Appendix B

Post-breeding Use Study Site Descriptions

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Introduction

In this section we provide descriptions of all sites which were part of the post-breeding observational study. Each site is made up of a combination of disturbed and undisturbed plots.

The disturbed plots include portions of the gravel pads, areas of thin gravel or gravel spray, and reserve pits. For disturbed plots, descriptions include plot size, gravel thickness, extent of thermokarsting, and presence or absence of vegetation and water. Where more than one gravel plot is present at a particular site, the extent and type of vegetative cover is compared among plots. Plant species were identified on plots with vegetation (Table B-1).

For undisturbed plots, the vegetation and landform are described (after Walker et al. 1983, see Appendix D).

Maps of the study sites are included in the site descriptions. These maps are provided to show the spatial relationships among plots.

Term Well C Observational Plots

Gravel Plot

The gravel pad at Term Well C is approximately 150 m x 65 m (Fig. B-1). This is a thick pad and gravel depth is over 2 m in most places. Virtually no vegetation is growing on the pad and no thermokarsting has occurred. We staked a 75 m x 40 m study plot with short pieces of wooden lath on the main portion of the pad immediately north of the reserve pit. This plot included the well head, which consists of a "christmas tree" surrounded by steel railing.

Reserve Pit Plot

The reserve pit plot has the same dimensions as the gravel plot. It includes the water in the pit and the mud bank below the base of the berm surrounding the pit. The reserve pit and the berm (see below) were scanned during the same three-min periods.

Table B-1. Checklist of vascular plant taxa found on study plots with vegetation at disturbed gravel sites, Prudhoe Bay, Alaska, 1990.

Species	Term Well C	Storage Pad		Lake State 1			Lake State 2
	Berm	"Wet" Thermokarsted	"Dry" Thermokarsted	Natural Spray	"Road"	Unseeded	Unseeded
Graminoids							
Agropyron spp.	x						
Alopecurus alpinus	x	x		x			
Arctogrostis latifolia	x	x	x	x	x		x
Carex aquatilis		x	x	x	x		
Carex Biglowii		x					
Carex capitata					x		
Deschampsia caespitosa	x	x	x	x	x		
Dupontia fischeri				x			
Eriophorum angustifolium	x	x	x	x	x		
Eriophorum russeolum				x			
Festuca baffinensis	x	x	x	x	x		x
Festuca vivipara		x	x	x	x		
Juncus arcticus		x	x	x	x		
Juncus castaneus				x	x		
Poa glauca	x						
Puccinellia borealis	x						
Tricetum spicatum	x			x	x		
Forbs							
Artemesia alaskana		x					
Artemesia glomerata		x	x				
Cerastrium Beeringianum	x	x	x	x	x		x
Chrysanthemum integrifolium			x				
Draba cinerea				x		x	
Draba lanceolata					x	x	
Draba spp.		x	x			x	x
Epilobium latifolium		x	x		x	x	x
Melandrium apelatum		x	x				
Minuartia rubella		x	x				x
Papaver lapponicum		x	x				x
Sagina intermedia				x	x	x	x
Saxifraga hirculus		x	x		x		
Saxifraga oppositifolia		x	x				
Shrubs							
Dryas integrifolia		x	x				
Salix arctica		x	x	x	x		
Salix spp.				x	x		x

