

**MISSOURI RIVER
INTERIOR LEAST TERN AND PIPING PLOVER
POPULATION STATUS AND PRODUCTIVITY SUMMARY**

including
Permit Activity Report



*.....Learning today
Knowledge tomorrow.....*



**US Army Corps
of Engineers**
Omaha District

DECEMBER 1995

MISSOURI RIVER
INTERIOR LEAST TERN AND PIPING PLOVER
POPULATION STATUS AND PRODUCTIVITY SUMMARY
including
Permit Activity Report

1995

Prepared by the U. S. Army Corps of Engineers
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215 North 17th Street, Omaha NE 68102

A report submitted to meet condition 6 page 5
of the permit PRT-704930 (subpermit 93-07)

issued to

U.S. Army Corps of Engineers - Omaha District
Col. Michael S. Meuleners

1995 AT-A-GLANCE

INTERIOR LEAST TERN (*STERNA ANTILLARIUM*)

Missouri River Population Survey & Productivity Monitoring

	ADULT CENSUS	MONITORED ADULT CEN	NESTS	NESTS HATCHED	NEST(S) SUCCESS	EGGS	AVE CLUTCH SIZE	EGGS HATCHED	MONITORED CHICKS FLEDGED	TOTAL CHICKS FLEDGED ^(b)	RATIO	COLLECTED NESTS	COLLECTED EGGS	COLLECTED FLEDGED
Fort Peck Lake (FTPKRES)	2	2	5	0	0.0	6	1.20	0	0	0	0.00	0	0	0
Fort Peck River (FTPARRV)	95	43	31*	20*	64.5*	76*	2.45*	51*	21	47**	0.98	0	0	0
Lake Sakakawea (LKSRES)	7	7	2	0	0.0	5	2.50	0	0	0	0.00	0	0	0
Garrison River (GARRRIV)	284	284	159	72	45.3	403	2.53	193	126	126	0.89	15	26	13
Lake Oahe (LKOHRRES)	84	84	35	13	37.1	78	2.23	27	0	0	0.00	0	0	0
Fort Randall River (FTRLRIV)	10	10	26	0	0.0	32	1.23	0	0	0	0.00	11	17	9
Lewis & Clark Lak (LECLRES)	16	16	17	0	0.0	31	1.82	0	0	0	0.00	12	23	6
Gavina Point River (GAPTRIV)	93	93	118	26	22.0	253	2.14	55	23	23	0.49	42	92	50
TOTAL	591	539	393	131	33.3	884	2.25	326	170	196	0.66	80	160	78

a = Nests per 100 attempts

b = fledged chicks per pair of adult birds (Does not include collected fledged.)

* = Numbers represent monitored Reach subsample

** = Fledge Ratio x Adult Census Pairs

1995 AT-A-GLANCE

PIPING PLOVER (CHARADRIUS MELODUS)

MISSOURI RIVER POPULATION SURVEY & PRODUCTIVITY MONITORING

SITE	ADULT MONITORED		NESTS		ADULTS		NESTS		ADULTS		NESTS		ADULTS		NESTS		ADULTS	
	5	5	10	2	20.0	31	3.10	7	3	3	3	1.20	0	0	0	0	0	0
Fort Peck Lake (FTPKRES)	20	4	3*	3*	100.0*	11*	3.87*	8*	7	35**	0	3.50	0	0	0	0	0	0
Lake Sakakawea (LKSHRES)	24	24	42	5	11.9	145	3.45	14	0	0	14	0.00	14	51	0	0	0	44
Gardiner River (GARDRIV)	281	261	136	85	62.5	500	3.68	282	122	122	14	0.93	14	40	9	0	0	33
Lake Oahe (LKOHRES)	30	30	21	7	25.0	70	3.33	21	14	14	3	0.63	3	6	0	0	0	4
Ford Bendall River (FBLRIV)	0	0	7	0	0.0	9	1.29	0	0	0	0	0.00	0	0	0	0	0	0
Lewis and Clark Lake (LECLRES)	4	4	3	0	0.0	6	2.00	0	0	0	2	0.00	2	5	0	0	0	4
Gardner Point River (GAPTRV)	63	63	56	6	16.1	189	3.36	28	5	5	26	0.16	26	93	7	0	0	76
TOTAL	407	381	276	111	38.9	661	3.46	371	151	179	61	0.88	197	16	0	0	0	181

a = Nests per 100 attempts

b = fledged chicks per pair of adult birds (Does not include collected fledged.)

* = Numbers represent monitored Reach subsample

** = Fledge Ratio x Adult Census Pairs

SUBJECT: U.S. Army Corps of Engineers annual report on the Missouri River interior least tern (*Sterna antillarum*) and piping plover (*Charadrius melodus*) population status and productivity including activities conducted under endangered species research permit PRT-704930, subpermit 93-07.

PURPOSE: This report is intended to provide annual trend data on the adult populations and production estimates of least terns and piping plovers nesting along monitored reaches of the mainstem Missouri River during 1995. Efforts have been made to standardize data presentation in this report so that comparisons can be made with previous data collected on these reaches. All activities and procedures used to collect this data during the 1995 nesting season are discussed within this document. This report represents compiled data from eight U.S. Army Corps of Engineers Project and Natural Resource Offices, a contracted U.S. Fish and Wildlife Service-Ecological Services Office, and a contracted tribal fish and wildlife agency. If procedural information in greater detail than what is presented herewithin is required for comparative studies, unassimilated field office reports are available from the Operations Division of the Omaha District, U.S. Army Corps of Engineers, 215 North 17th Street, Omaha, NE 68102-4978.

