



NORTHERN ALASKA RESEARCH STUDIES

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

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by
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Prepared for
BP Exploration (Alaska) Inc.

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Prudhoe Bay Region, 1992**

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July 1993

Prepared by

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**BP Exploration (Alaska) Inc.
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PRUDHOE BAY REGION, 1992**

by
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and
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July 1993

**This report was prepared under contract to BP Exploration
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Executive Summary

This document comprises an inventory of arctic fox den locations in the Prudhoe Bay region of northern Alaska and synthesizes available information on the use of fox dens during the period 1975–1992. Development of a Geographic Information System (GIS) database of den locations was initiated in 1991 and continued during 1992. Den sites were located from historical records, aerial surveys, ground reconnaissance, and interviews with oil-field workers and environmental scientists active in the region in recent years. The GIS database currently includes 86 “natural” fox dens in the region between the Milne Point Road on the west and Bullen Point on the east, and inland approximately 24 km. An additional nine “artificial” den sites (in or associated with man-made structures), all believed to represent “secondary” dens (rather than whelping dens), were located in 1992. At a

minimum, 45–58% of the natural dens in the study area were used for whelping in 1992. However, of the 49 fox families this figure represents, only 26 (53%) were known to have survived through early August 1992. Many pups were known to have been killed by predators (golden eagles and brown bears); starvation and disease are additional factors probably contributing to mortality.

At present, the estimated density of dens in the study area is 1/31.2 km². The estimated density of dens in the Prudhoe Bay Unit is 1/13.4 km². Differences in accessibility between developed and undeveloped portions of the study area precipitated differences in search effort and may have affected density estimates. Additional years with similar search efforts will allow estimates of the proportion of natural dens that have been located in various parts of the study area.

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Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

INTRODUCTION

In 1991, BP Exploration (Alaska) Inc. (BPX) initiated a program to develop a Geographic Information System (GIS) database of arctic fox (*Alopex lagopus*) den sites. That program synthesized historical information on the locations and use of den sites, initiated searches for current dens, and successfully established a database for long-term investigations of the density and productivity of arctic foxes between the Kuparuk and Sagavanirktok rivers (Burgess and Stickney 1992). In 1992, BPX continued the den surveys, expanding the area covered by the GIS database, with the long-term goal of evaluating various predictions regarding the impacts of oil development on arctic foxes. This volume provides an inventory of arctic fox den locations in the coastal region (inland to approximately 24 km) between approximately the Milne Point Road on the west and Bullen Point on the east (Figure 1). A more comprehensive treatment of the scientific investigations conducted for this program appears under separate cover (Burgess et al. 1993).

The GIS database is an integral part of compulsory "spill response plans" for environmentally sensitive areas, which include fox dens. The GIS database includes records of annual use of dens, enabling evaluation of density of breeding individuals. Precise knowledge of den locations will facilitate evaluations of annual productivity of foxes in the region, the capture and marking of breeding adults and pups, and behavioral observations.

STUDY AREA

The Prudhoe Bay Unit (PBU, east and west operat-

ing areas, 805.1 km²), as defined by development leases, constituted the "developed" portion of the study area. Unit boundaries were expanded to include entire townships on the edges of the PBU. Adjacent townships with little or no development, primarily to the southeast of the PBU, constituted the "undeveloped" portion of the study area (1876.2 km²), which is geomorphologically similar to the developed portion. The "undeveloped" portion of the study area includes all of the Duck Island Unit (3.86 km²) and part of the Kuparuk River Unit (9.76 km²); however, development associated with these units in the study area is restricted to access roads. Portions of other development units included in the study area remain undeveloped. The southern and eastern boundaries of the study area were determined by the distribution of habitats broadly similar to the coastal wet tundra dominant in the PBU. The specific characteristics considered included elevation, drainage, and relief or microtopography. The Prudhoe Bay region is dominated by moist-wet low-relief habitats, interspersed with numerous dry microsites, including pingos, bird mounds, and low ridges. In a broad sense, these characteristics were used to determine the southern and eastern boundaries of the study area.

METHODS

1991 Surveys

Prior to conducting surveys of den sites in 1991, we obtained maps of den locations identified during 1974–1979 by Dr. Wayne Hanson's group from Battelle Pacific Northwest Laboratories (under con-

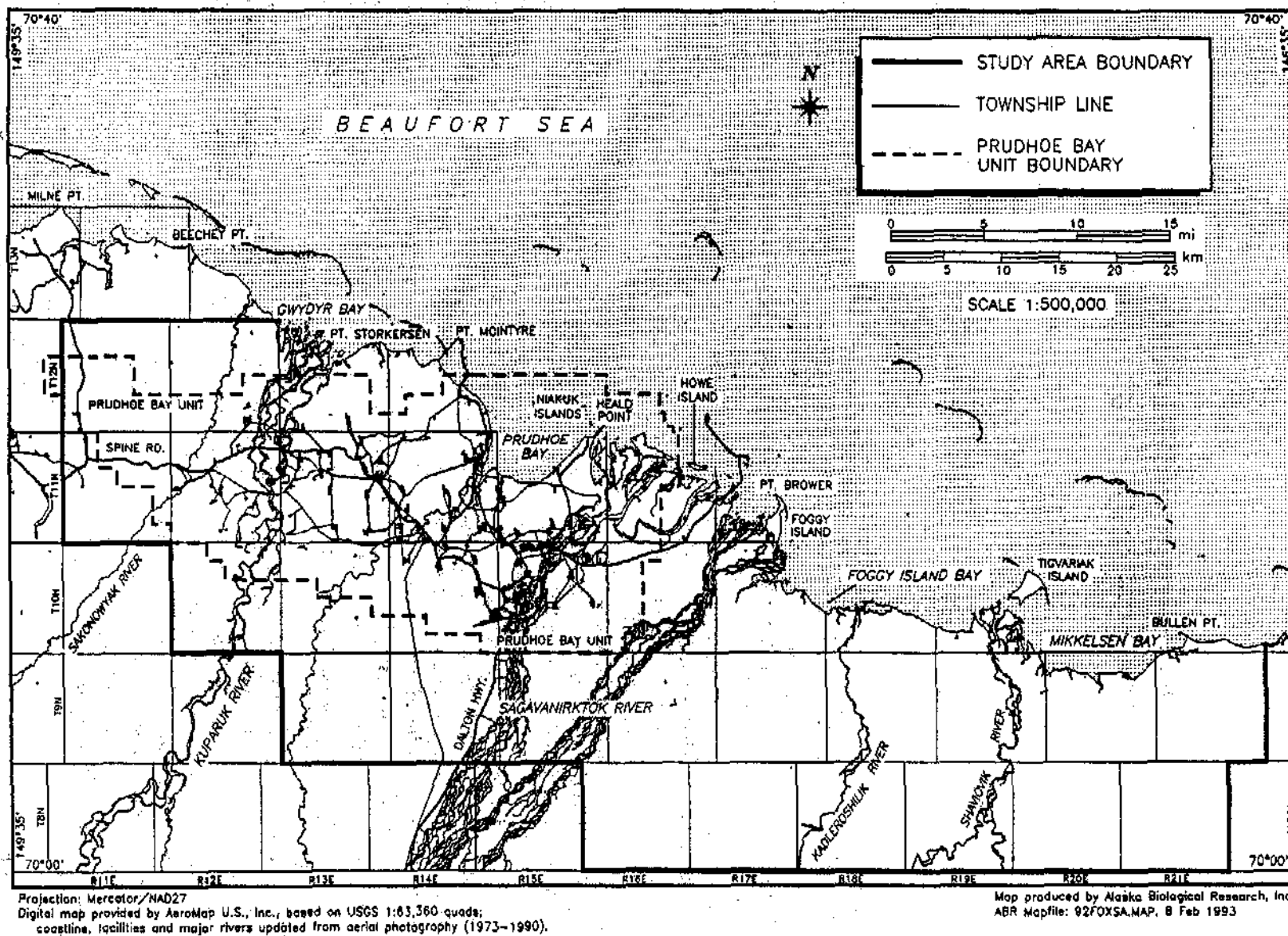


Figure 1. Study area for arctic fox den surveys in 1992.

RESULTS AND DISCUSSION

By definition, *den* refers to an underground burrow or other sheltered place used by a wild mammal, the primary function of which is to provide protection for offspring from weather and predators (Gunderson 1976). Because of the limited availability of appropriate substrate in the far north, arctic foxes typically den in sites that are used regularly, that possess common morphological characteristics, and that develop characteristic vegetative cover (Chesemore 1969, Garrett 1980). These characteristics make arctic fox dens a commonly recognized element of arctic tundra. However, canids (including arctic foxes) typically move pups to other locations at which dens may or may not be present. Hence, the terms *natal* and *secondary* are useful to distinguish between sites at which pups are whelped and sites to which pups have been moved.

In the Prudhoe Bay region, it also is useful to distinguish between *natural* and *artificial* (in or associated with man-made structures) dens. In any particular year, natural dens include both *active* sites (used by foxes in the current season) and *inactive* sites. The abundance of potential artificial den sites in the PBU and the lack of historical information on their use make such a distinction meaningless for artificial sites.

Our field methods were capable of locating all types of dens, but aerial searches were biased toward natural dens (whether active, inactive, secondary, or natal). Artificial dens could be identified only by report or sighting of pups. As used herein, secondary dens may include active natural dens known not to have been used for whelping (there were none in 1991 or 1992) and artificial sites at which we obtained no evidence of whelping. Secondary dens do not include rendezvous sites or resting places either of pups or adults if a natural den or stationary artificial structure is not available for shelter.

A total of 86 natural fox dens were located in the study area (Table 1; Figure 2). An additional nine artificial dens were located; in the absence of clear evidence of whelping at these sites, all were designated secondary dens, indicating that they probably were occupied after pups had become mobile. Artificial secondary dens were located in culverts, utilidors, and crawl spaces. Not included in either category as dens were dumpsters, and culverts or crawl spaces frequented by only a single adult or lone pup. However, some dumpsters provided both shelter and food for families of foxes over a substantial duration of time, and from the foxes' perspective, probably qualified as

dens. Maps with precise den locations are presented in Appendix A.

Although flying conditions were poor and complete coverage of the study area was not possible in May 1992, the survey results verified that mid-May is the optimal time to locate active fox dens by aerial survey. Active dens were quite conspicuous against the nearly complete snow cover. In contrast, it was much more difficult to detect and identify fox dens during the July aerial survey. However, both the July survey and helicopter reconnaissance were required to identify inactive den sites, particularly where den occupancy was low. Together, the three surveys provided a comprehensive census of natural dens in the study area.

Once located, dens were examined periodically for evidence of use in the current season (Table 1). Although usually simple, these evaluations occasionally were not straightforward. Problems in determining the status of a den were most frequent when no evaluation had been made prior to 21 July. The most confident determinations of status could be made for dens located early in the season and visited on several occasions during the summer; nearly all such dens were in the PBU. In a double-blind test (ground personnel did not know the previous status of dens), observers during

Table 1. Arctic fox dens in the Prudhoe Bay Unit (PBU) and adjacent undeveloped tundra on the Arctic Coastal Plain of Alaska, 1992.

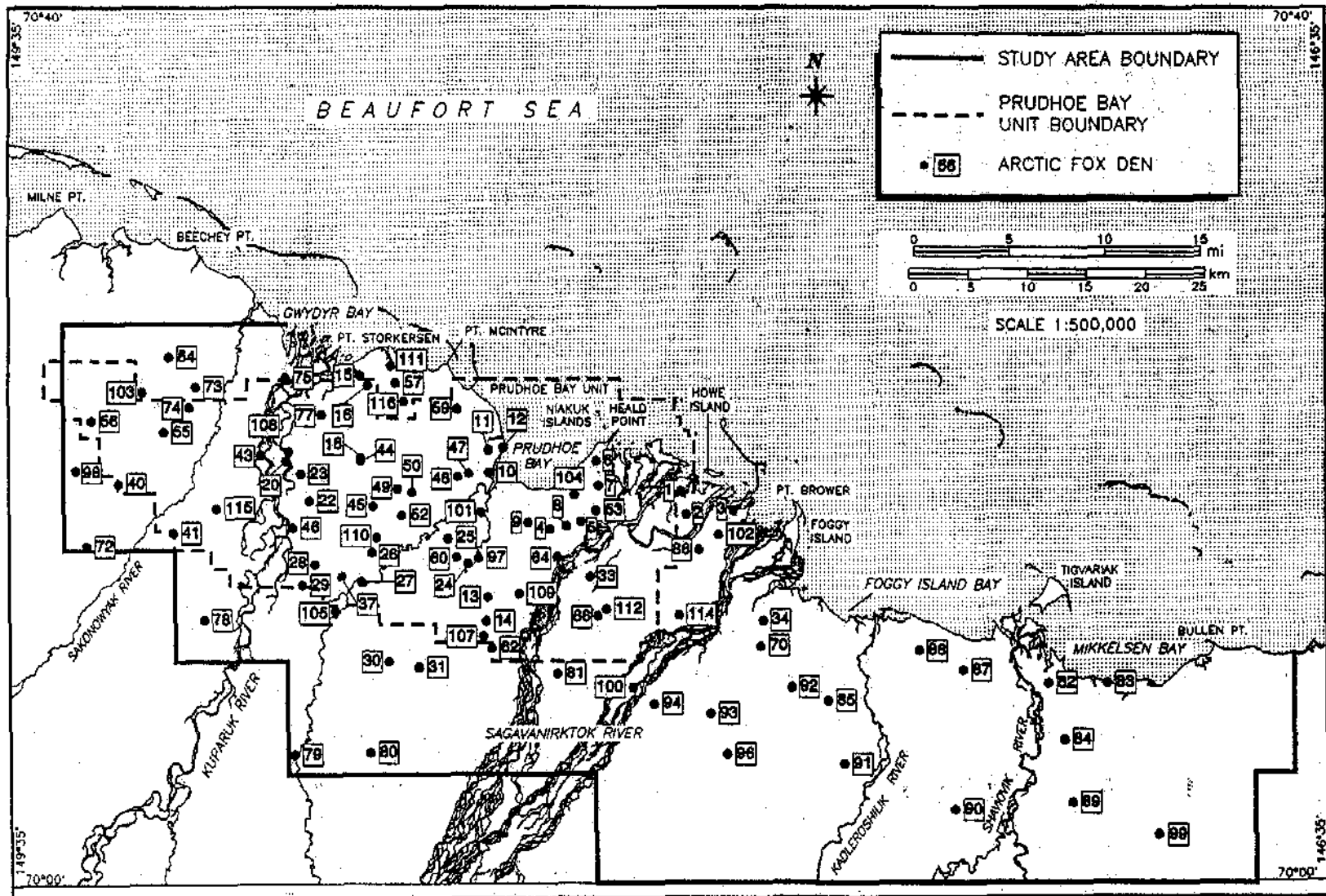
	Total No.	No. in PBU	No. Outside of PBU
NATURAL DENS			
Natal dens ^a	39 ^b	29 ^b	10
Probable natal dens ^c	10	4	6
Secondary dens	0	0	0
Inactive dens	35	27	8
Status in 1992 unknown	2	0	2
Total	86	60	26
ARTIFICIAL DENS^d			
Natal dens	0	0	0
Secondary dens	9	9	0

^a Dens at which the presence of pups was confirmed by sign or direct observation.