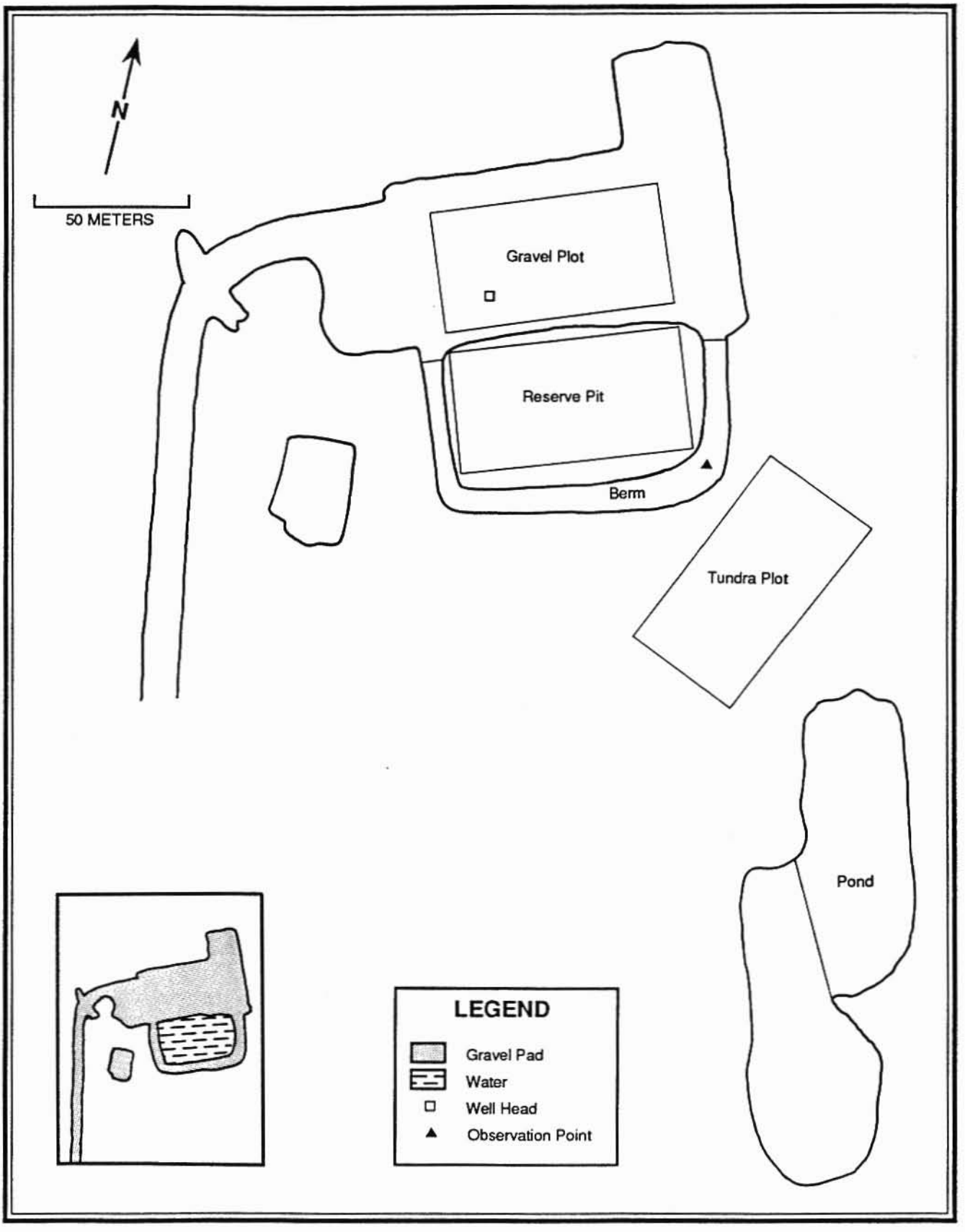

Fig. B-1. Location of disturbed and undisturbed study plots for observational study at Term Well C, Prudhoe Bay, Alaska, 1990. Inset shows types of gravel disturbances.

Berm

The berm is composed of a mixture of gravel and overburden, and it surrounds the reserve pit on the east, west, and south sides. The surface area is approximately 48 percent that of the other plots at this site. Portions of the berm are well vegetated, particularly the outside banks, which have less gravel; vegetation is also scattered on the top where gravel is mixed with overburden. Most of the vegetation is composed of graminoids (Table B-1).

Most of the berm (the top surface, the inside bank, and most of the outside bank) could be seen well from the blind. None of the outside bank on the west side could be observed, and observations were sometimes obscured by the vegetation on the southern bank.

Tundra Plot

The tundra plot is the same size as the gravel and reserve pit plots, and is located southeast of the reserve pit. The vegetation type is moist and wet graminoid tundra; the landform is primarily strangmoor. The tundra plot and the pond (see below) were scanned during the same three-min periods.

Pond Plot

The pond plot consists of a portion of a natural pond lying southeast of the tundra plot. It is similar in size to the gravel, reserve pit, and tundra plots. Water had receded, and a mud bank on the eastern pond edge was exposed. The entire pond could be seen well from the blind except for the water's edge in the northwest portion which was blocked by tundra vegetation.