INTRODUCTION

The U.S. Army Corps of Engineers (Corps) received a jeopardy Biological Opinion on the operations of the Missouri River Main-stem System from the U.S. Fish and Wildlife Service (USFWS) on November 14, 1990. This Biological Opinion (Opinion) concluded that the operations of the Missouri River would likely jeopardize the continued existence of the interior population of the least tern (*Sterna antillarum*) and the Great Plains population of the piping plover (*Charadrius melodus*). The least tern was listed as state and federally endangered in 1985. The piping plover was listed as state and federally threatened also in 1985.

The Opinion included Reasonable and Prudent Measures, Reasonable and Prudent Alternatives, and Conservation Measures that, if implemented, would preclude jeopardy to these species. The preclusion of jeopardy was based on production to be measured by fledge ratios of least terns and piping plovers on the Missouri River. Implementation of recovery measures is to be monitored through annual breeding adult population censuses and productivity surveys. Once productivity standards are achieved they will be maintained and monitored for ten consecutive years.

During the period from 1986-89 the Corps, in anticipation of an Opinion, began funding a series of studies to determine the population distribution of least terns and piping plovers throughout the Missouri River basin, and to determine factors influencing the decline of these species. Based on findings of these studies, measures were initiated to reduce the impacts of human recreation on nesting areas and water release hydrographs were developed to prevent flooding of nests and pre-fledged chicks.

Upon receiving the Opinion in 1990, the Corps intensified efforts to gather life history data and vital rates of piping plovers and least terns nesting on the Missouri River. Universities and the USFWS were contracted to collect this information during a second series of studies. Further measures, resulting from these continuing studies, have been developed and are currently being implemented to deter predation on the nesting colonies, to better control the inundation of low elevation nesting sites, and to retard the loss of habitat due to vegetation encroachment.

The 1995 nesting season represented the third year of an effort by the Corps to conduct the survey and monitoring activities and to become actively involved from the field perspective in the recovery of these two species. Corps staff from five Project Offices and three Natural Resource Offices were involved on seven of eight designated reaches of the Missouri River, conducting adult population surveys and productivity monitoring of nesting sites along nearly 850 miles of river and reservoir shoreline. In addition, the Corps provided funding for scope-of-work contracts with the USFWS-Montana Ecological Services field office and the Cheyenne River Sioux Tribal Fish and Wildlife Agency, which surveyed and monitored an additional reach and part of a second involving 60 river miles.

Data collection was standardized through the development and use of basin wide data cards for nest sites, adult surveys, and chick observations (See Appendix A for examples of nest cards and adult census cards). A guidelines manual for field personnel to use during piping plover and least tern survey and monitoring activities was utilized during the field season. Training sessions covering proper field techniques, chick identification, juvenile aging, permit compliance, and record keeping were held for all staff involved with either the adult surveys or the productivity monitoring.

All work was conducted in compliance with the conditions of the endangered species research permit (Regional Blanket Permit PRT-704930, subpermit 93-07) issued to the U.S. Army Corps of Engineers, Omaha District, Omaha, Nebraska, by the USFWS's Denver Regional Office to work on least terns and piping plovers within the Missouri River Basin during 1995, and with authorization of represented state game and fish departments. Contracted agencies were individually permitted.

DESIGNATED STUDY AREAS

Study development included designating eight reaches historically identified as plover and tern nesting areas within the mainstem Missouri River, to be used as management units. These reaches were selected based on geographic location, hydrographic characteristics, and the ability to control or influence water elevations through dam releases.

These eight management units include four riverine or lotic reaches and four reservoir reaches. Project or field office responsibilities for adult censuses and productivity monitoring were determined by proximity to the given reach.

In a change from 1994, the Corps of Engineers' Fort Peck Project assumed adult census and productivity monitoring on the Fort Peck River Reach from the U.S. Fish & Wildlife Service. Also a new subsample of the Fort Peck River Reach was monitored in 1995. The Corps' Garrison Project's Williston Resource Office conducted the adult census and productivity monitoring on the Missouri from River Mile (RM) 1581.4 to 1568.1.

Management reaches, agency and office conducting the surveys and monitoring activities during 1995, and inclusive river miles of survey and productivity subsample are listed below.

FORT PECK RESERVOIR (FTPKRES)

USFWS Charles M. Russell National Wildlife Refuge-Fort Peck Office
Billings Suboffice, Ecological Services; Assisted by Corps Fort Peck Project, Fort Peck, Montana

Adult Census: River Miles 1785.0-1771.0

Productivity: River Miles 1785.0-1771.0

MISSOURI RIVER BELOW FORT PECK RESERVOIR (FTPKRIV)

Corps Fort Peck Project, Fort Peck, Montana

Adult Census: River Miles 1770.9-1581.5

Productivity: River Miles 1714.0-1673.0

Corps Garrison Project Williston Resource Office, Williston, ND

Adult Census: River Miles 1581.4-1568.1

Productivity: River Miles 1581.4-1568.1

LAKE SAKAKAWEA RESERVOIR (LKSKRES)

Corps Garrison Project Williston Resource Office, Williston, ND

Adult Census: River Miles 1568.0-1480.5

Productivity: River Miles 1568.0-1480.5

Corps Garrison Project Riverdale Resource Office, Riverdale, ND

Adult Census: River Miles 1480.4-1389.6

Productivity: River Miles 1480.4-1389.6

MISSOURI RIVER BELOW LAKE SAKAKAWEA RESERVOIR (GARRRIV)

Corps Garrison Project Riverdale Resource Office, Riverdale, ND

Adult Census: River Miles 1389.2-1355.1

Productivity: River Miles 1389.2-1355.1

Corps Oahe Project Bismarck Resource Office, Bismarck, ND

Adult Census: River Miles 1355.0-1299.1

Productivity: River Miles 1355.0-1299.1

LAKE OaHE RESERVOIR (LKOHRRES)