^b Includes one arctic fox den occupied by red foxes.

^c Dens that appeared active on at least one visit in 1992, but at which the presence of pups could not be confirmed.

^d Artificial sites include culverts, utilidors, crawl spaces, and burrows in gravel roadbeds.



Projection: Mercator/NAD27
 Digital map provided by AeroMap U.S., Inc., based on USGS 1:63,360 quads;
 coastline, facilities and major rivers updated from aerial photography (1973-1990).

Map produced by Alaska Biological Research, Inc.
 ABR Mapfile: FOXDENS.MAP, 8 Feb 1993

Figure 2. Locations of arctic fox dens in the Prudhoe Bay Unit and adjacent undeveloped areas.

late July and early August could detect no clear evidence of earlier activity at 5 of 20 dens that were active during at least two previous visits. These observations lead to the conclusion that the number of remote dens that were active early in 1992 probably was underestimated.

At a minimum, 45–58% of natural dens in the study area were used for whelping in 1992 (Table 1). However, by the time of the late summer ground reconnaissance, only 18 dens (21%) in the study area were still occupied. A small number of litters (≥ 7 litters) were known to have moved to secondary locations, but the ultimate fate of most pups from abandoned dens was unknown. Golden eagles (*Aquila chrysaetos*) and brown bears (*Ursus arctos*) were believed to have caused abandonment of many dens and deaths of many pups in 1992. Six whelping dens had evidence of recent excavation by bears and at least six pups from three dens were known to have been killed by bears. Golden eagles were observed standing on the surface of 10 dens during the mid-July survey, and a total of 17 dens had fresh sign of eagles (castings, droppings, feathers, characteristic prey remains, or direct sightings) during ground reconnaissance. Carcass remains characteristic of eagle predation were found at 9 dens during ground reconnaissance, representing ≥ 13 pups.

It became clear during the ground reconnaissance that many fox families in the oil field had moved out of their natal dens and into culverts, crawl spaces, and utilidoris nearer to artificial food sources. By the end of our capture effort, it also was evident that territoriality was breaking down (arctic foxes are territorial only during the summer breeding season), because families were often in close proximity to one another and probably far from their natal dens. Although we have no information on the abundance of natural foods, early dispersal from natal dens is characteristic of arctic foxes during periods of low food availability (Dementyeff 1958). Consequently, we believe it reasonable to speculate that litters in remote areas may have dispersed from natal dens in search of food, occupying formerly inactive natural dens (as previously mentioned, this type of secondary den was not documented in 1991 or 1992) or dying from lack of food prior to ground reconnaissance. It is also possible that litters were moved to secondary sites lacking natural dens and thereby escaped detection. However, we can-

not distinguish between the two alternatives for any specific den or litter, and both probably contributed to the decrease in den occupancy during 1992. Clearly, future evaluation of reproductive effort (as opposed to realized production measured as the pups approach independence) will require closer scrutiny of natal dens earlier in the season than was possible in 1992.

At the time of the late summer ground reconnaissance and trapping effort, a total of 26 arctic fox (and 1 red fox) families was known in the study area. As previously mentioned, 18 natural dens (representing 18 families) were active during late summer 1992. In addition, at least some members of a family from one abandoned den survived in a secondary location (after a bear excavated the natal den), and seven families were known only from secondary artificial dens.

The density of natural dens in the study area was 1/31.2 km² (Table 2). The density of natural dens (active and inactive) and the density of natal dens were considerably higher in the PBU than in areas outside the PBU. A more comprehensive analysis of these differences appears in the report on scientific investigations of the arctic fox study program (Burgess et al. 1993). No estimate can yet be made of the proportion of dens missed; however, it is clear that differences in accessibility between developed and undeveloped areas led to different levels of search effort. Although a consistent level of effort over a period of at least three years will allow such an estimate, we believe that few dens were missed and do not believe that additional natural dens found in the next several years are likely to alter the general pattern of higher densities in the PBU.

Table 2. Densities of arctic fox dens in the Prudhoe Bay Unit (PBU) and adjacent undeveloped areas of the Arctic Coastal Plain of Alaska, 1992.

	Natal Dens ^a	All Dens ^b
PBU	1/24.4 km ²	1/13.4 km ²
Undeveloped Areas	1/117.3 km ²	1/72.2 km ²
Total	1/54.7 km ²	1/31.2 km ²

^a Includes confirmed and probable natal dens (from Table 1).

^b Excludes secondary artificial dens (from Table 1).

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Appendix A

Table A1. Location and status of arctic fox dens in the Prudhoe Bay region in 1975, 1976, 1979, and 1985-1992. U = status unknown, A = active natal den, N = inactive, 2 = site used as secondary den (not a natal den), R = site used by red foxes, and 2A = artificial secondary den (known only in 1992).

Den No.	Latitude (°N)	Longitude (°W)	Year										Figure No. (page)		
			75	76	79	85	86	87	88	89	90	91		92	
1	70° 18' 04"	148° 03' 19"	U	U	U	U	U	U	U	U	A	U	A	N	A28 (39)
2	70° 17' 00"	148° 02' 41"	U	U	U	U	U	U	U	U	U	U	A	N	A39 (50)
3	70° 17' 11"	147° 56' 05"	U	U	U	U	U	U	U	U	U	U	A	A	A29 (40)
4	70° 16' 21"	148° 21' 19"	A	U	A	U	A	N	A	A	A	U	A	A	A38 (49)
5	70° 16' 41"	148° 17' 08"	A	U	N	A	N	A	U	A	U	N	A	A	A38 (49)
6	70° 19' 30"	148° 14' 53"	U	U	U	U	U	A	U	U	U	N	N	A	A19 (30)
7	70° 18' 20"	148° 14' 35"	U	U	U	U	U	A	2	A	U	N	A	A	A27 (38)
8	70° 16' 27"	148° 18' 55"	U	U	U	U	U	U	U	U	2	U	U	N	A38 (49)
9	70° 16' 39"	148° 24' 18"	U	U	U	U	U	U	U	A	U	U	A	A	A37 (48)
10	70° 18' 58"	148° 29' 33"	U	U	U	U	U	U	U	U	U	U	A	N	A18 (29)
11	70° 20' 01"	148° 29' 37"	U	U	U	U	U	U	U	A	U	N	A	A	A18 (29)
12	70° 20' 08"	148° 27' 34"	U	U	U	A	A	A	N	N	N	N	A	A	A18 (29)
13	70° 13' 13"	148° 29' 48"	A	U	U	U	U	U	U	U	U	U	A	A	A51 (62)
14	70° 12' 07"	148° 30' 08"	N	U	A	U	U	U	U	U	U	U	U	N	A51 (62)
15	70° 23' 24"	148° 47' 04"	A	A	U	U	U	U	U	U	U	U	U	N	A6 (17)
16	70° 22' 58"	148° 46' 02"	A	A	U	U	U	U	U	U	U	U	A	N	A6 (17)
18	70° 19' 40"	148° 47' 04"	N	U	A	U	U	U	U	U	U	U	U	A	A16 (27)
20	70° 19' 32"	148° 57' 14"	A	U	U	U	U	U	U	U	U	U	U	N	A15 (26)
22	70° 17' 39"	148° 54' 01"	N	U	U	U	U	U	U	U	U	U	U	A	A22 (33)
23	70° 18' 56"	148° 55' 12"	N	U	U	U	U	U	U	U	U	U	U	A	A15 (26)
24	70° 14' 44"	148° 32' 30"	A	U	U	U	U	U	U	U	U	U	A	N	A44 (55)
25	70° 15' 56"	148° 35' 15"	N	U	A	U	U	U	U	U	U	U	A	A	A35 (46)
26	70° 15' 16"	148° 45' 39"	N	U	U	U	U	U	U	U	U	U	U	A	A43 (54)
27	70° 13' 56"	148° 47' 05"	N	U	U	U	U	U	U	U	U	U	U	A	A43 (54)
28	70° 14' 45"	148° 53' 24"	A	U	N	U	U	U	U	U	U	U	U	A	A41 (52)
29	70° 13' 47"	148° 55' 06"	A	U	N	U	U	U	U	U	U	U	U	A	A41 (52)
30	70° 10' 15"	148° 43' 26"	N	U	U	U	U	U	U	U	U	U	U	N	A56 (67)
31	70° 09' 59"	148° 39' 18"	A	U	U	U	U	U	U	U	U	U	U	A	A60 (71)
33	70° 14' 09"	148° 15' 50"	U	U	U	U	U	U	R	R	U	2	R	A	A47 (58)
34	70° 12' 07"	147° 52' 11"	U	U	A	U	U	U	U	U	U	U	A	A	A55 (66)
37	70° 14' 11"	148° 49' 44"	U	U	U	U	U	U	U	U	U	U	U	N	A42 (53)
40	70° 18' 28"	149° 20' 07"	U	U	U	U	U	U	U	U	U	U	U	A	A20 (31)
41	70° 16' 11"	149° 12' 44"	U	U	U	U	U	U	U	U	U	U	U	A	A31 (42)
43	70° 19' 47"	149° 00' 41"	U	U	U	U	U	U	U	U	U	U	U	A	A14 (25)
44	70° 19' 33"	148° 47' 04"	U	U	U	U	U	U	U	U	U	U	U	N	A16 (27)
45	70° 17' 24"	148° 45' 24"	U	U	U	U	U	U	U	U	U	U	U	N	A23 (34)
46	70° 16' 25"	148° 56' 26"	U	U	U	U	U	U	U	U	U	U	U	A	A32 (43)
47	70° 18' 55"	148° 32' 18"	U	U	U	U	U	U	U	U	U	U	U	2A	A17 (28)
48	70° 18' 46"	148° 33' 47"	U	U	U	U	U	U	U	U	U	U	U	2A	A25 (36)
49	70° 18' 13"	148° 42' 01"	U	U	U	U	U	U	U	U	U	U	U	N	A24 (35)
50	70° 18' 03"	148° 40' 03"	U	U	U	U	U	U	U	U	U	U	U	A	A24 (35)
52	70° 16' 59"	148° 41' 35"	U	U	U	U	U	U	U	U	U	U	U	A	A34 (45)

Table A1 (Cont'd). Location and status of arctic fox dens in the Prudhoe Bay region in 1975, 1976, 1979, and 1985-1992. U = status unknown, A = active natal den, N = inactive, 2 = site used as secondary den (not a natal den), R = site used by red foxes, and 2A = artificial secondary den (known only in 1992).

Den No.	Latitude (°N)	Longitude (°W)	Year											Figure No. (page)
			75	76	79	85	86	87	88	89	90	91	92	
53	70° 17' 11"	148° 14' 55"	U	U	U	U	U	U	U	U	U	U	N	A27 (38)
54	70° 24' 15"	149° 13' 07"	U	U	U	U	U	U	U	U	U	U	A	A2 (13)
55	70° 20' 51"	149° 13' 54"	U	U	U	U	U	U	U	U	U	U	N	A8 (19)
56	70° 21' 22"	149° 23' 52"	U	U	U	U	U	U	U	U	U	U	A	A7 (18)
57	70° 23' 04"	148° 42' 11"	U	A	U	U	U	U	U	U	U	U	N	A6 (17)
59	70° 21' 56"	148° 33' 46"	U	U	U	U	U	U	U	U	U	U	N	A12 (23)
60	70° 15' 03"	148° 34' 05"	U	U	U	U	U	U	U	U	U	U	2A	A44 (55)
62	70° 10' 52"	148° 29' 24"	U	U	U	U	U	U	U	U	U	U	A	A57 (68)
64	70° 15' 04"	148° 20' 22"	U	U	U	U	U	U	U	U	U	U	A	A46 (57)
66	70° 12' 20"	148° 14' 45"	U	U	U	U	U	U	U	U	U	U	N	A53 (64)
70	70° 10' 55"	147° 52' 33"	U	U	U	U	U	U	U	U	U	U	N	A58 (69)
72	70° 15' 36"	149° 24' 36"	U	U	U	U	U	U	U	U	U	U	A	A30 (41)
73	70° 22' 54"	149° 09' 25"	U	U	U	U	U	U	U	U	U	U	N	A4 (15)
74	70° 21' 59"	149° 10' 27"	U	U	U	U	U	U	U	U	U	U	N	A9 (20)
75	70° 23' 18"	148° 57' 14"	U	U	U	U	U	U	U	U	U	U	A	A5 (16)
77	70° 21' 39"	148° 52' 26"	U	U	U	U	U	U	U	U	U	U	N	A10 (21)
78	70° 12' 13"	149° 08' 35"	U	U	U	U	U	U	U	U	U	U	A	A49 (60)
79	70° 05' 57"	148° 56' 24"	U	U	U	U	U	U	U	U	U	U	A	A70 (81)
80	70° 06' 02"	148° 46' 05"	U	U	U	U	U	U	U	U	U	U	A	A71 (82)
81	70° 09' 39"	148° 20' 26"	U	U	U	U	U	U	U	U	U	U	A	A61 (72)
82	70° 09' 12"	147° 13' 23"	U	U	U	U	U	U	U	U	U	U	A	A65 (76)
83	70° 09' 12"	147° 05' 24"	U	U	U	U	U	U	U	U	U	U	A	A66 (77)
84	70° 06' 34"	147° 11' 20"	U	U	U	U	U	U	U	U	U	U	A	A74 (85)
85	70° 08' 23"	147° 43' 19"	U	U	U	U	U	U	U	U	U	U	A	A69 (80)
86	70° 15' 23"	148° 00' 58"	U	U	U	U	U	U	U	U	U	U	N	A48 (59)
87	70° 09' 48"	147° 24' 59"	U	U	U	U	U	U	U	U	U	U	A	A64 (75)
88	70° 10' 41"	147° 30' 58"	U	U	U	U	U	U	U	U	U	U	A	A59 (70)
89	70° 03' 40"	147° 10' 11"	U	U	U	U	U	U	U	U	U	U	N	A76 (87)
90	70° 03' 19"	147° 26' 11"	U	U	U	U	U	U	U	U	U	U	N	A75 (86)
91	70° 05' 27"	147° 41' 13"	U	U	U	U	U	U	U	U	U	U	N	A73 (84)
92	70° 08' 59"	147° 48' 14"	U	U	U	U	U	U	U	U	U	U	N	A63 (74)
93	70° 07' 48"	147° 59' 22"	U	U	U	U	U	U	U	U	U	U	A	A68 (79)
94	70° 08' 15"	148° 07' 12"	U	U	U	U	U	U	U	U	U	U	N	A67 (78)
96	70° 05' 55"	147° 57' 15"	U	U	U	U	U	U	U	U	U	U	N	A72 (83)
97	70° 15' 00"	148° 31' 03"	U	U	U	U	U	U	U	U	U	U	2A	A45 (56)
98	70° 19' 06"	149° 25' 58"	U	U	U	U	U	U	U	U	U	U	A	A13 (24)
99	70° 02' 12"	146° 58' 30"	U	U	U	U	U	U	U	U	U	U	N	A77 (88)
100	70° 09' 01"	148° 10' 05"	U	U	U	U	U	U	U	U	U	U	A	A62 (73)
101	70° 17' 06"	148° 30' 39"	U	U	U	U	U	U	U	U	U	U	A	A36 (47)
102	70° 16' 04"	147° 58' 15"	U	U	U	U	U	U	U	U	U	U	A	A40 (51)
103	70° 22' 40"	149° 16' 44"	U	U	U	U	U	U	U	U	U	U	N	A3 (14)

Table A1 (Cont'd). Location and status of arctic fox dens in the Prudhoe Bay region in 1975, 1976, 1979, and 1985-1992. U = status unknown, A = active natal den, N = inactive, 2 = site used as secondary den (not a natal den), R = site used by red foxes, and 2A = artificial secondary den (known only in 1992).