Observer's Station

The blind was located on the berm above the southeast corner of the reserve pit.

Storage Pad Observational Plots

We set up two study plots on the gravel pad at this site (Fig. B-2). Gravel thickness over most of the pad is about 0.5 m. The pad exhibits a high degree of thermokarsting and is composed primarily of high-centered polygons. The primary differences between the two plots are the amount of standing water in thermokarst troughs and the extent of the vegetation.

"Wet" Thermokarsted Plot

A gravel study plot designated as "wet" thermokarsted was staked on the southern portion of the pad. Plot measurements are 60 m x 65 m. The plot is characterized by the presence of high-centered polygons formed by deep thermokarst troughs, many of which are water-filled. Plant species colonizing the pad are varied (Table B-1) and are similar to species on the "dry" thermokarsted plot (see below); however, vegetation is more robust on the "wet" plot, particularly near wet troughs.

"Dry" Thermokarsted Plot

A gravel study plot designated as "dry" thermokarsted was staked on the northern portion of the pad. Plot measurements were the same as the "wet" thermokarsted plot, 60 m x 65 m. This plot is also composed of high-centered polygons formed by deep troughs, however the troughs contain little water. Vegetation appears to be more sparsely distributed here than on the "wet" thermokarsted plot; however most of the plant species in the two plots are the same (Table B-1).

Tundra Plot

A tundra plot the same size as the gravel plots was staked adjacent to the west edge of the pad. The landform is primarily low-relief and high-relief high-centered polygons, although a small area of low-centered polygons is present on the southern portion of the plot. The vegetation is primarily moist graminoid tundra, although the tops of some high-centered approach dry prostrate shrub tundra. Most of the troughs do not contain water; a wet thermokarsted area was located in the northwestern portion of the plot.