Corps Oahe Project Bismarck Resource Office, Bismarck, ND

Adult Census: River Miles 1299.0-1232.0

Productivity: River Miles 1299.0-1232.0

Corps Oahe Project Mobridge Resource Office, Mobridge, SD

Adult Census: River Miles 1231.5-1165.1

Productivity: River Miles 1231.5-1165.1

Corps Oahe Project Pierre Resource Office, Pierre, SD

Adult Census: River Miles 1165.0-1072.0

Productivity: River Miles 1165.0-1072.0

Cheyenne River Sioux Tribe, Cheyenne Sioux Reservation, SD

Adult Census: River Miles 1187.0 - 1110.0

MISSOURI RIVER BELOW FORT RANDALL DAM (FTRLRIV)

Corps Fort Randall Project Office, Pickstown, SD

Adult Census: River Miles 880.0-845.0

Productivity: River Miles 880.0-845.0

LEWIS AND CLARK RESERVOIR (LECLRES)

Corps Gavins Point Project Office, Yankton, SD

Adult Census: River Miles 845.0-811.0

Productivity: River Miles 845.0-811.0

MISSOURI RIVER BELOW GAVINS POINT DAM (GAPTRIV)

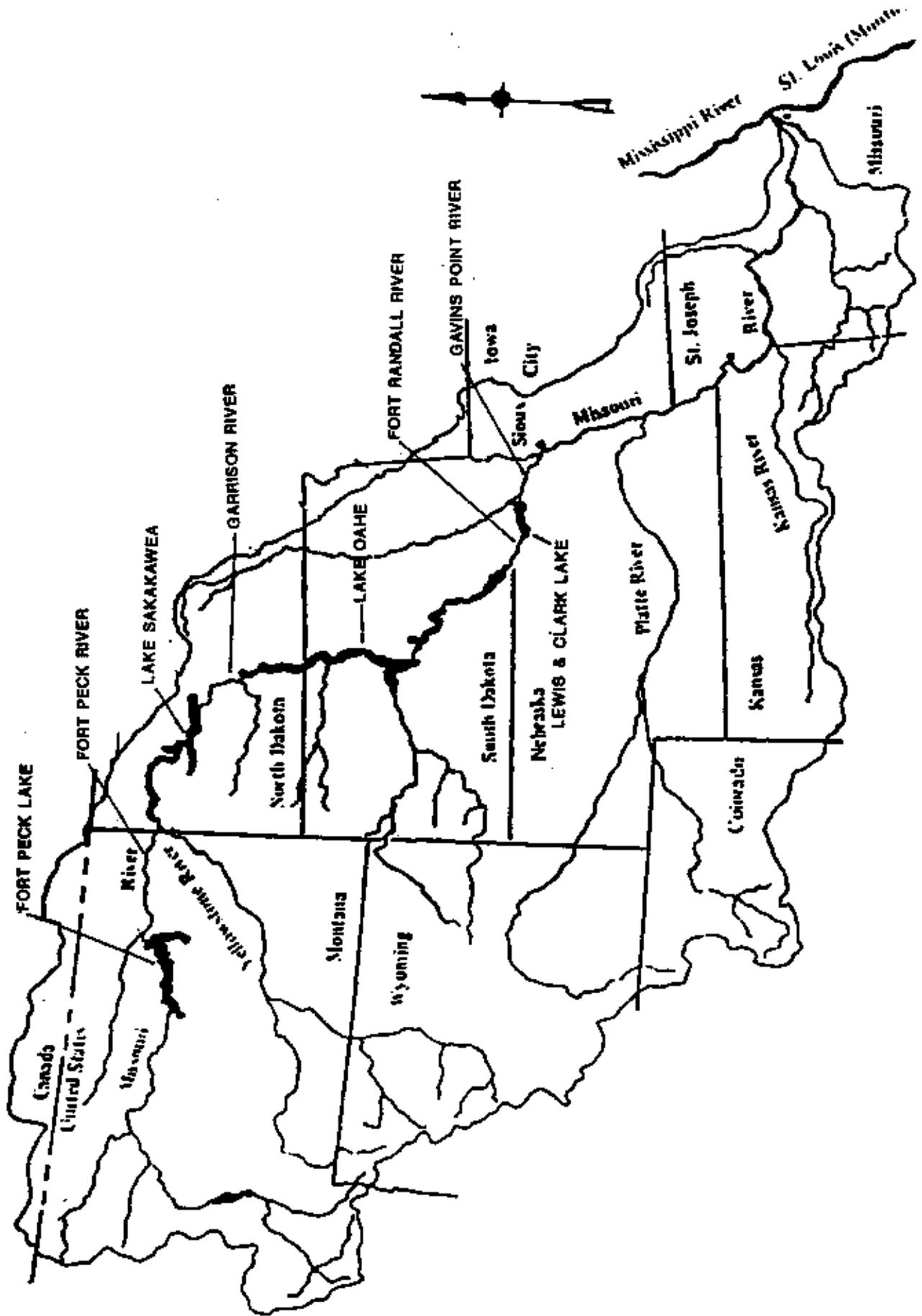
Corps Gavins Point Project Office, Yankton, SD

Adult Census: River Miles 811.0-750.0

Productivity: River Miles 811.0-750.0

On the following page is a map of the study areas.