Den No.	Latitude (°N)	Longitude (°W)	Year										Figure No. (page)		
			75	76	79	85	86	87	88	89	90	91		92	
104	70° 17' 54"	148° 17' 54"	U	U	U	U	U	U	U	U	U	U	U	A	A26 (37)
105	70° 12' 37"	148° 50' 35"	U	U	U	U	U	U	U	U	U	U	U	N	A50 (61)
107	70° 11' 25"	148° 30' 32"	U	U	U	U	U	U	U	U	U	U	U	2A	A57 (68)
108	70° 19' 58"	148° 56' 54"	U	U	U	U	U	U	U	U	U	U	U	A	A15 (26)
109	70° 13' 23"	148° 25' 30"	U	U	U	U	U	U	U	U	U	U	U	2A	A52 (63)
110	70° 15' 58"	148° 45' 01"	U	U	U	U	U	U	U	U	U	U	U	2A	A33 (44)
111	70° 23' 51"	148° 42' 50"	U	A	U	U	U	U	U	U	U	U	U	U	A6 (17)
112	70° 12' 39"	148° 13' 35"	U	U	U	U	U	U	U	U	U	U	U	2A	A53 (64)
113	70° 06' 59"	148° 59' 42"	U	U	U	U	U	U	U	U	U	U	U	A	A78 (89)
114	70° 12' 22"	148° 03' 40"	U	U	U	U	U	U	U	U	U	U	U	N	A54 (65)
115	70° 17' 19"	149° 06' 40"	U	U	U	U	U	U	U	U	U	U	U	2A	A21 (32)
116	70° 22' 15"	148° 41' 04"	U	A	U	U	U	U	U	U	U	U	U	U	A11 (22)

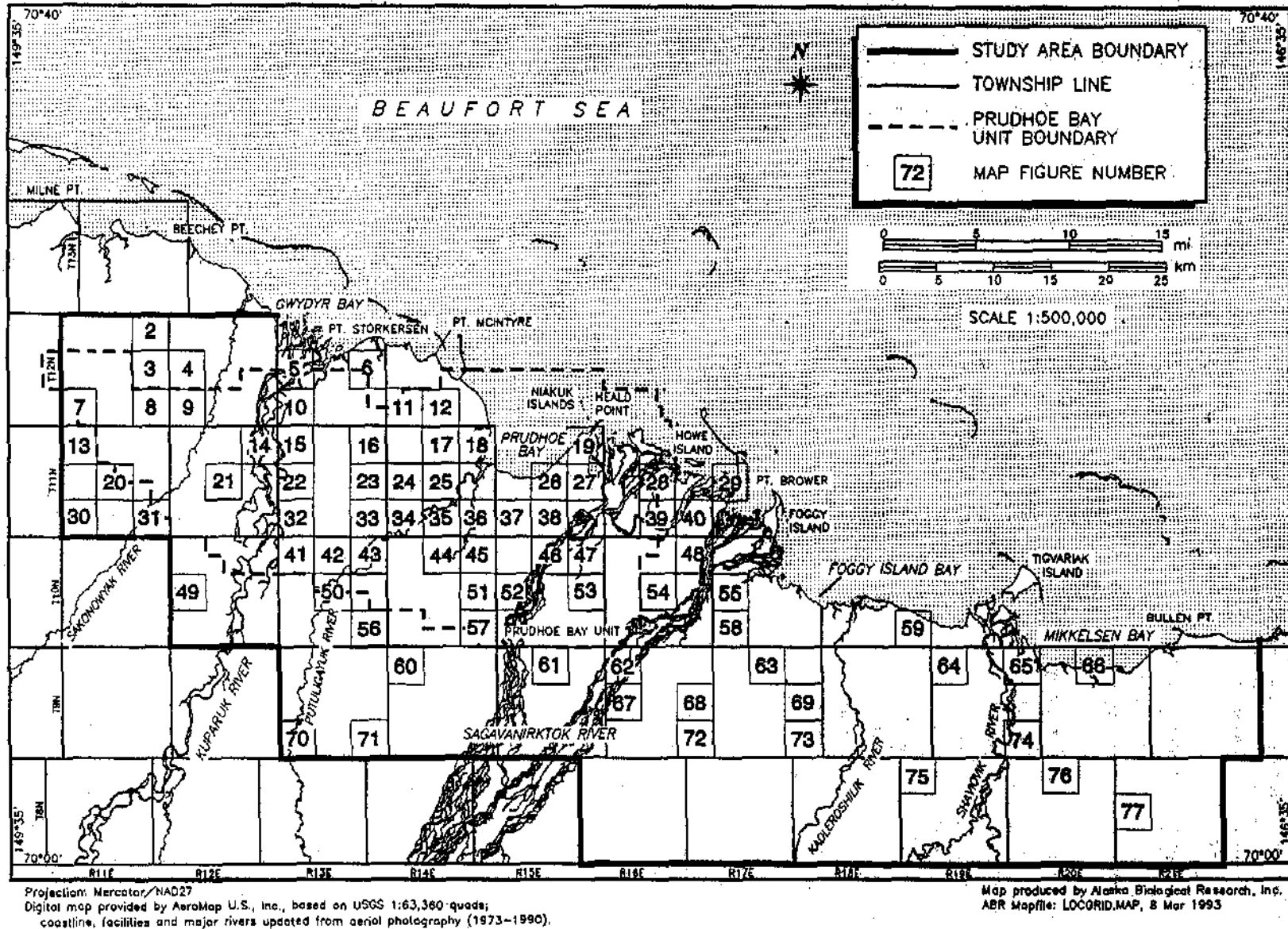


Figure A1. Reference map for appendix figures A2-A78. Figure numbers for each map in this appendix comprise a letter-number code; figures are referenced on this location map by the number portion of that code.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Figure A2. Location of fox den 54 in Beechey Point Quadrangle B-4, Township 12N, Range 11E, Sections 1, 2, 11, and 12.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

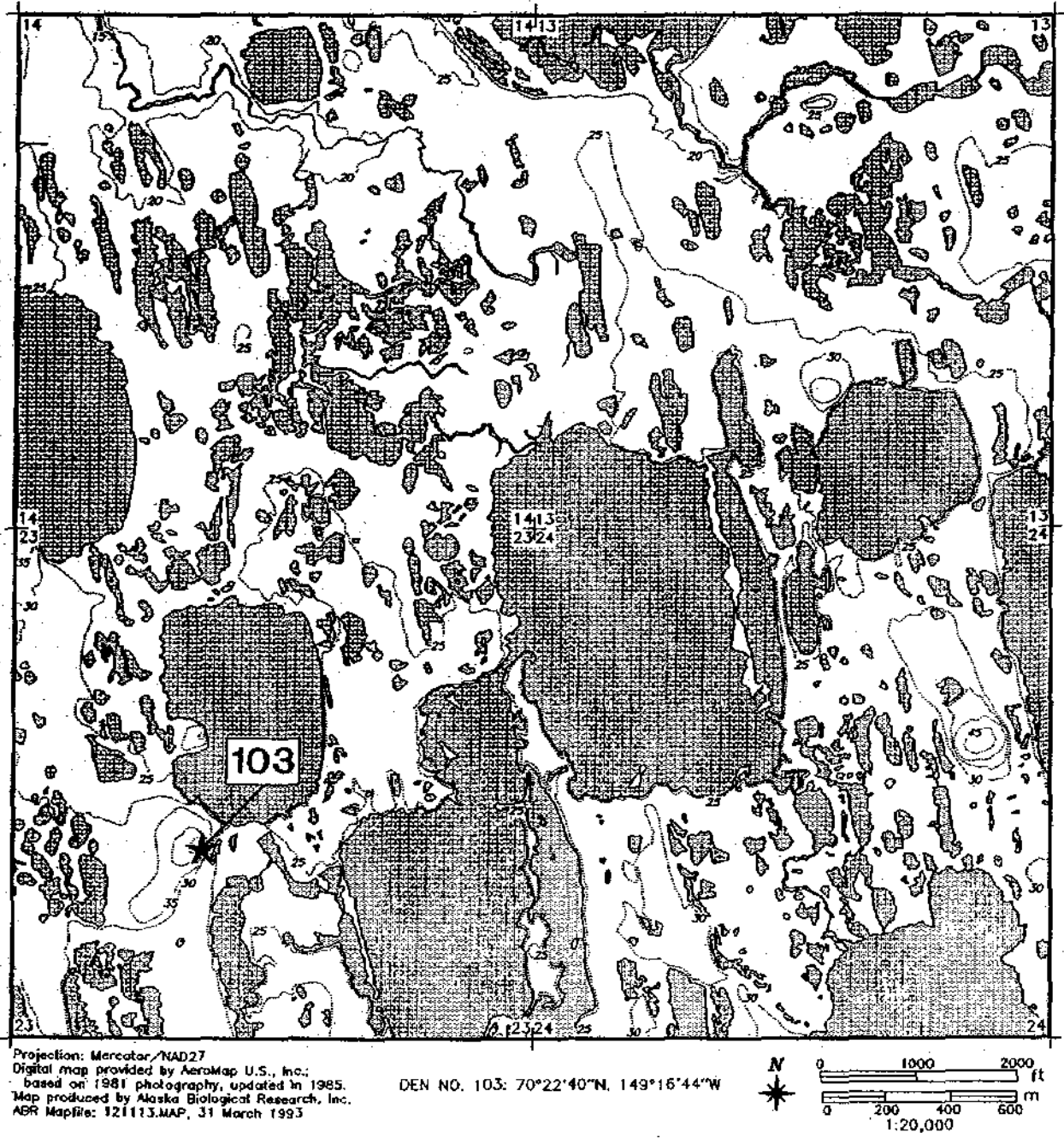


Figure A3. Location of fox den 103 in Beechey Point Quadrangle B-4, Township 12N, Range 11E, Sections 13, 14, 23, and 24.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Figure A4. Location of fox den 73 in Beechey Point Quadrangle B-4, Township 12N, Range 12E, Sections 17, 18, 19, and 20.



Figure A5. Location of fox den 75 in Beechey Point Quadrangle B-4, Township 12N, Range 13E, Sections 17, 18, 19, and 20.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

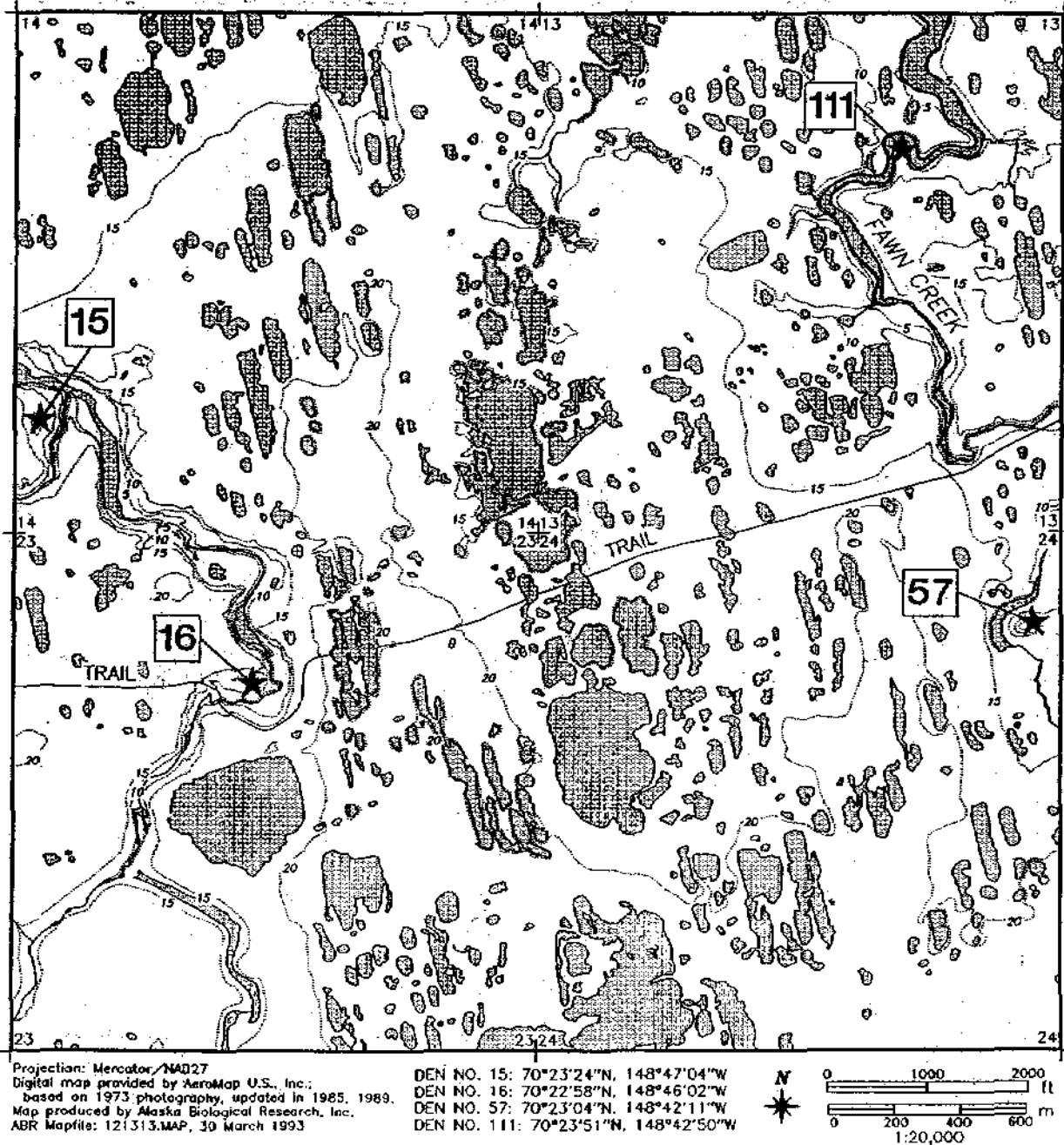


Figure A6. Location of fox dens 15, 16, 57, and 111 in Beechey Point Quadrangle B-3, Township 12N, Range 13E, Sections 13, 14, 23, and 24.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