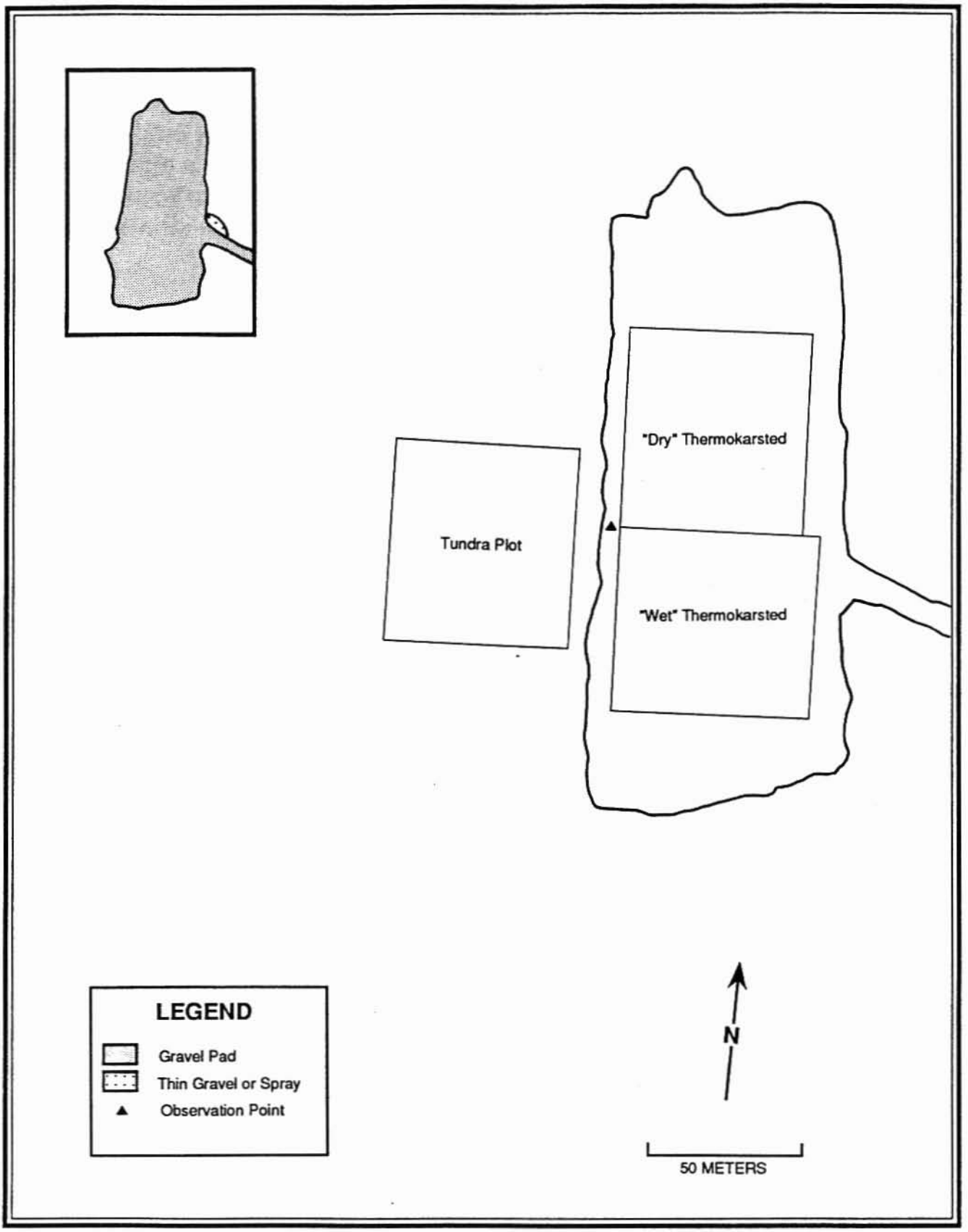

Fig. B-2. Location of disturbed and undisturbed study plots for observational study at Storage Pad, Prudhoe Bay, Alaska, 1990. Inset shows extent of gravel.

Observer Station

The blind was located on the western edge of the pad at the margin of the two gravel plots. The tundra plot was located west of the blind. Most of the area of the study plots could be seen well, except for the thermokarst troughs in all plots, which were sometimes obscured from view.

Delta State 2 Observational Plots

Gravel Plot

A gravel plot, 50 m x 100 m, was staked east of the reserve pit (Fig. B-3). The well head, consisting of a "christmas tree", is located on the plot near the northwest corner. Gravel thickness is approximately 0.5 m. No thermokarsting has occurred on the pad, but some vehicle tracks are present. Virtually no vegetation is present on the plot.

Reserve Pit Plot

The reserve pit plot has the same dimensions as the gravel plot. The plot includes the water in the pit, the mud around the water's edge, and the gravel bank extending down from the pad. Much of the mud in the pit is composed of cuttings from the drilling operation.

Tundra Plot

The tundra plot is located northeast of the reserve pit. The surface area is the same as that of the gravel and reserve pit plots; the dimensions are 71 m x 71 m. The vegetation is moist and wet graminoid tundra; the landform is non-patterned ground.

Observer Station

The blind was located on the gravel pad north of the reserve pit. The entire area of the gravel and reserve pit plots could be seen well, and probably no birds were missed. Observations on the tundra plot were obscured by the vegetation, however, we saw few birds during routine walks through the plot after the observation periods and probably few birds were missed.