MISSOURI RIVER STUDY AREAS



MISSOURI RIVER REACH DESCRIPTIONS & HISTORICAL BACKGROUND

Missouri River:

The Missouri River and its tributaries dominate the north central region of the United States. The Missouri begins at the confluence of Madison, Jefferson, and Gallatin Rivers near Three Forks, Montana. The river travels 2,300 miles north, east, and southeasterly to its joining with the Mississippi River just north of St. Louis Missouri. The Missouri and its tributaries drain a basin of over 529,000 square miles, including 9,700 square miles in Canada. The Missouri River Basin includes all of Montana and Wyoming east of the Continental Divide, most of North Dakota and South Dakota, all of Nebraska, the northern halves of Kansas, and Missouri, the northeast part of Colorado, and small portions of western Iowa and southwestern Minnesota.

Topographically the western part of the Basin is dominated by the northern Rocky Mountains. Going east the Rockies give way to the Great Plains which encompasses more than half of the Basin. These high relatively flat lands in turn slope down to the central lowlands in the eastern part of the Basin. In the northern plains the major tributary of the Missouri is the Yellowstone River. The Yellowstone originates in northwestern Wyoming in Yellowstone National Park. The river wanders northeasterly through Montana to its confluence with the Missouri just east of the Montana-North Dakota state line. Other important northern tributaries of the Missouri include the Milk, Little Missouri, Cheyenne, White, James, and Niobrara Rivers.

The Missouri River and its ecosystem have seen vast changes since the coming of the first European explorers in the 1700s. Originally the river meandered through a broad riverine/floodplain forest ecosystem forming braided channels, sandbars, sloughs, chutes, islands, and backwater areas. The system was constantly refreshed by the Missouri's high propensity for flooding. Typically river flows would rise in March and April with the snow melt on the plains and ice melt from the rivers and streams feeding the Missouri. There would be a second higher peak in the flows in June as the snow melt from the Rockies reached the river. Flows would then decline through the summer and fall. More often than not however, the flows of the Missouri were not typical. It has been estimated that the Missouri would flood on average two out of every three years. This flooding benefited the ecosystem by scouring sandbars of vegetation, by building up existing sandbars, and by creating new islands.

Though flooding benefited the Missouri's ecosystem, it proved disastrous to the towns and industries that sprung up along the river. The flooding of towns and farms would cause loss of life, destroy and damage property, and inundate farmland. The creation of sandbars and shifting of the river channel would make navigation hazardous and difficult on the Missouri. Following a series of destructive floods on the Missouri and Mississippi Rivers in the 1930s the Congress took action. In 1944 the Flood Control Act became law.

This legislation authorized the construction of dams on the Missouri and its tributaries as a means of obviating the flood threat. The centerpiece of the construction was the building of five major dams on the Missouri. These dams; Gavins Point on the Nebraska-South Dakota border, Fort Randall, Big Bend, and Oahe in South Dakota, Garrison in North Dakota, and the previously constructed Fort Peck Dam in Montana, became the primary mechanism for controlling floods on the Missouri. To provide for safe navigation the Missouri was channelized and dredged from Sioux City, Iowa to St. Louis.

These construction projects accomplished the goals of reducing flooding on the Missouri and providing a reliable navigation season on the river. However these actions had a detrimental effect on the Missouri's riverine-floodplain forest ecosystem. The reservoirs formed by the dams inundated hundreds of miles of the river. The reservoirs also serve as depositories for sediment carried by the Missouri. The loss of this sediment has had two detrimental effects on the river below the dams. First it has eliminated material for sandbar and island building. Second it has resulted in greater degradation of the riverbed. With the loss of sediment the riverbed deepens and the elevation of the sandbars above the river rises. The elimination of periodic flooding through the controlled releases from the dams has destroyed the river's ability to scour vegetation from the sandbars. This had led to the encroachment of vegetation onto many of sandbars located downriver from the dams. The elimination of the flood threat has also led to more housing developments along the river. This in turn has led to a greater recreational use of the sandbars. Finally the channelization of the Missouri from Sioux City to its confluence with the Mississippi has despoiled it as a natural system.

Fort Peck Lake Reach:

The Fort Peck Lake Reach of the Missouri River consists of the eastern portion of Fort Peck Lake. Fort Peck Lake is the result of the construction of Fort Peck Dam at Missouri River Mile (RM) 1771.5 Construction on the dam began in 1933 and operation of the facility began in 1940. Fort Peck Lake varies in size from 212,000 acres at elevation 2234 feet mean sea level (msl) to 240,000 acres at elevation 2246 feet msl. The primary water source for the reach is the Missouri River. The Missouri drains around 57,500 square miles of Montana and Canada into the lake.

The land surrounding Fort Peck Lake consists mostly of upland rolling hills and "breaks" containing badlands topography. Several sand and gravel mixed beaches exist along the shoreline of the lake. The size of the beaches varies with the elevation of the lake. Grasslands dominate the vegetation of the reach. Some trees and shrubs will be found in coulees and other drainages.

The climate of the Fort Peck Lake Reach is typical of the western Great Plains region, with hot summers, and cold, dry winters. Prolonged droughts and frequent shorter periods of deficient moisture, interspersed with periods of abundant precipitation are characteristic of the area. The average annual temperature is 43 degrees Fahrenheit, with

normal summer daily high temperatures ranging in the 80s and 90s, usually accompanied by low humidity. Winter temperatures frequently drop below zero degrees Fahrenheit with temperatures of minus forty degrees being recorded. The reach is a semi-arid region, with normal annual precipitation between ten to twelve inches, 80% of which occurs during April to September. Hail is also a common occurrence in the project area. The prevailing winds during April to October are predominately west to northwesterly, and east to southeasterly. Summer winds are highly variable since they are subject to passing storm systems and fronts

The primary human activity on Fort Peck Lake is recreation. Recreational use includes fishing, both from shore and boats, pleasure boating, water skiing, camping, and swimming. The majority of project lands that surround the lake are leased to the U.S. Fish & Wildlife Service to form the Charles M. Russell National Wildlife Refuge. Away from the lake agriculture, in the form of livestock raising and some farming, is the dominant industry.