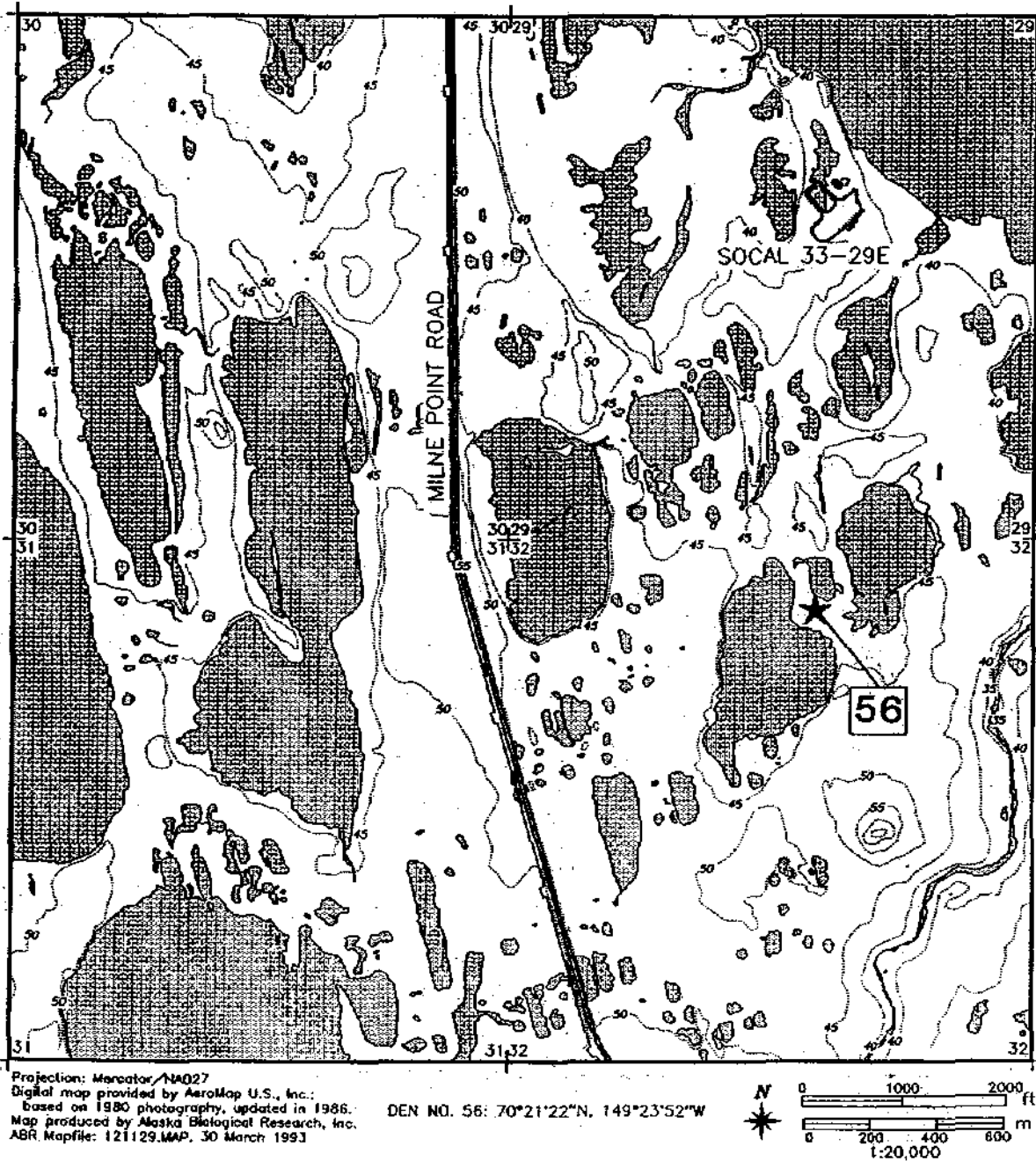


Figure A7. Location of fox den 56 in Beechey Point Quadrangles B-4 and B-5, Township 12N, Range 11E, Sections 29, 30, 31, and 32.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Projection: Mercator/NAD27
Digital map provided by AeroMap U.S., Inc.,
based on 1981 photography, updated in 1985.
Map produced by Alaska Biological Research, Inc.
ABR Mapfile: 121125.MAP, 30 March 1993

DEN NO. 55: 70°20'51"N, 149°13'54"W

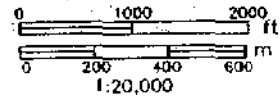


Figure A8. Location of fox den 55 in Beechey Point Quadrangle B-4, Township 12N, Range 11E, Sections 25, 26, 35, and 36.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Figure A9. Location of fox den 74 in Beechey Point Quadrangle B-4, Township 12N, Range 12E, Sections 29, 30, 31, and 32.

Inventory of Arctic Fox Dens In the Prudhoe Bay Region, 1992



Projection: Mercator, NAD27
Digital map provided by AeroMap U.S., Inc.;
based on 1973 photography, updated in 1988.
Map produced by Alaska Biological Research, Inc.
ABR Mapfile: 121329.MAP, 30 March 1993

DEN NO. 77: 70°21'39"N, 148°52'26"W

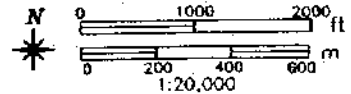


Figure A10. Location of fox den 77 in Beechey Point Quadrangle B-4, Township 12N, Range 13E, Sections 29, 30, 31, and 32.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

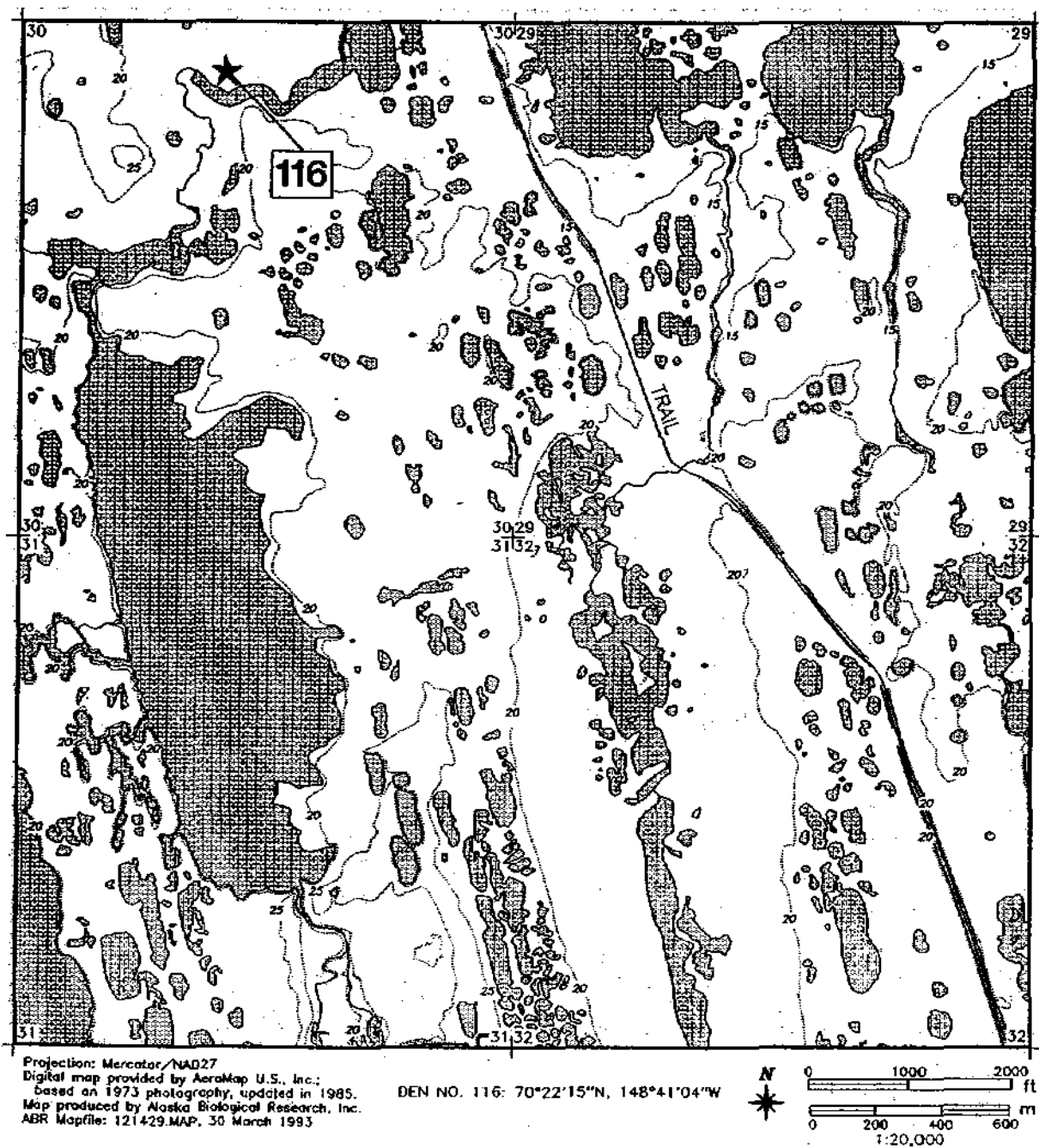
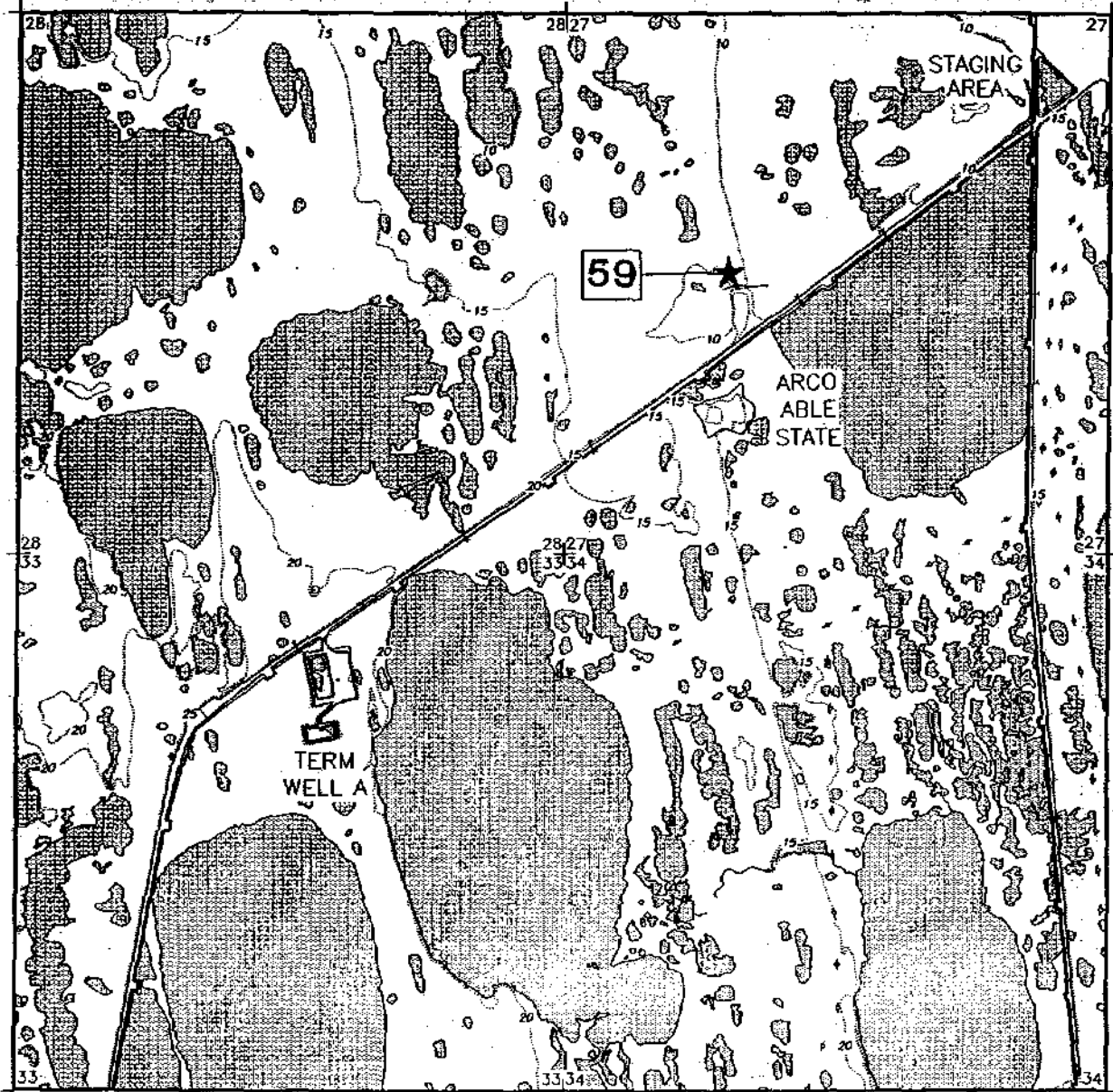


Figure A11. Location of fox den 116 in Beechey Point Quadrangle B-3, Township 12N, Range 14E, Sections 29, 30, 31, and 32.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Projection: Mercator/NAD27
Digital map provided by AeroMap U.S., Inc.,
based on 1973 photography, updated in 1985.
Map produced by Alaska Biological Research, Inc.
ABR Mapfile: 121427.MAP, 31 March 1993

DEN NO. 59: 70°21'56"N, 148°33'46"W

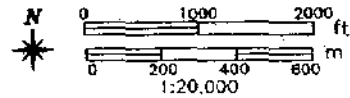


Figure A12. Location of fox den 59 in Beechey Point Quadrangle B-3, Township 12N, Range 14E, Sections 27, 28, 33, and 34.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