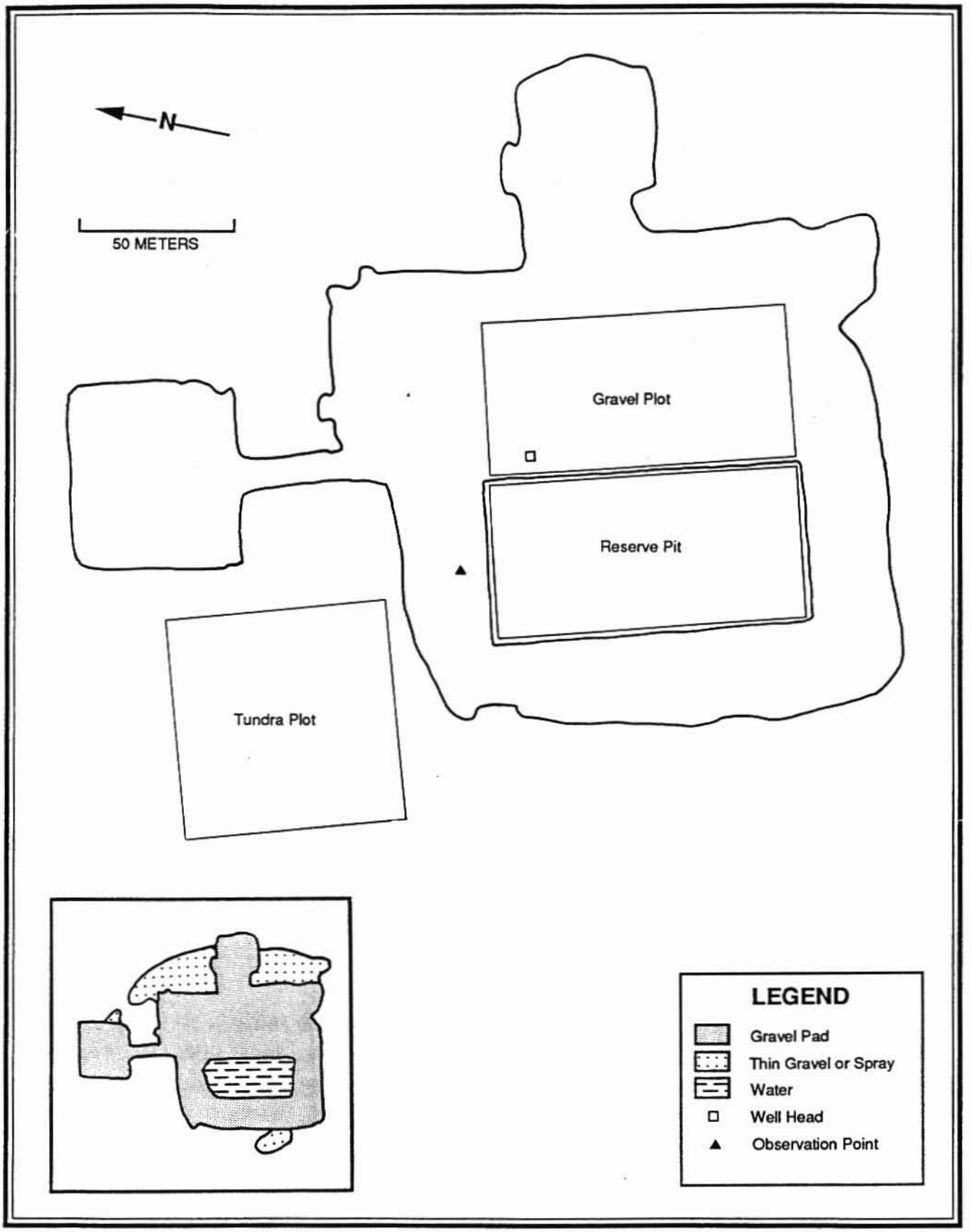

Fig. B-3. Location of disturbed and undisturbed study plots for observational study at Delta State 2, Prudhoe Bay, Alaska, 1990. Inset shows extent of gravel.

Lake State 1 Observational Plots

This site is the object of an ARCO Alaska, Inc., revegetation study which was initiated in 1986 (Jorgenson 1988). The gravel pads were fertilized and portions were seeded with Tundra Blue Grass (*Poa glauca*) and Arctared Fescue (*Festuca rubra*). Other portions were not seeded. No seed or fertilizer were distributed over gravel spray around the edges of pads or on the road connecting them. We made observations at the main drilling pad and a flare pad to the northeast, but not at a thick pad southwest of the main pad.

We established two sets of plots at this site (Fig. B-4). Initially, four gravel plots (seeded, unseeded, "road", and gravel spray) and one tundra plot were established at the main gravel pad to compare bird use among different types of gravel habitats. These plots are designated as Lake State 1(A). By August 3, a second set of plots was set up at the flare pad and was observed concurrently with the first set. The second set consists of seeded and unseeded gravel plots, an impoundment, and a tundra plot, and is designated as Lake State 1(B).

Lake State 1(A)

Seeded Plot

The dimensions of the seeded plot are 40 m x 45 m. Gravel thickness is approximately 0.7 m and no thermokarsting is evident. Cultivars were well established over the entire plot; they were green and robust on the southeastern portion, and brown and stunted on the northwestern portion. The well head (a pipe embedded into the gravel) is located in this area. Several small wire exclosures (associated with the revegetation study) are present on the plot.