Fort Peck River Reach:

The Fort Peck River Reach of the Missouri River begins at Fort Peck Dam in eastern Montana, RM 1771.5, and travels 203 miles in an easterly direction to the western boundary of Lake Sakakawea in North Dakota (RM 1568). The primary water sources for this reach are the releases from Fort Peck Dam, and inflows from the Milk (RM 1761.5), Poplar (RM 1678.9), and Yellowstone (RM 1582) Rivers. Smaller tributaries such as the Big Muddy Creek and Redwater River also contribute to the discharge, albeit to a lesser extent.

The majority of the sandy/silty substrates typically used by terns and plovers in the upper reach are situated downstream of the Milk River confluence, possibly resulting from the Milk River's relatively high contribution of suspended particulate matter. The Poplar River also transports a considerable amount of suspended fine sediments. The islands and sandbars formed by sediment deposition along the Missouri River system are highly dynamic, and are altered by fluctuating river flows. Pre-dam flows were generally high early in the season (spring) and decreased throughout the summer season. High spring flows, in addition to ice, would scour the river basin, accelerating erosion rates and preventing the establishment of emergent vegetation on seasonally-exposed sandy areas. Flows generally decreased in late spring, exposing the sandy substrate free of dense vegetation, which was ideal for tern and plover nesting. The construction of Fort Peck Dam altered normal seasonal flow rates, creating artificial rates which fluctuate daily.

On the lower part of the reach the Yellowstone has the potential to greatly influence the Missouri below the confluence of the two rivers. The Yellowstone drains over 70,000 square miles. It is the longest free flowing river in the United States with only one dam, Yellowtail, located on a major tributary, the Bighorn River. Spring runoff from the Yellowstone watershed can dramatically change this portion of the Missouri's appearance

from year to year. High runoff will inundate many of the sandbars and islands. Conversely a low runoff exposes miles of sandy beaches.

Three landforms; uplands, breaks, and floodplains, dominate the reach. The Missouri River marks the southernmost advance of the Pleistocene glaciers. The glaciated portions of the area are characterized by level to rolling uplands dissected by coulees and gullies, whereas the unglaciated areas are characterized by low hills, rugged breaks and badlands. Soils in the area result from soft, sedimentary bedrock (sandstone, siltstone, shale), local and regional alluvium, and a small amount of glacial till. The dissected badlands area is composed predominately of loam and clay, creating a high erosion potential. The north side of the river tends toward a broad floodplain while the south side is a combination of floodplain and bluffs dissected by coulees.

The riverbank vegetation contains a combination of mature floodplain cottonwood forest, woody draws in the coulees, grasslands, and farm fields. Several sandbars and islands dot this reach. Vegetation on the islands includes grasses, forbs, shrubs, and willows. Mature cottonwoods will be found on some islands.

The climate of the Fort Peck River Reach is typical of the western Great Plains region, with hot summers, and cold, dry winters. Prolonged droughts and frequent shorter periods of deficient moisture, interspersed with periods of abundant precipitation are characteristic of the area. The average annual temperature is 43 degrees Fahrenheit, with normal summer daily high temperatures ranging in the low 80s and 90s, usually accompanied by low humidity. Winters may be extremely cold with temperatures of minus 40 degrees being recorded. The reach is a semi-arid region, with normal annual precipitation of 11.52 inches, 80% of which occurs during April to September. Runoff is rapid due to the fine texture and high clay content of the soil. Thus, sudden rainstorms can cause major flooding on the watershed. Hail is also a common occurrence within the reach. The prevailing winds during April to October are predominately west to northwesterly, and east to southeasterly. Summer winds are highly variable since they are subject to passing storm systems and fronts

Human activities within the reach include recreation, farming, livestock grazing, bank stabilization projects and water intakes for irrigation. Recreational use includes fishing, both from shore and boats, pleasure boating, and canoeing.

Lake Sakakawea Reach:

The Lake Sakakawea Reach consists of two lakes, Sakakawea and Audubon. Both were created with the impoundment of the Missouri River by the construction of the Garrison Dam. Garrison Dam was constructed in the 1950s by the U.S. Army Corps of Engineers and is fifth in ascending order of six mainstem dams on the Missouri. The dam is located in central North Dakota at RM 1389.86. From the dam Lake Sakakawea extends 178 miles in a northwesterly direction ending at river mile 1586.00. Lake Audubon is

located ten miles northeast of the dam and was created by the placement of a three mile long causeway across the eastern end of Lake Sakakawea. At full pool (1850 feet mean sea level) Lake Sakakawea covers 364,000 acres, making it the largest man made lake in the United States. Lake Audubon covers 17,500 acres.

Water from 181,400 square miles of the Missouri River Basin flow into Lake Sakakawea. Of this, 57,500 square miles of Missouri River drainage are controlled by Fort Peck Dam in Montana. The remaining 123,900 square miles drain from the Yellowstone River and it's primary tributaries; the Big Horn, the Tongue, and Powder Rivers, and from the Milk, Poplar, and Little Missouri Rivers. The Yellowstone River furnishes about 50% of the 17,500,000 acre feet of water that annually flows into the headwaters of Lake Sakakawea. The Missouri River provides 42%. The remaining 8% flows into the lake by way of the Little Missouri River, Little Muddy River, White Earth River, Douglas Creek, and Shell Creek. The major source of water for Lake Audubon is Lake Sakakawea through a pumping station maintained by the Bureau of Reclamation.