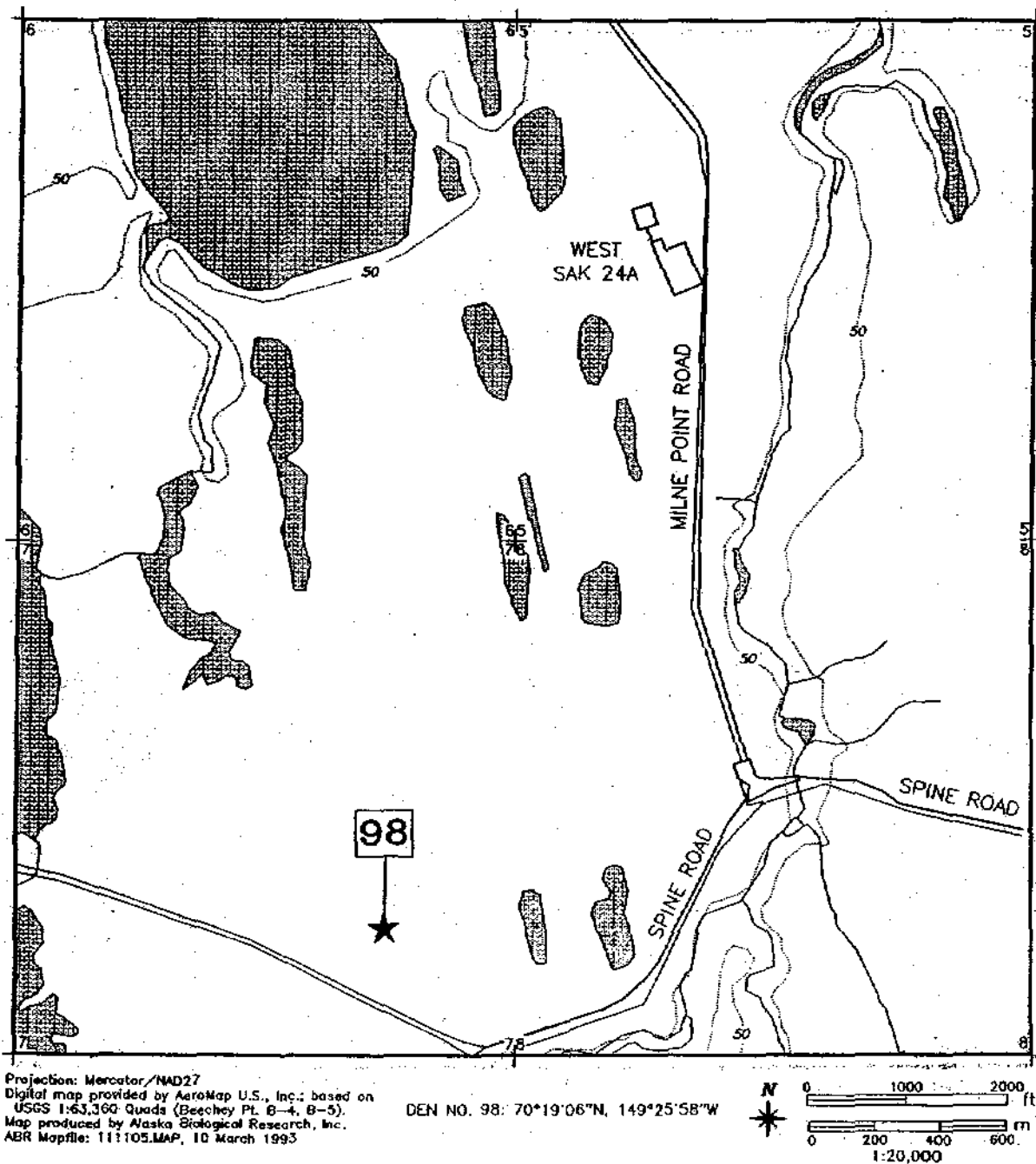


Figure A13. Location of fox den 98 in Beechey Point Quadrangles B-4 and B-5, Township 11N, Range 11E, Sections 5, 6, 7, and 8.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

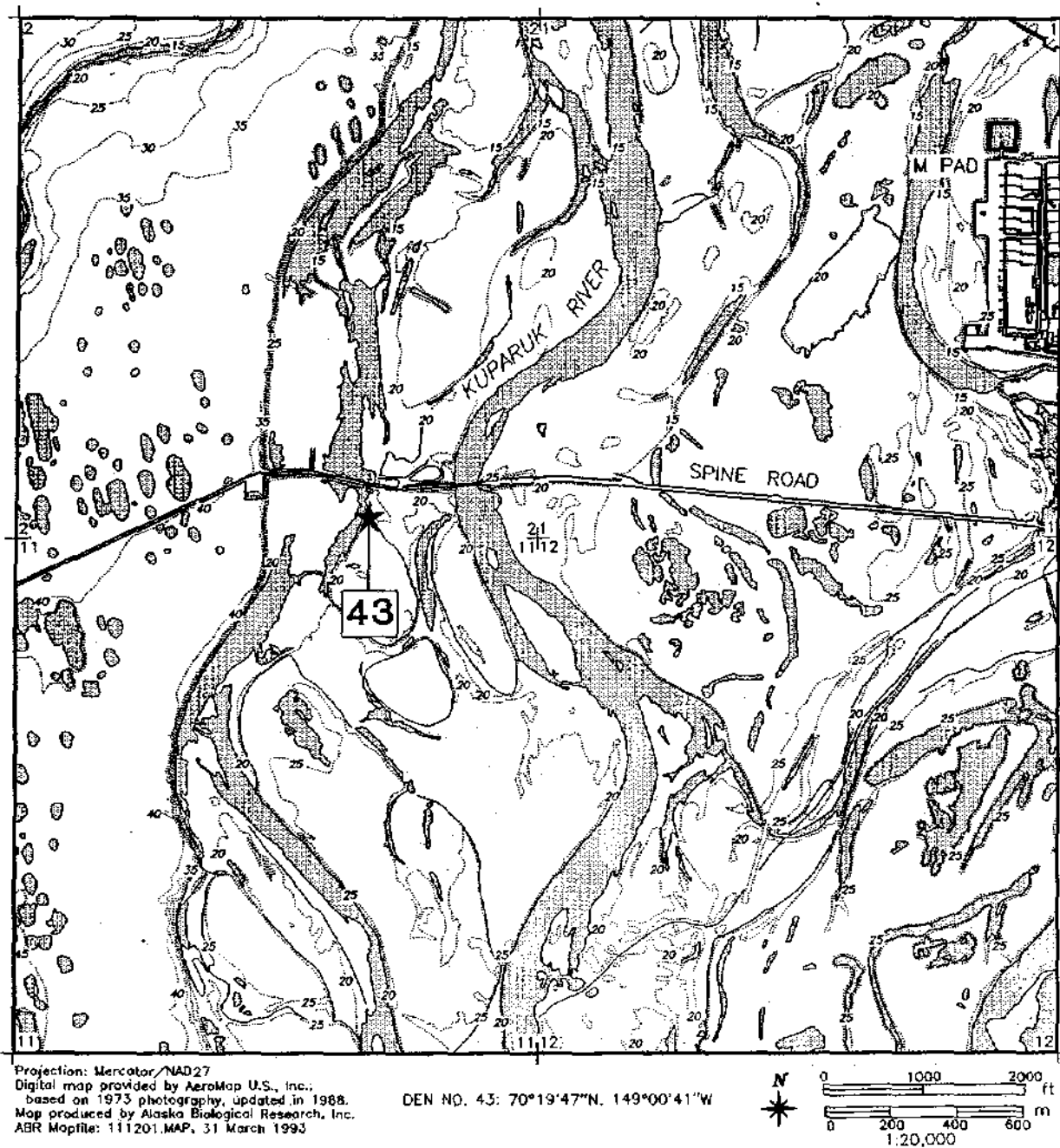
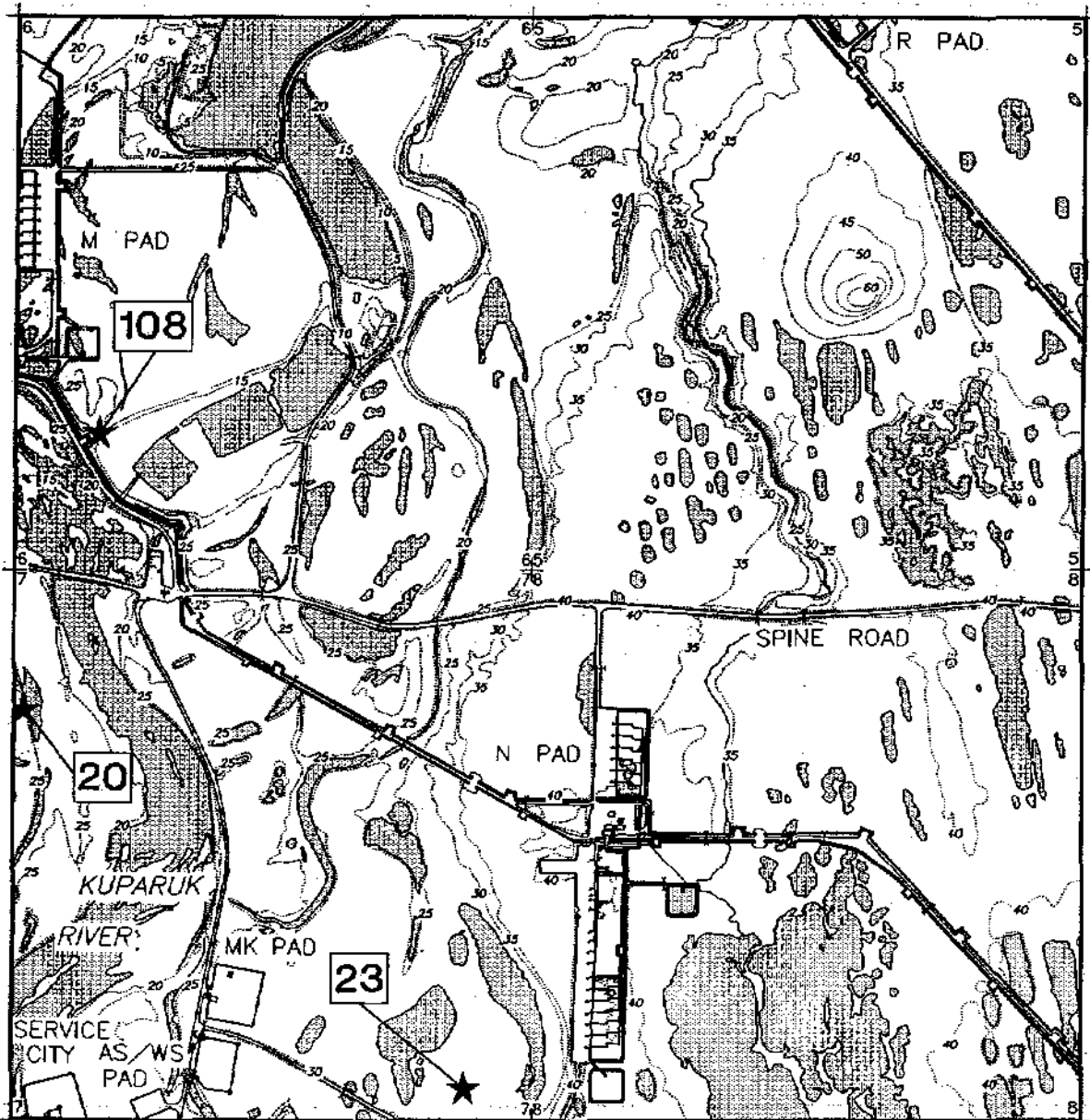


Figure A14. Location of fox den 43 in Beechey Point Quadrangle B-4, Township 11N, Range 12E, Sections 1, 2, 11, and 12.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Projection: Mercator, NAD27

Digital map provided by AeroMap U.S., Inc.,
 based on 1973 photography, updated in 1988.
 Map produced by Alaska Biological Research, Inc.
 ABR Mapfile: 111305.MAP, 31 March 1993

DEN NO. 20: 70°19'32"N, 148°57'14"W
 DEN NO. 23: 70°18'56"N, 148°55'12"W
 DEN NO. 108: 70°19'58"N, 148°56'54"W

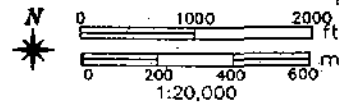


Figure A15. Location of fox dens 20, 23, and 108 in Beechey Point Quadrangle B-4, Township 11N, Range 13E, Sections 5, 6, 7, and 8.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

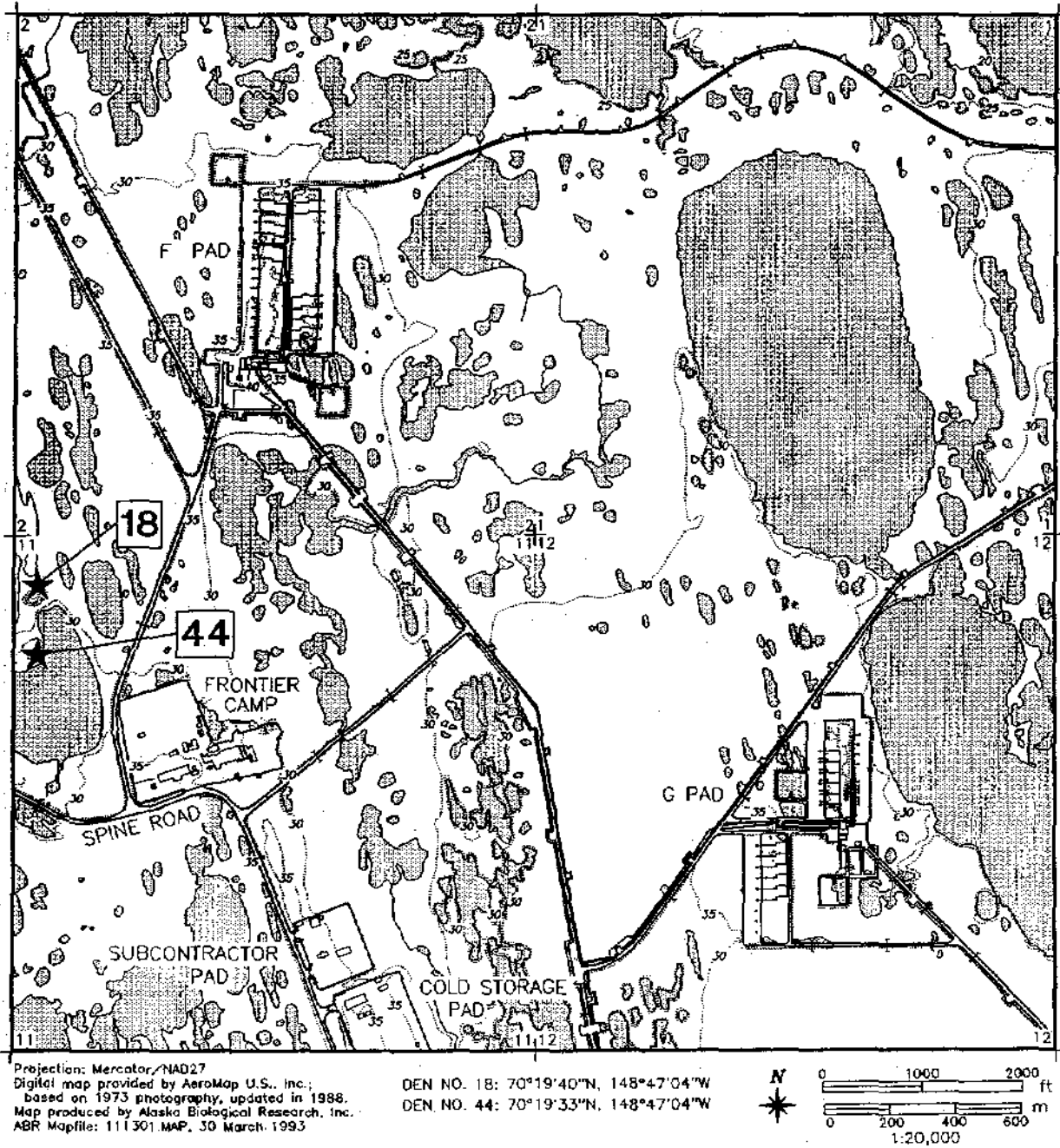


Figure A16. Location of fox dens 18 and 44 in Beechey Point Quadrangle B-3, Township 11N, Range 13, Sections 1, 2, 11, and 12.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