Unseeded Plot

The unseeded plot is adjacent to the seeded plot and has the same dimensions. Gravel thickness is also approximately 0.7 m, and no thermokarsting is evident. Naturally colonizing forb species (Table B-1) are sparsely distributed on this fertilized plot, and there is little vegetative cover . The unseeded plot and the "road" plot were scanned during the same three-min periods.

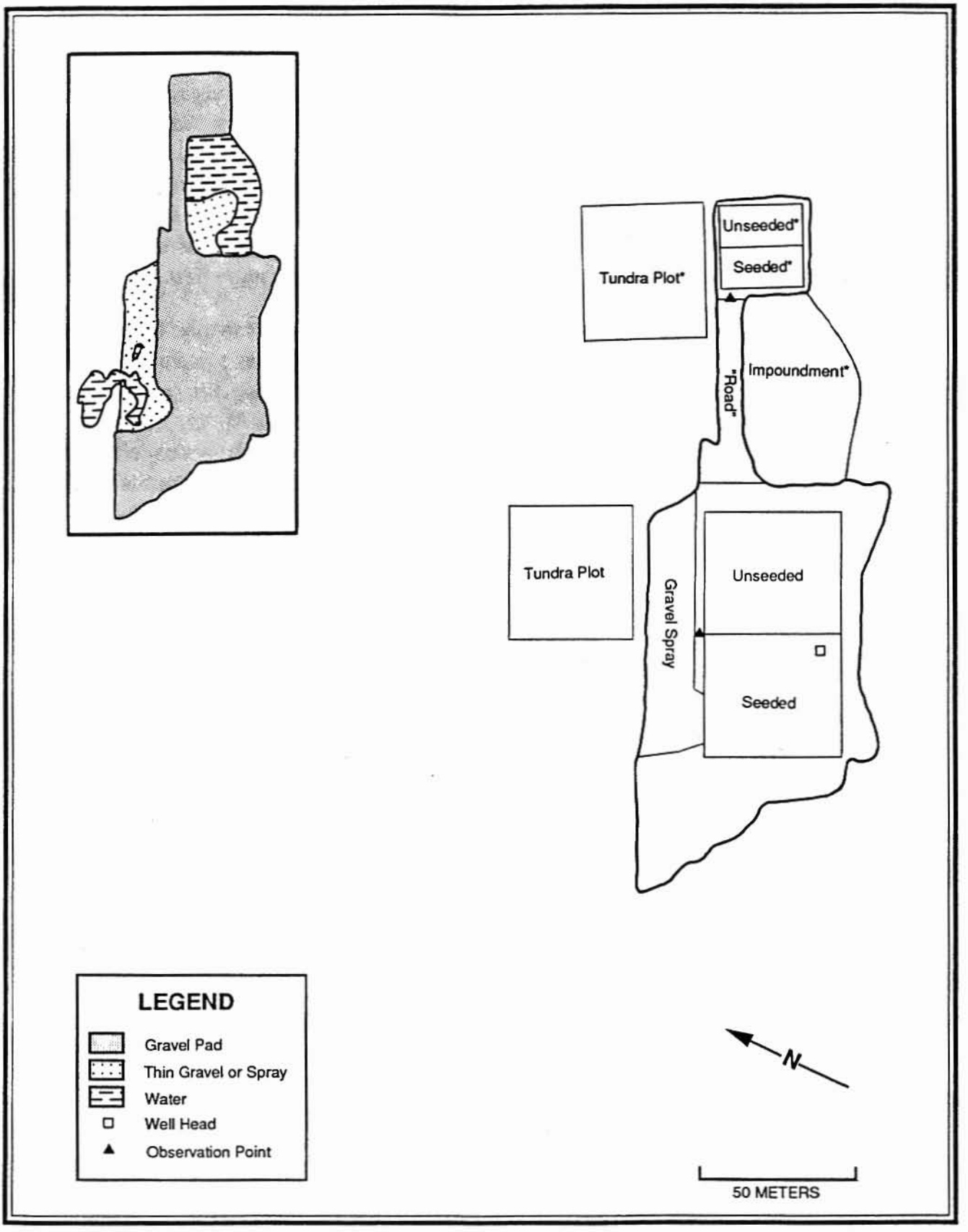

Fig. B-4. Location of disturbed and undisturbed study plots for observational study at Lake State 1 (A and B), Prudhoe Bay, Alaska, 1990. Inset shows extent of gravel. * indicates plots of Lake State 1(B).