The pool elevation Lake Sakakawea varies from an average low of 1834.4 feet msl in March to an average high of 1842.3 feet msl in July. Though uncommon, yearly elevation changes of more than fifteen feet have occurred on the lake. These changes can drastically alter the amount of habitat available to shorebirds including the least tern and piping plover. The lake elevation for Lake Audubon is controlled by the Snake Creek Pumping Station. The elevation is kept stable throughout the spring, summer, and fall under a cooperative agreement between the Bureau of Reclamation, the U.S. Fish & Wildlife Service, and the North Dakota Game & Fish Department. The lake elevation is then drawn down before winter to curb shoreline erosion.

The topography of the Lake Sakakawea Reach is dominated by the Missouri Trench through which flows the Missouri River. This river valley has been flooded nearly 180 miles by the impoundment of the Missouri by the Garrison Dam. The trench is generally three to five miles wide with a maximum elevation between 200 and 250 feet. Throughout its length the trench is dissected by intermittent stream valleys and coulees draining into the Missouri.

The Lake Sakakawea Reach is located in the high latitude continental climate. This climate is marked by long cold winters where the temperature frequently drops below zero degrees Fahrenheit with temperatures of -40 degrees Fahrenheit being recorded. Summer maximums range in the mid 80 degrees Fahrenheit though temperatures above 100 degrees Fahrenheit are not uncommon. The lake surface is frozen about four months out of the year with the average ice up occurring on December 25 and average ice out on April 21. The prevailing wind is from the west to northwest. The wind averages around eleven miles per hour but winds have been clocked at greater than seventy miles per hour. Though infrequent, tornadoes do occur. The precipitation averages around fourteen to fifteen inches per year with 75% occurring during the months of April through September.

Five vegetation communities are found within the project boundaries of the Lake Sakakawea Reach. In ascending order from the lake they are Aquatics, Flood Plain, Riparian-Woody Draws, Lowland Grasslands, and Upland Grasslands.

The land surrounding the Lake Sakakawea Reach is almost entirely owned by the federal government and administered by the U.S. Army Corps of Engineers. Land use activities include wildlife management, livestock grazing, farming, and recreation. Potential conflicts with terns and plovers exist with the last three uses. Livestock use beaches favored by the birds for watering purposes. Farmers use the shoreline for irrigation pumps. People use the shoreline and island beaches for camping, picnicking, sightseeing, off road vehicle driving, exercising pets, and other recreation activities.

The completion of Garrison Dam in the 1950s dramatically changed the hydrograph in the Lake Sakakawea Reach. About 160 to 180 miles of riverine habitat was destroyed and replaced by a reservoir. The presence of nesting least terns and piping plovers within the reach shows the birds have adapted to this changed ecosystem. Despite this adaptation, it must be concluded that the loss of such extensive riverine habitat has detrimentally affected the two species.

Garrison River Reach:

The Garrison Reach of the Missouri River begins at the Garrison Dam in west central North Dakota (RM 1389.9) and travels south 90 miles to the northern boundary of Lake Oahe located just south of Bismarck ND (RM 1299). The vast majority of water for this reach is supplied through releases from Garrison Dam. The only major tributaries within the reach are the Knife (RM 1374.5) and Heart (RM 1311.3) Rivers. The contributions of the two rivers are minimal except for occasional flooding within their watersheds.

The Missouri on this reach is free flowing, however it is constrained by bank stabilization projects and the dam has eliminated periodic flooding. The topography is that of a relatively flat floodplain with some breaks and upland areas. Cutbanks vary from 5 to 35 feet in height. Usable nesting islands and sandbars begin at RM 1380 and continue downstream throughout the stretch. These islands and bars have traditionally been forming and eroding throughout the history of the Missouri River. Since closure of the Garrison Dam the islands and bars have been eroding with little or no additional formation due to the reduced silt load and stabilization projects on both banks of the river.

Vegetation has become established on nearly all the islands. These include grasses, forbs, and shrubs. The islands which rarely or never become inundated have mature woody vegetation including sand willows and cottonwoods. The existing vegetation along the banks is either overmature dying cottonwoods or some type of agriculture regime - grazing and farm lands.

The reach is located in the high latitude continental climate. This climate is marked by long cold winters where the temperature frequently drops below zero degrees Fahrenheit with temperatures of -40 degrees Fahrenheit being recorded. Summer maximums range in the mid 80 degrees Fahrenheit though temperatures above 100 degrees Fahrenheit are not uncommon. The prevailing wind is from the west to northwest. The wind averages around ten miles per hour but winds have been clocked at greater than seventy miles per hour. Though infrequent, tornadoes do occur. The precipitation averages around fourteen to fifteen inches per year with 75% occurring during the months of April through September.

Human activities within the reach include recreation, agriculture, bank stabilization projects, water intakes for cities and power plants, and housing developments. Recreational use includes fishing, both from shore and boats, pleasure boating, jet skis, canoeing, water skiing, beach sports, swimming and sunbathing. Fishing enthusiasts may be found all over the reach. The other recreational activities are concentrated in the reach areas next to the Bismarck-Mandan metropolitan area. Likewise the majority of the riverside housing developments are found around and above Bismarck-Mandan. Other riverside communities may be found near Stanton, Washburn, and Wilton ND.

Several bank stabilization projects have been conducted over the years along the river. They have been sponsored by state, Federal and local entities including private individuals and companies. About 50% of the shoreline between the Garrison Dam and Bismarck ND is under some form of bank protection (abutments, jetties and riprap).