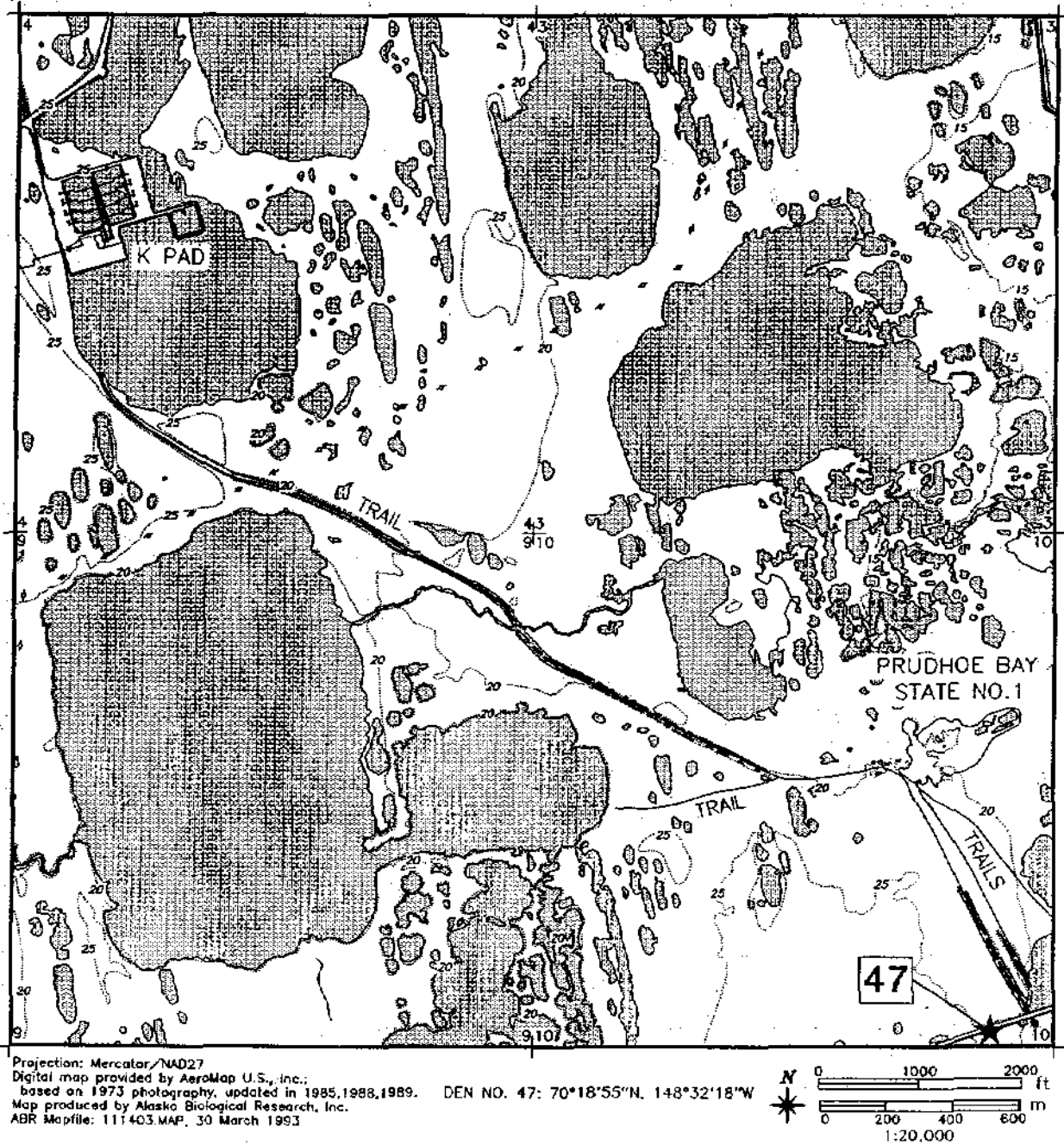


Figure A17. Location of fox den 47 in Beechey Point Quadrangle B-3, Township 11N, Range 14, Sections 3, 4, 9, and 10.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Projection: Mercator / NAD27
 Digital map provided by AeroMap U.S., Inc.,
 based on 1973 photography, updated in 1989.
 Map produced by Alaska Biological Research, Inc.
 ABR Mapfile: 111401.MAP, 30 March 1993

DEN NO. 10: 70°18'58"N, 148°29'33"W
 DEN NO. 11: 70°20'01"N, 148°29'37"W
 DEN NO. 12: 70°20'08"N, 148°27'34"W

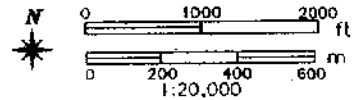


Figure A18. Location of fox dens 10, 11, and 12 in Beechey Point Quadrangle B-3, Township 11N, Range 14E, Sections 1, 2, 11, and 12.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

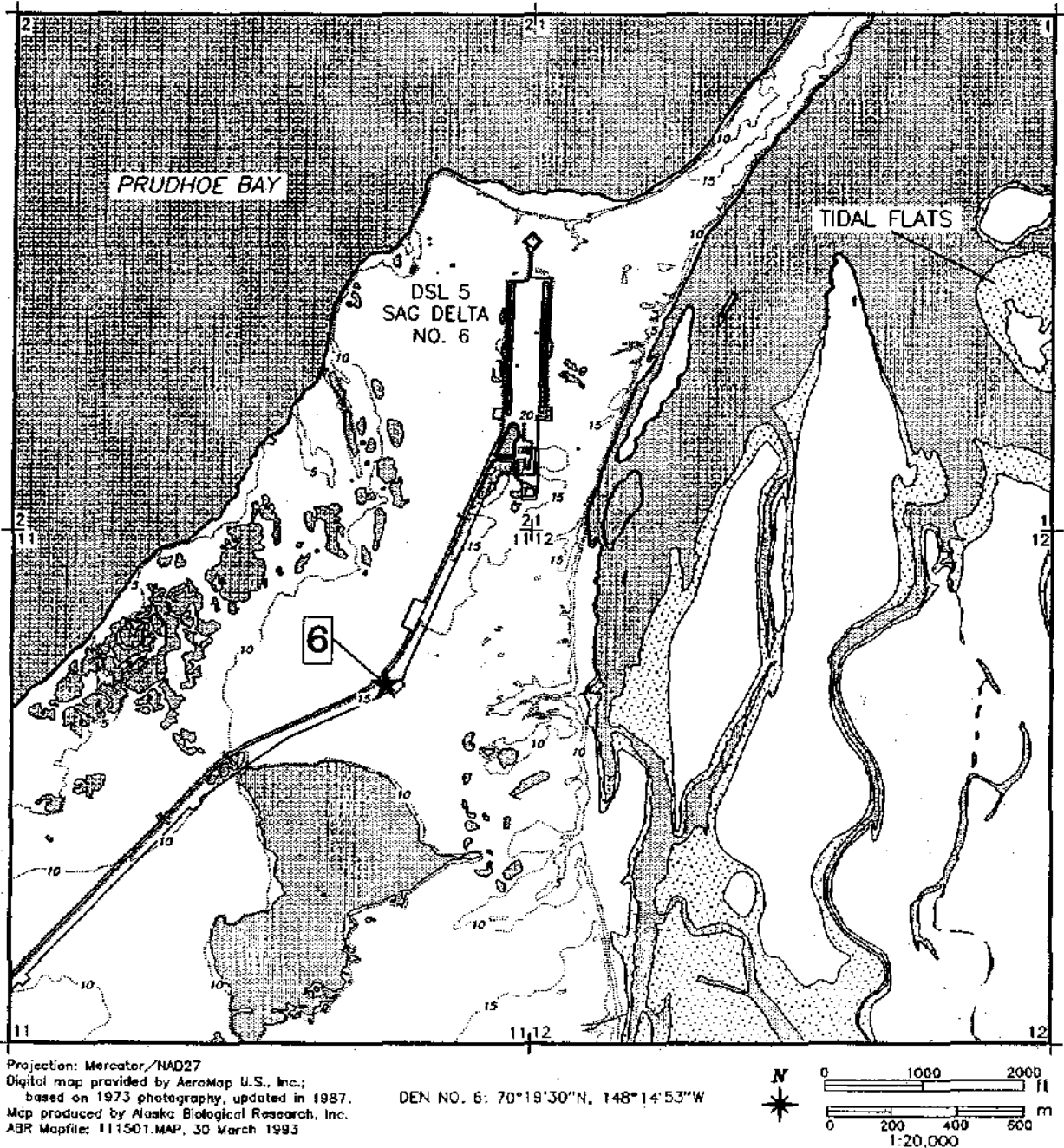


Figure A19. Location of fox den 6 in Beechey Point Quadrangle B-3, Township 11N, Range 15E, Sections 1, 2, 11, and 12.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

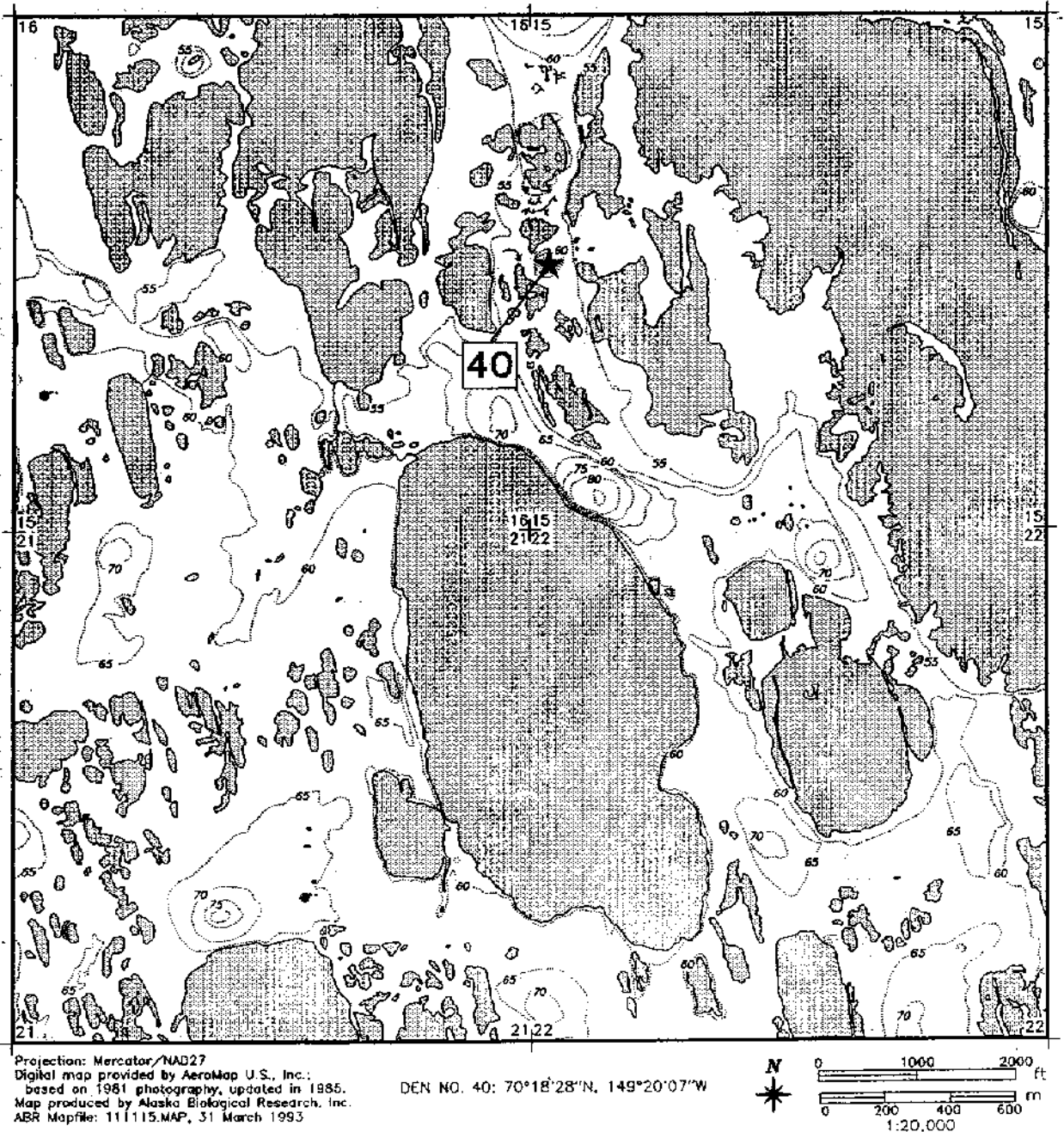


Figure A20. Location of fox den 40 in Beechey Point Quadrangle B-4, Township 11N, Range 11E, Sections 15, 16, 21, and 22.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

