771671	79	288159	4773471	136	291759	4776171
24	285459	4771671	80	288159	4773921	137	282759	4773021
25	292209	4776171	84	295359	4777521	138	295359	4777971
26	292659	4776171	85	291759	4773471	139	282742	4772571
27	292209	4777521	86	291740	4773921	140	294009	4774821
28	292659	4777521	87	289959	4773471	141	284109	4772121
29	285009	4773471	88	289959	4773921	142	284559	4772121
30	283209	4773471	89	290410	4772581	143	284102	4773471
31	283209	4773921	90	290409	4773021	144	283209	4771671
33	293109	4776171	91	290859	4773021	145	283659	4771671
34	292659	4782921	92	294009	4778421	146	280059	4771671
35	291309	4774821	94	292659	4778421	147	293109	4774821
36	284109	4773921	95	292659	4778871	148	280059	4772121
37	285009	4774821	96	293559	4778421	149	284109	4771671
38	285459	4774821	98	293109	4778421	150	284559	4771671
39	283659	4773471	99	293086	4778871	151	280509	4771671
40	283659	4773921	100	294459	4778421	152	280959	4771671
41	292209	4777071	101	294459	4778871	153	280059	4771221
43	285909	4773921	104	295359	4778421	154	280509	4771221
44	285009	4773021	105	295359	4778871	155	281409	4771671
45	285459	4773021	106	294909	4778421	156	282309	4771221
46	282759	4773471	107	294909	4778871	158	284109	4771221
47	282759	4773921	108	291309	4774371	159	282759	4771221
48	288609	4773471	109	291759	4774371	160	283209	4772571
49	288609	4773921	110	280509	4772121	161	280959	4771221
50	292659	4773471	111	280959	4772121	162	281409	4771221
51	292659	4773921	112	282309	4772121	163	280509	4770862
52	293559	4773471	113	282759	4772121	164	280077	4770879

Appendix C-continued

<u>Point #</u>	<u>Easting</u>	<u>Northing</u>	<u>Point #</u>	<u>Easting</u>	<u>Northing</u>	<u>Point #</u>	<u>Easting</u>	<u>Northing</u>
165	282309	4771671	226	288609	4770771	282	289059	4772187
166	292209	4774821	227	285909	4772121	283	289959	4772156
167	294909	4776171	228	286359	4772121	285	285909	4772571
169	282759	4771671	229	286359	4771221	286	287709	4769004
170	282759	4770789	230	286809	4772121	287	293559	4774371
171	282309	4770799	231	286809	4772571	288	286359	4772571
172	294908	4775259	233	287709	4769421	289	295359	4780671
173	294459	4775721	234	288159	4768985	290	294909	4780671
174	284109	4770771	235	288159	4769421	291	291309	4773021
175	294459	4776171	236	294459	4774400	292	294459	4780671
176	294909	4774821	237	287259	4769871	293	291759	4773021
177	283209	4771221	238	292659	4779321	294	293559	4780671
178	281859	4772121	239	286809	4771221	296	293109	4780671
179	293109	4782921	240	287709	4772121	297	292659	4780671
180	283659	4772121	241	294009	4777071	298	293109	4774371
181	283209	4772121	243	287259	4770771	299	293109	4779771
182	294909	4775721	244	295359	4781121	301	292659	4780221
183	281859	4770811	245	292659	4781121	302	295359	4776171
184	289509	4769871	246	287709	4770771	303	293109	4780221
186	287259	4772571	247	294009	4774371	304	295359	4779755
187	287259	4773021	248	293109	4781121	305	294009	4776171
188	289509	4772571	249	287259	4770321	306	288159	4775271
189	289959	4772571	250	288159	4770321	307	294459	4777071
190	287259	4771221	251	285909	4771671	308	288609	4775271
191	287709	4771221	252	287709	4770321	309	292209	4777971
192	288159	4769871	253	289059	4770321	310	289059	4775271
193	288609	4769871	254	289509	4770321	311	292659	4777971
194	288159	4771221	255	286359	4771671	312	289509	4775271
195	288159	4771671	256	287259	4772121	313	293109	4777971
196	288609	4769421	257	286809	4771671	314	289959	4775271
198	288609	4771221	258	289059	4770771	315	293559	4777971
199	288609	4771671	260	287709	4769871	316	286809	4774371
200	289059	4771221	262	288609	4772121	317	287259	4774371
201	294909	4781121	263	288159	4772121	318	293559	4779771
202	289509	4771221	264	288159	4772571	319	294909	4774385
205	286359	4773021	265	288609	4772571	320	295350	4774380
206	286809	4773021	266	287709	4771671	321	291759	4777521
208	289059	4769871	268	289509	4770771	322	288159	4774371
209	293109	4779321	269	289059	4772571	323	288159	4774821
210	287259	4769421	270	289959	4770771	326	288609	4774371
212	294459	4777521	271	294459	4781121	327	288609	4774821
213	288159	4773021	272	288609	4770321	328	289037	4774380
214	288609	4773021	273	294909	4779321	329	289059	4774821
217	285909	4770771	274	288609	4768969	330	291759	4777971
220	285909	4771221	275	290409	4770771	331	289509	4774371
221	287259	4771671	276	287259	4769027	332	289509	4774821
222	295359	4774821	277	295359	4779321	333	289959	4774371
223	291759	4774821	279	294009	4781121	334	289959	4774821
224	286359	4770771	280	293559	4781121	336	291759	4776621
225	288159	4770771	281	289509	4772170	337	286359	4774371

Appendix C-continued

<u>Point #</u>	<u>Easting</u>	<u>Northing</u>
338	294909	4776621
339	285909	4774821
340	294459	4776621
341	286359	4774821
342	286809	4774821
343	287259	4774821
344	294909	4777071
345	295359	4777071
346	292659	4774371
347	285909	4775271
348	286359	4775271
349	286809	4775271
350	287259	4775271
351	291309	4775271
352	294909	4777971
353	291759	4775271
354	291759	4775721
355	292209	4775271
356	292209	4775721
357	292659	4775271
358	292659	4775721
359	293109	4775271
360	293109	4775721
361	293552	4775271
363	294009	4775271
364	294009	4775721
365	294459	4775271