Lake Oahe Reach:

The Lake Oahe Reach was created with the impoundment of the Missouri River by the construction of the Oahe Dam. Oahe Dam was constructed in the 1950s and 1960s by the U.S. Army Corps of Engineers and is fourth in ascending order of six mainstem dams on the Missouri. The dam is located in central South Dakota five miles north of Pierre at RM 1072.3. Lake Oahe continues north for 227 miles and ends just south of Bismarck ND (river mile 1299). At full pool (1617 feet mean sea level) Lake Oahe covers 360,000 acres, making it the second largest man made lake in the United States. Water from 243,490 square miles of the Missouri River Basin flow into Lake Oahe. Of this, 123,900 square miles of Missouri River drainage are controlled by Garrison Dam in North Dakota. The major contributor of water to Lake Oahe is the Missouri River. Other rivers that flow into the lake include the Cannonball, Grand, Moreau, and Cheyenne.

The topography of the reach consists primarily of rolling hills and plains interspersed with some ridges and buttes. These forms give way in the north to the relatively flat and non-inundated floodplain of the Missouri River. The land surrounding Lake Oahe contains a variety of habitats. In the floodplain the cottonwood forests have been reduced to corridor riverine habitat by the development of farmland and pasture. High islands that remain above water during peak flows are now often heavily to moderately vegetated. The sandbars that emerge during low water levels are clean to lightly vegetated

although these bars easily become inundated. Up from the lake grasses dominate the upland prairies. Mixed in are a variety of wildflowers and some shrubs. Connecting the uplands with lake are numerous coulees and draws that contain an assortment of trees and shrubs.

The land surrounding Lake Oahe is almost entirely owned by the federal government and is administered by the U.S. Army Corps of Engineers. Land use activities include wildlife management, livestock grazing, farming, and recreation. Potential conflicts with terns and plovers exist with the last three uses. Livestock use beaches favored by the birds for watering purposes. Farmers use the shoreline for irrigation pumps. People use the shoreline and island beaches for camping, picnicking, sightseeing, off road vehicle driving, exercising pets, and other recreation activities.

The Missouri River and surrounding land have undergone extensive change since the completion of Oahe Dam. Before its impoundment the Missouri River was a meandering and dynamic river that constantly eroded and deposited sandbars and islands. These sandbars and islands had the vegetation continuously scoured off by heavy spring flows and ice. These actions created habitat favorable to nesting terns and plovers. Over two hundred miles of this habitat was inundated by Lake Oahe. Periodic low lake levels temporarily recreates some of this habitat on the northern part of the lake. The current operating procedure for Lake Oahe calls for a peak pool elevation in May followed by slowly declining levels. This regime uncovers shoreline and some islands in the northern part and must be considered favorable for terns and plovers. Naturally, the lower the beginning elevation the more habitat that is available.

For the thirty miles of Lake Oahe below the headwaters, the lake exhibits riverine characteristics. This portion offers the least terns and piping plovers sandbars for nesting when Oahe's pool elevation is below 1604 feet mean sea level (msl) and discharges from Garrison Dam are less than 15,000 cubic feet per second (cfs). At higher pool levels and or higher discharge rates, most of the sandbars become inundated. The majority of available habitat will become inundated with an increase to only 17,500 cfs flows. Most of the sandbars have a sand and gravel composition although bars that emerge when the high water levels recede are often silty and quickly acquire an algal growth.

Oahe Dam has a greater effect on the rest of Lake Oahe than can be seen on the northern portion. The lake has few sandbars, but does have an extensive shoreline. This leaves limited habitat for the terns and plovers. The few islands that are on the lake are heavily vegetated and the shoreline is subject to rapid change with rising and falling pool levels. The only extensively used habitat in the lower part of the lake is a silt and sand man-made island (Dredge Island) at RM 1270.0 and Porcupine Island at RM 1249.0. New sandbars are rarely created on the lake or the river. The lake's shoreline offers nesting areas where sandbars are not present. The width of the shoreline varies with the pool level. Historically, little lakeshore habitat is available with pool elevations above 1600 feet msl. Lakeshore habitat used for nesting have a sand and pebble composition with an abundance

of driftwood and scattered cottonwoods. This habitat is marginal at best and is often subject to cattle and human disturbance.

Fort Randall River Reach:

The Fort Randall Reach of the Missouri River begins at the Fort Randall Dam in southeast South Dakota (RM 880.0) and travels in a southeasterly direction 35 miles to the western boundary of Lewis & Clark Lake (RM 845.0). The majority of water for this reach is supplied through releases from Fort Randall Dam.

The Missouri here is free flowing, however controlled releases from Fort Randall Dam has eliminated periodic flooding for most of the reach. The topography is that of a relatively flat floodplain that gives way to upland areas. The uplands in turn are dissected by coulees and ravines that lead down to the river.

The floodplain forest is the dominant ecosystem along the river. In many areas along both banks however the forest has been eliminated and replaced by farm lands. Without the scouring by floods vegetation has become established on most of the islands in the reach. These include grasses, forbs, and shrubs. Some islands that seldom, if ever, are inundated have developed stands of cottonwoods.

The reach is located in an area typical of a continental-interior climate with great variations in weather not only from season to season but also from year to year. Hot summers and cold winters are typical with humidity ranging from an average of 60% in the afternoon to 80% during the night and early dawn. The frost-free period in the area averages 155 days. Precipitation in the region averages 25 inches of rainfall annually with the majority of it occurring during the spring and summer months. The average seasonal snowfall for the reach is around 30 inches. Thunderstorms can be expected to occur about 45 days out of the year. Tornado and severe weather pass through the region infrequently. Temperatures can exceed 100 degrees Fahrenheit in summer and drop to below 0 degrees in the winter months. The average summer daily temperature is 72 degrees and the average winter daily temperature is 24 degrees. The winds are predominantly from the south-southwest during the summer and from the northwest during the winter months. Wind speeds vary greatly, and it is not uncommon to have winds up to 50 mph during the year.