"Road" Plot

A plot designated as the "road" plot was located on the gravel berm joining the main pad to the flare pad. The surface area of this plot is approximately 35 percent of the larger seeded and unseeded plots. A variety of graminoid, forb, and shrub vegetation has colonized the plot (Table B-1).

Gravel Spray Plot

The gravel spray plot is located north of the main pad and covers a surface area approximately 74 percent of the seeded and unseeded plots. Gravel is thinner here than on the pad, and the plot is well vegetated with graminoid, forb, and shrub species (Table B-1). Vegetative cover is higher than at the other unseeded plots. Several thermokarst troughs in this plot contained water and had exposed mud banks. Observations of bird use on the gravel spray plot and the tundra plot north of the main pad (see below) were made during the same three-min periods.

Tundra Plot

The tundra plot, located north of the gravel spray plot, has the same dimensions as the seeded and unseeded plots. The vegetation type is moist and wet graminoid tundra and the landform is non-patterned ground. The high level of use on the gravel spray plot (which was observed during the same 3-min scanning period), may have distracted our observations of the tundra plot, and some birds may have been missed. However, this number is probably relatively low as we saw very few birds on the tundra during routine walks after observation periods.

Observer's Station

The blind was located on the main pad between the gravel spray plot and the seeded and unseeded plots.

Lake State 1(B)

Seeded Plot

The dimensions of the seeded plot, located on the flare pad, are 14 m x 28 m. Gravel thickness is approximately 0.5 m and no thermokarsting is evident. This plot covers approximately 22 percent of the area of the tundra plot (see below). Cultivars are well established, and the vegetation was green and robust on the southeastern portion of this plot and brown and stunted on the northwestern portion. Small wire exclosures were also present. The seeded plot and the adjacent unseeded plot (see below) were scanned during the same three-min period.

Unseeded Plot

The unseeded plot is adjacent to the seeded plot and has the same dimensions. Gravel thickness is similar to that of the seeded plot. Natural plant colonization is occurring on this fertilized plot and includes graminoid, forb, and shrub species (Table B-1). Vegetative cover is greater than that on the unseeded plot at Lake State 1(A). *Sagina intermedia* was particularly abundant.

Impoundment Plot

The impoundment plot, located between the flare pad and the main pad, covers approximately 82 percent of the surface area of the tundra plot. Much of the water had receded, exposing areas of mud. A channel on the south side was water-filled. Graminoids were sparsely distributed over portions of the plot, particularly in drier areas. A peninsula of vegetated gravel spray extended into the impoundment from the main gravel pad.

Tundra Plot

The dimensions of the tundra plot are 45 m x 40 m. The vegetation is moist and wet graminoid tundra; the landform is primarily non-patterned ground.

Observer's Station

The blind was located near the western edge of the flare pad on the end of the gravel berm connecting it to the main pad. All plots could be seen well, and we probably missed few birds.

Literature Cited

Jorgenson, M. T. 1988. Revegetation of the Lake State 1 exploratory well site, Prudhoe Bay oilfield, Alaska, 1987. Report prepared for ARCO Alaska, Inc. and Kuparuk River Unit by Alaska Biological Research, Inc., Fairbanks, Alaska.

Walker, D. A., K. R. Everett, P. J. Webber. 1983. Geobotany. Chapter 2 In: D. M. Troy (ed.) Prudhoe Bay Unit--Eileen West End environmental studies program, summer 1982. Report to Sohio Alaksa Petroleum Co., Anchorage, by LGL Alaska Research Associates, Inc., Fairbanks. 77pp.

Appendix C

List of Birds and Mammals

Table C-1. Wildlife species observed during nesting and observational studies, Prudhoe Bay, Alaska, 1990.