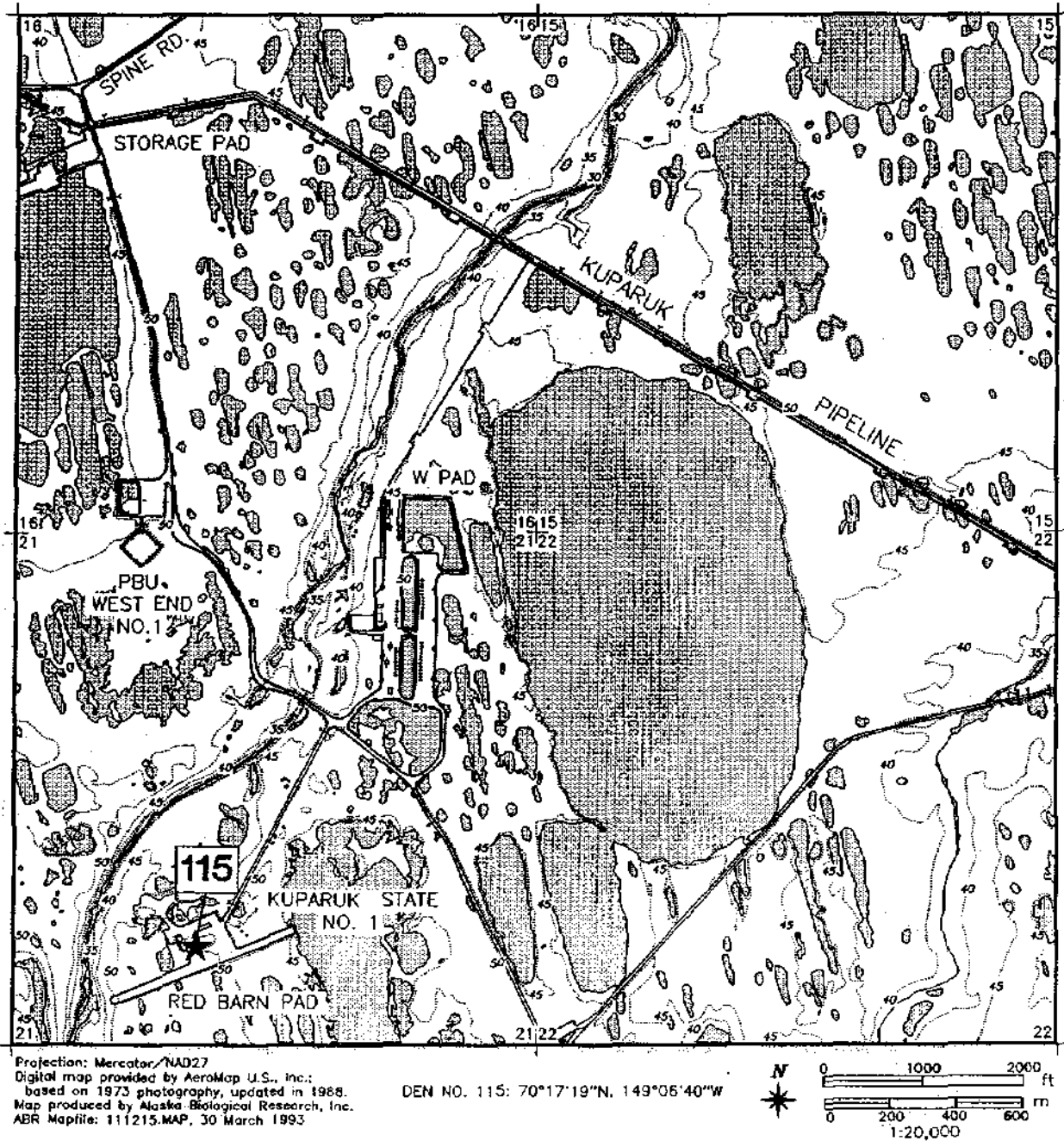
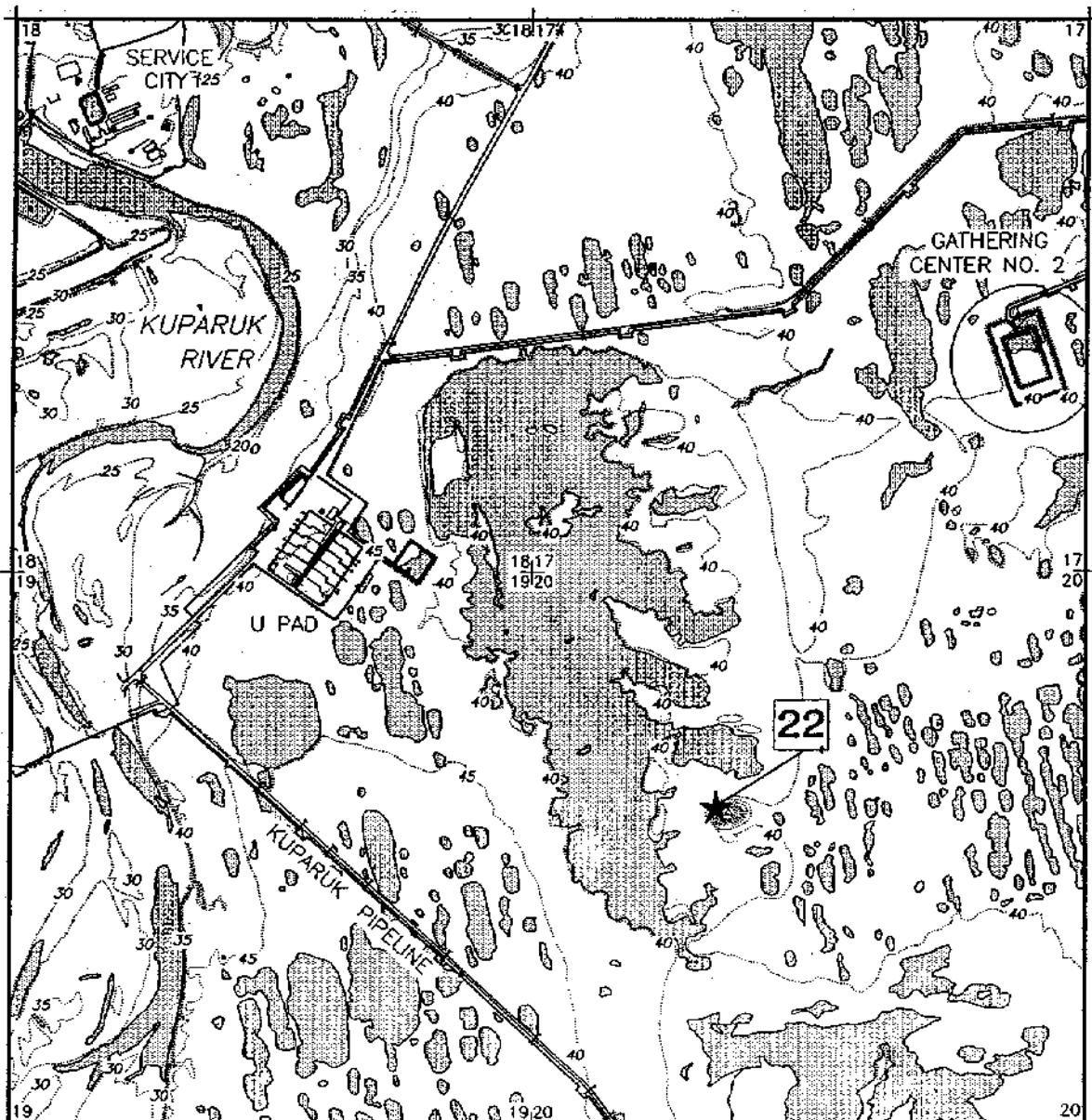


Figure A21. Location of fox den 115 in Beechey Point Quadrangle B-4, Township 11N, Range 12E, Sections 15, 16, 21, and 22.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Projection: Mercator, NAD27
 Digital map provided by AeroMap U.S., Inc.,
 based on 1973 photography, updated in 1989.
 Map produced by Alaska Biological Research, Inc.
 ABR Mapfile: 111317.MAP, 30 March 1993

DEN NO. 22: 70°17'39"N, 148°54'01"W

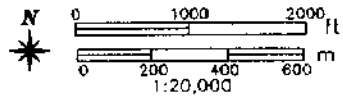


Figure A22. Location of fox den 22 in Beechey Point Quadrangle B-4, Township 11N, Range 13E, Sections 17, 18, 19, and 20.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

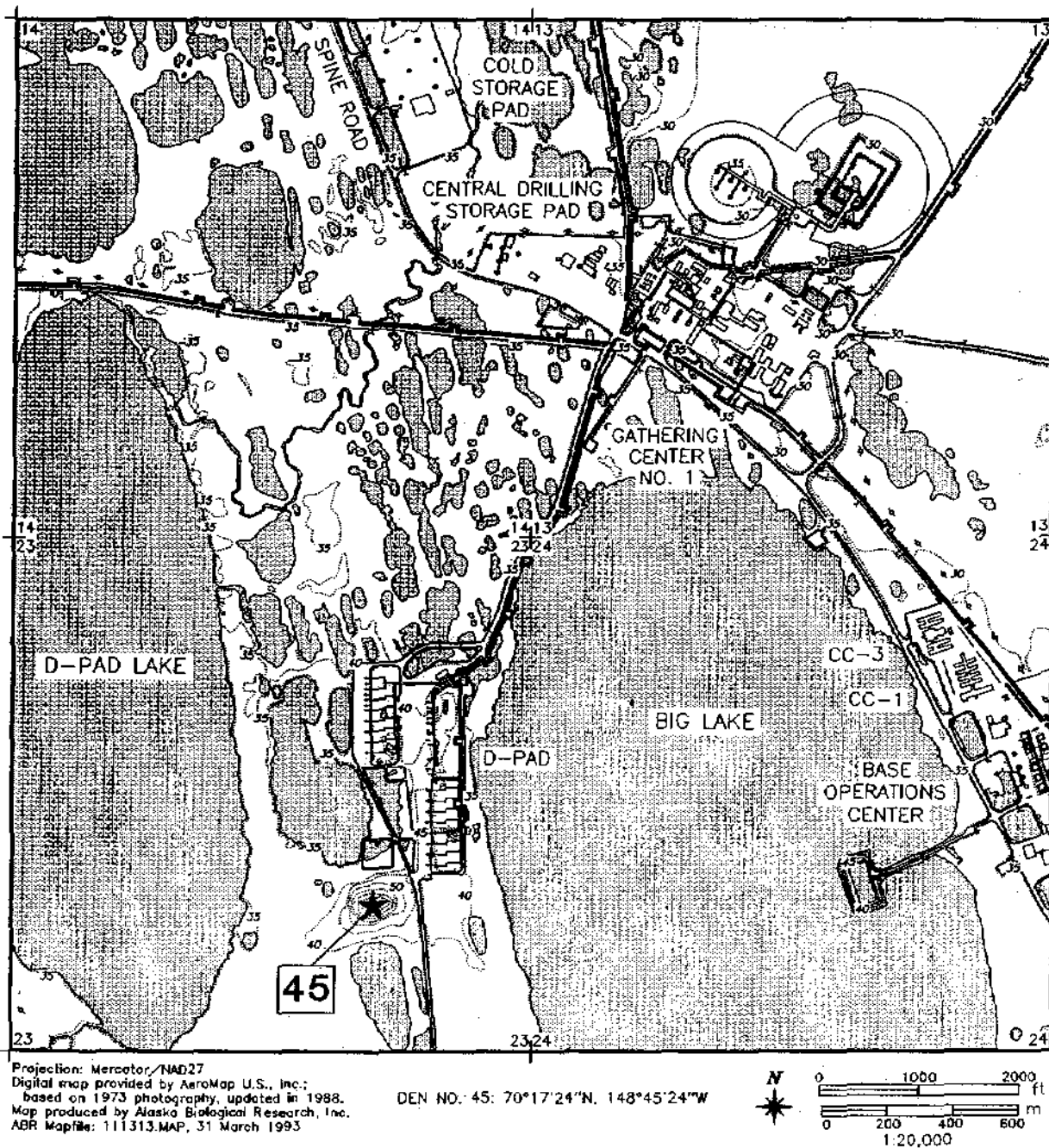
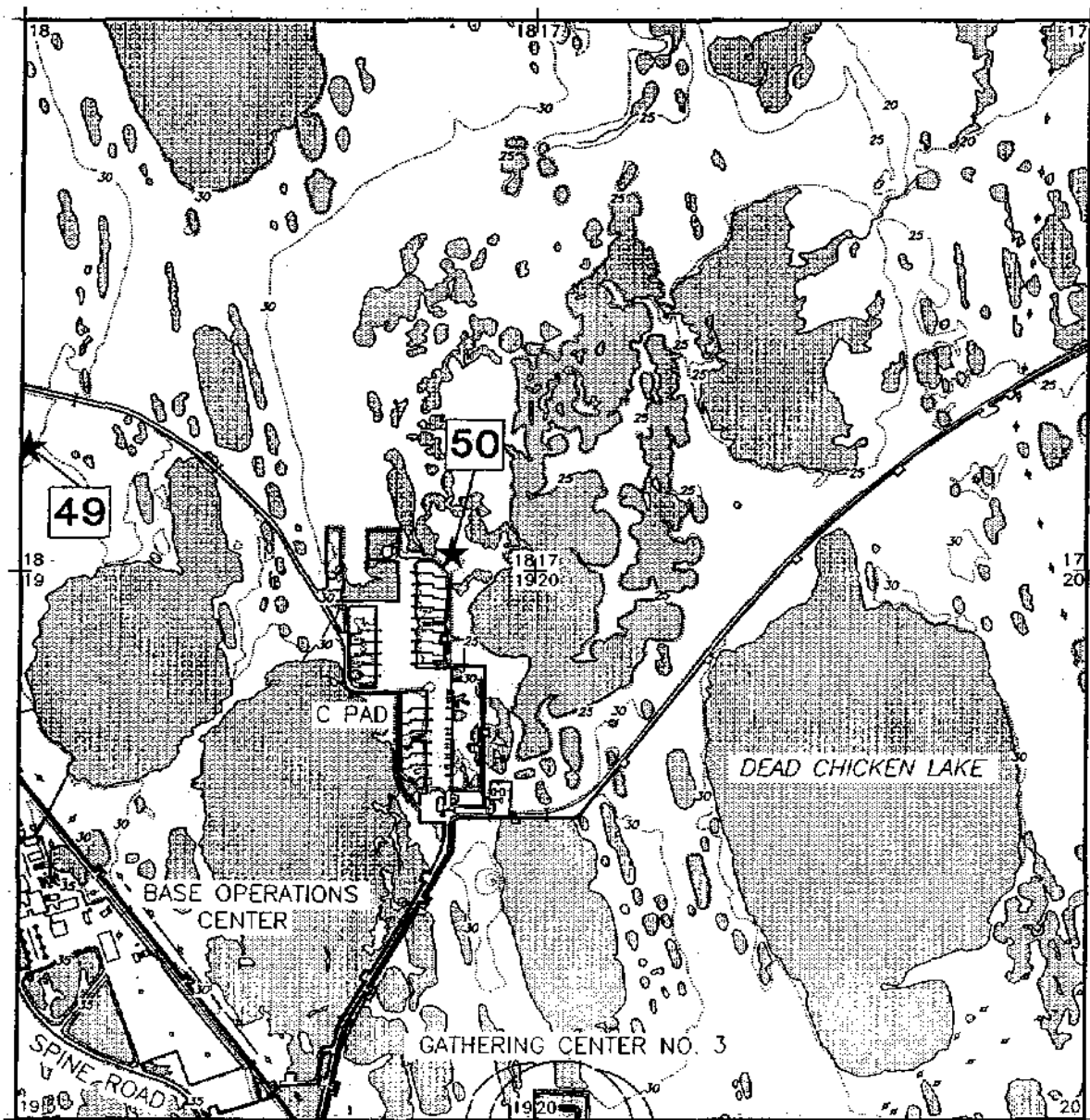


Figure A23. Location of fox den 45 in Beechey Point Quadrangle B-3, Township 11N, Range 13E, Sections 13, 14, 23, and 24.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Projection: Mercator/NAD27

Digital map provided by AeroMap U.S., Inc.

Based on 1973 photography, updated in 1988.

Map produced by Alaska Biological Research, Inc.

ABR Mopfile: 111417.MAP, 30 March 1993

DEN NO. 49: 70°18'13"N, 148°42'01"W

DEN NO. 50: 70°18'03"N, 148°40'03"W

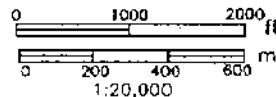


Figure A24. Location of fox dens 49 and 50 in Beechey Point Quadrangle B-3, Township 11N, Range 14E, Sections 17, 18, 19, and 20.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

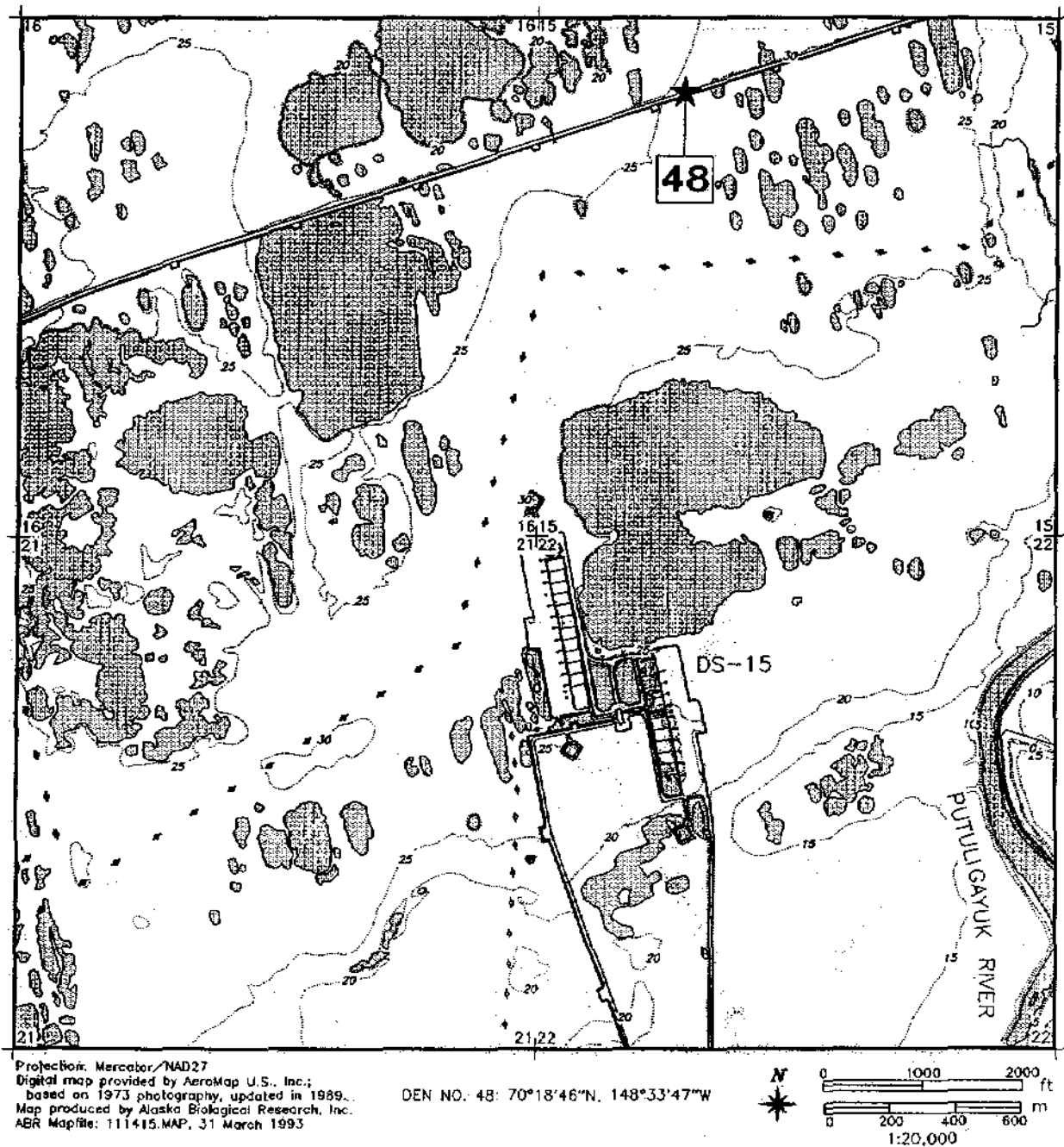
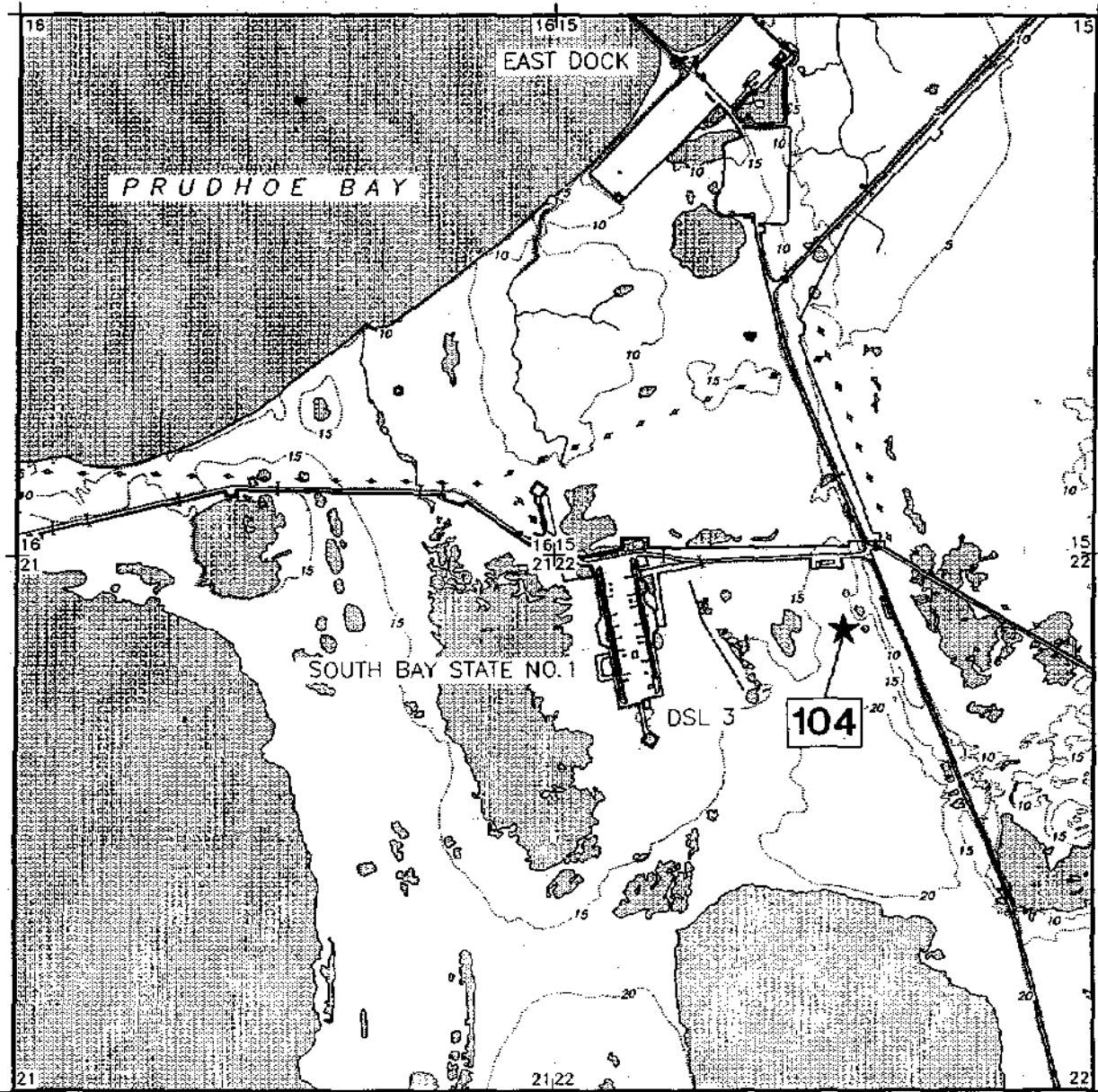


Figure A25. Location of fox den 48 in Beechey Point Quadrangle B-3, Township 11N, Range 14E, Sections 15, 16, 21, and 22.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992



Projection: Mercator/NAD27
Digital map provided by AeroMap U.S., Inc.;
based on 1973 photography, updated in 1989.
Map produced by Alaska Biological Research, Inc.
ABR Mapfile: 111515.MAP, 30 March 1993

DEN NO. 104: 70°17'54"N, 148°17'54"W

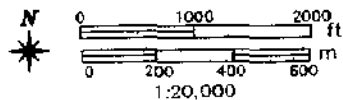


Figure A26. Location of fox den 104 in Beechey Point Quadrangle B-3; Township 11N, Range 15E, Sections 15, 16, 21, and 22.

Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992

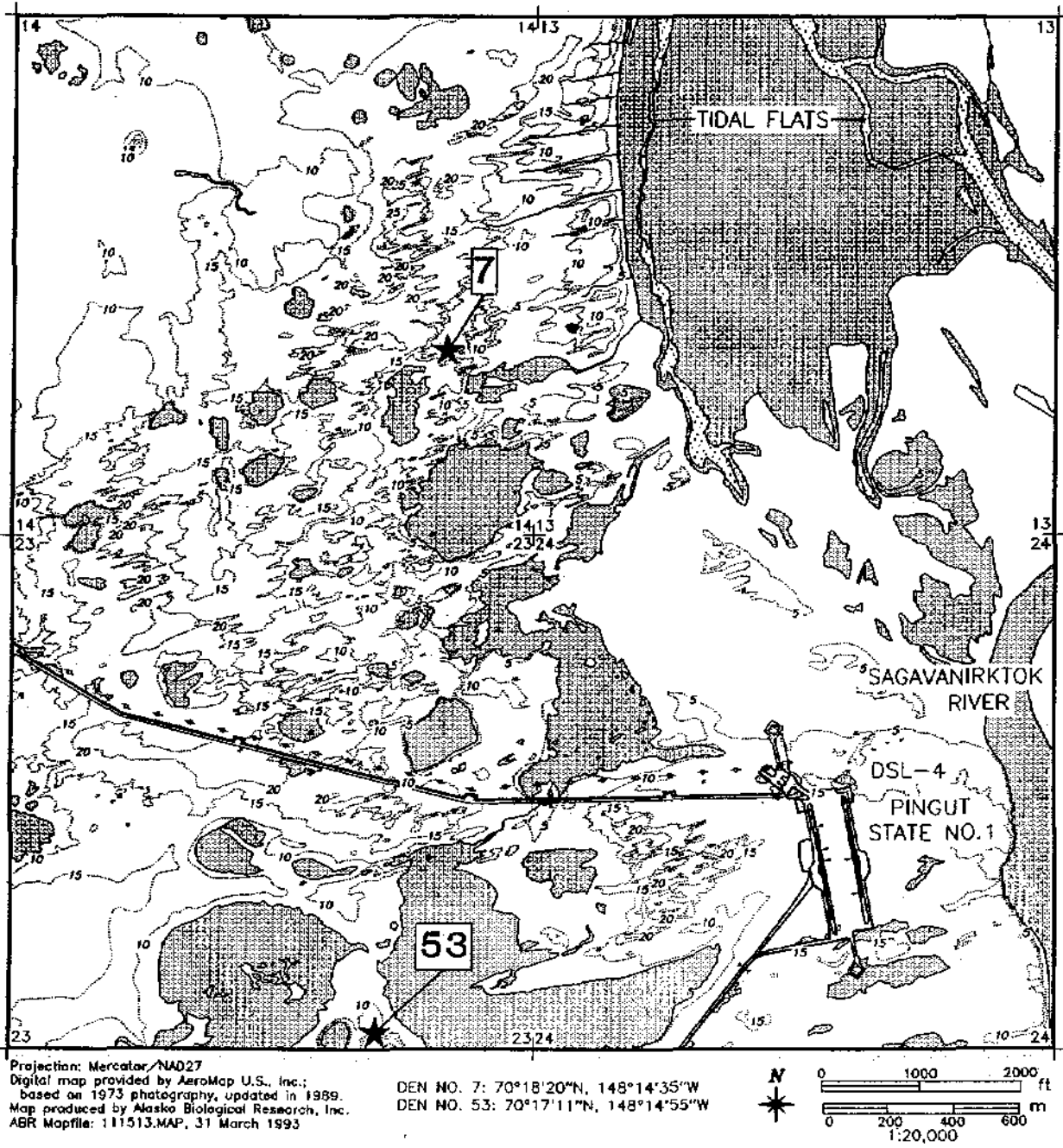
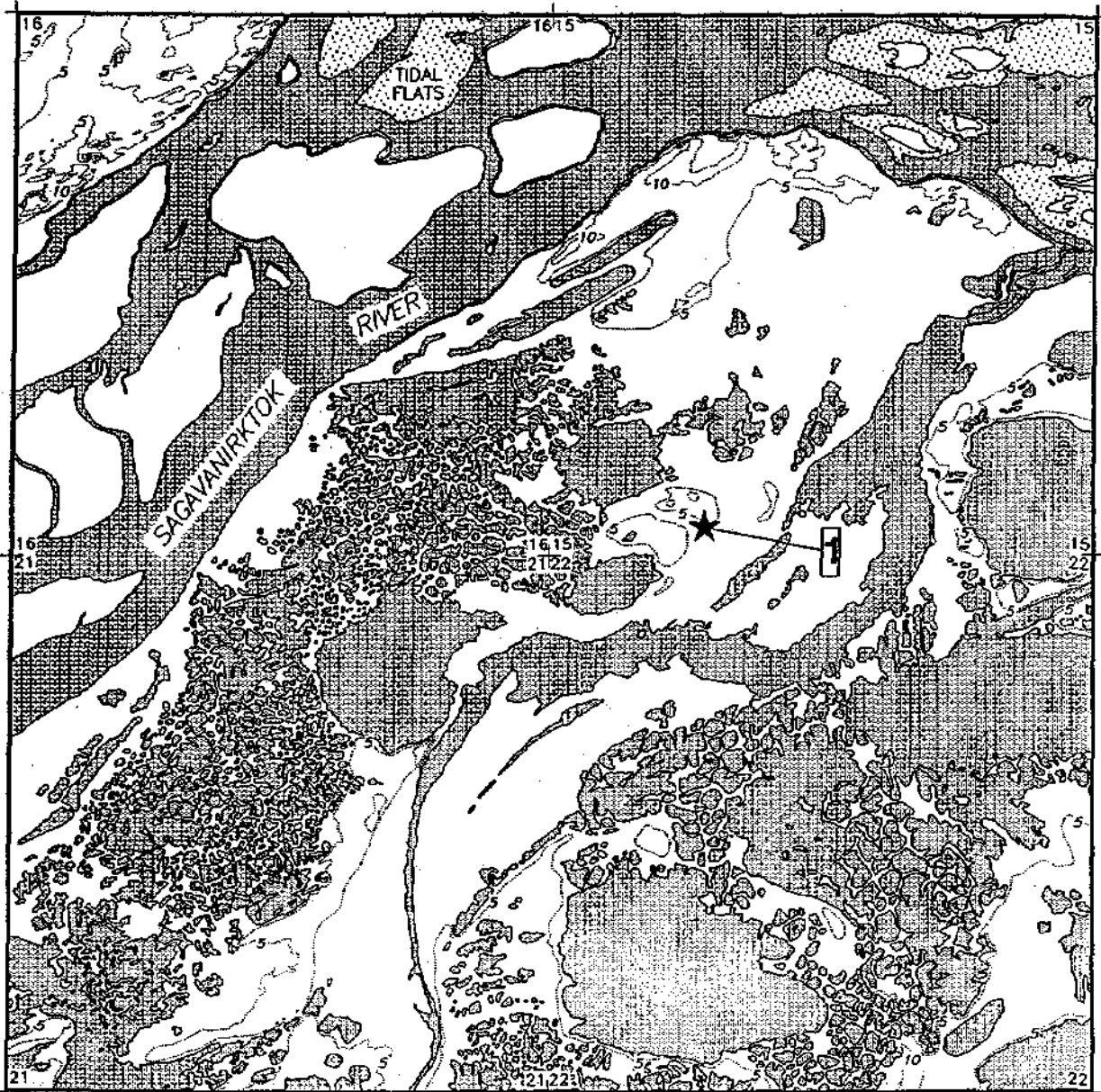


Figure A27. Location of fox dens 7 and 53 in Beechey Point Quadrangle B-3, Township 11N, Range 15E, Sections 13, 14, 23, and 24.



Projection: Mercator, NAD27
Original map provided by AeroMap U.S., Inc.,
based on 1973 photography, updated in 1987.
Map produced by Alaska Biological Research, Inc.
ABR Mapfile: 111615.MAP, 31 March 1993

DEN NO. 1: 70°18'04"N, 148°03'19"W

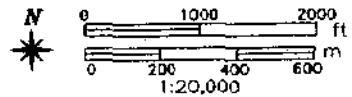


Figure A28. Location of fox den 1 in Beechey Point Quadrangle B-2, Township 11N, Range 16E, Sections 15, 16, 21, and 22.