Birds	
Scientific Name	Common Name
Anser albifrons	Greater White-fronted Goose
Branta canadensis	Canada Goose
Branta bernicla	Brant
Anas acuta	Northern Pintail
Anas clypeata	Northern Shoveler
Somateria spectabilis	King Eider
Clangula hyemalis	Oldsquaw
Charadrius semipalmatus	Semipalmated Plover
Pluvialis squatarola	Black-bellied Plover
Pluvialis dominica	Lesser Golden-Plover
Phalaropus lobatus	Red-necked Phalarope
Phalaropus fulicaria	Red Phalarope
Limnodromus scolopaceus	Long-billed Dowitcher
Calidris himantopus	Stilt Sandpiper
Arenaria interpres	Ruddy Turnstone
Calidris alpina	Dunlin
Calidris pusilla	Semipalmated Sandpiper
Calidris fuscicollis	White-rumped Sandpiper
Calidris bairdii	Baird's Sandpiper
Calidris melanotos	Pectoral Sandpiper
Tryngites subruficollis	Buff-breasted Sandpiper
Stercorarius parasiticus	Parasitic Jaeger
Larus hyperboreus	Glaucous Gull
Xema sabini	Sabine's Gull
Lagopus mutus	Rock Ptarmigan
Lagopus lagopus	Willow Ptarmigan
Corvus corax	Common Raven
Motacilla flava	Yellow Wagtail
Calcarius lapponicus	Lapland Longspur
Plectrophenax nivalis	Snow Bunting
Carduelis flammea	Common Redpoll

Mammals	
Alopex lagopus	Arctic Fox

Appendix D

Vegetation and Landform Characteristics

Table D-1. Summary of the vegetation types and surface from units used in classifying tundra patches (after Walker et al. 1983). This information is displayed in fractional form on the maps, with the vegetation code in the numerator and the surface form code in the denominator.

VEGETATION	
Code	Dominant Vegetation
1	Riparian shrub tundra
1a	Riparian prostrate shrub, forb, grass tundra
2	Dry prostrate shrub, crustose lichen tundra
3	Moist sedge, prostrate shrub tundra
3a	Moist tussock sedge, prostrate shrub tundra
4	Wet sedge tundra

SURFACE FORM	
Code	Dominant Surface Form
1	High-centered polygons, center-relief > 0.5 m
2	High-centered polygons, center-relief ≤ 0.5 m
3	Low-centered polygons, center-relief > 0.5 m
4	Low-centered polygons, center-relief ≤ 0.5 m
5	Mixed high- and low-centered polygons
6	Frost-scar tundra
7	Strangmoor and/or discontinuous low-centered polygons rims
8	Hummocky terrain associated with steep slopes
10	Non-patterned ground or with pattern occupying < 20%
11	Reticulate pattern

Appendix E

Cartographic Notes

Cartographic Notes

The regional map (Figure 1) is a base map generalized from various sources, and projected to Universal Transverse Mercator, Zone 6, NAD27.

The specific area maps (Figures 1A to 1D) were produced from 1:63360 USGS quad maps. The coastline, rivers, and all facilities were taken from unit operator 1:6000 maps. The U.S. Public Land System (USPLS) grid was generated from a Bureau of Land Management (BLM) based protraction software package. All townships and sections are protracted. All features have been projected to Universal Transverse Mercator, Zone 6, NAD27.

Aerial Photography was obtained at a scale of 1"=500' with a cartographic camera using Kodak 2443 false color infra-red film. The date of each photograph and the original photograph label are given in Table E-1.

Table E-1. The following are dates and original labels of color infra-red aerial photographs used to produce overlays in Appendix A. The original scale of all photographs was 1"=500'. The photographs were enlarged and the scale is indicated on each overlay.

Figure	Date	Original Photo Label
A-1	8/22/89	Kup West Sak 17 #1
A-2	8/22/89	Kup Ugnu 1 #2
A-3	8/22/89	Kup West Sak 9 #2
A-4	8/22/89	Kup West Sak 3 #1
A-5	8/22/89	WPB MP 13-15-11-12 #2
A-6	8/22/89	WPB Term Well C #2
A-7	7/3/90	WPB Hurl State #2
A-8	8/22/89	WPB Put River 22-33-11-13 #1
A-9	8/22/89	WPB 37 #4
A-10	8/22/89	WPB 16 #16
A-11	8/22/89	EPB DS-7 #2
A-12	8/22/89	EPB 17 #6
A-13	8/22/89	EPB DS-16 #3
A-14	8/22/89	ENDCT 25 #10