Human activities within the reach include recreation, agriculture, bank stabilization projects, and housing developments. Recreational use includes fishing, both from shore and boats, pleasure boating, jet skis, canoeing, swimming and sunbathing. In the Niobrara Scenic River Designation Act of 1991 this 35 mile portion of the Missouri was designated a National Recreation River. With this designation increased recreation pressure on the reach is expected. With the construction of the Fort Randall Dam and the elimination of a flood threat several trailer park communities have sprung up along the river. The establishment of these trailers, primarily on the Nebraska side of the river, and the

development of agriculture tracts on both sides of the river has led to an increased demand for more bank stabilization projects.

Lewis & Clark Lake Reach:

The Lewis & Clark Lake Reach was created with the impoundment of the Missouri River by the construction of the Gavins Point Dam. Gavins Point Dam was constructed in the 1950s by the U.S. Army Corps of Engineers and is first in ascending order of six mainstem dams on the Missouri. The dam is located on the South Dakota Nebraska border four miles west of Yankton SD at RM 1811.1. From the dam Lewis & Clark Lake extends thirty-four miles in a westerly direction ending at RM 845. At full pool (1208 feet mean sea level) Lewis & Clark Lake covers 28,000 acres.

Water from 279,480 square miles of the Missouri River Basin flow into Lewis & Clark Lake. All but 16,000 square miles of this drainage is controlled by Fort Randall Dam which is 39 miles upriver from the lake. Most of Lewis & Clark's uncontrolled drainage comes from the Niobrara River which enters the lake at RM 844. The Niobrara transports a heavy amount of silt and sand into the reach. It is estimated the Niobrara contributes 60% of the annual sediment inflow to the lake, making it the major contributor to the accumulation of sand bars and delta formation in the upper third of the lake.

Lewis & Clark is a relatively stable lake that is managed between a three and half foot maximum (1208.0 msl) and minimum (1204.5 msl) operating pool levels. Under flood conditions the lake can be raised an additional two feet to 1210.0 msl. The reach's topography is divided into two distinct types. On the eastern half the lake is confined between hills and ridges that rise to 100 feet above the lake. The western half is a relatively flat floodplain headwaters mixture of braided channels and islands that become rolling hills away from the lake.

The reach is located in an area typical of a continental-interior climate with great variations in weather not only from season to season but also from year to year. Hot summers and cold winters are typical with humidity ranging from an average of 60% in the afternoon to 80% during the night and early dawn. The frost-free period in the area averages 155 days. Precipitation in the region averages 25 inches of rainfall annually with the majority of it occurring during the spring and summer months. The average seasonal snowfall for the project area is 34 inches. Thunderstorms can be expected to occur about 45 days out of the year. Tornado and severe weather pass through the region infrequently.

Temperatures range from an excess of 100 degrees Fahrenheit in summer to below 0 degrees Fahrenheit in the winter months. The average summer daily temperature is 72 degrees and the average winter daily temperature is 24 degrees. Winds in the area of the lake are predominantly from the south-southwest during the summer and from the northwest during the winter months. Wind speeds vary greatly, and it is not uncommon to

have winds up to 50 mph during the year. The highest average wind speed for a one month period occurs during April, with a daily average of 14 mph.

Four vegetation communities are found within the project boundaries of the Lewis & Clark Lake Reach. In ascending order from the lake they are Aquatics, Floodplain, Riparian-Woody Draws, and Upland Tallgrass and Mixed Grass Prairie.

The land surrounding the Lewis & Clark Lake is owned by the federal government and administered by the U.S. Army Corps of Engineers. The primary land use activities are wildlife management and recreation. Recreation activities include camping, picnicking, sightseeing, fishing, hunting, pleasure boating, water skiing, sailing, swimming, scuba diving, and sunbathing. Visitation to the lake topped 2.5 million visitors in 1994.

Gavins Point River Reach:

The Gavins Point Reach of the Missouri River begins at the Gavins Point Dam in southeast South Dakota northeast Nebraska (RM 811.1) and travels in a southeasterly direction 58 miles to Ponca NE (RM 753.0). The majority of water for this reach is supplied through releases from Gavins Point Dam. The two primary tributaries on this reach are the James River which joins the Missouri at RM 800.5 and the Vermillion River which enters at RM 772.0.

The Missouri here is free flowing, however controlled releases from Gavins Point Dam has eliminated periodic flooding for most of the reach. The reach can be effected by flooding from the James and Vermillion Rivers. The topography of the reach is that of a relatively flat floodplain on the South Dakota side with floodplain interspersed with steep, tree covered bluffs on the Nebraska side.

The floodplain contains a mixture of various stages of floodplain forest and cleared land used for farming and livestock grazing. The dominant species of the mature floodplain forest are large cottonwood trees. Understory species include dogwood, willows, eastern red cedars, sumac, wild grape, and poison ivy. On sandbars annual weeds, short lived grasses, sedges, and seedling willows and cottonwoods take root. On the north facing bluffs on the Nebraska side the hardwood forest dominates. Oak, ash, mulberry, and walnut trees will be found with the Bur Oak being the most prevalent. On hilltops and bluffs with southern or western exposures, the hardwood forest gives way to grasslands.

The reach is located in an area typical of a continental-interior climate with great variations in weather not only from season to season but also from year to year. Hot summers and cold winters are typical with humidity ranging from an average of 60% in the afternoon to 80% during the night and early dawn. The frost-free period in the area averages 155 days. Precipitation in the region averages 25 inches of rainfall annually with the majority of it occurring during the spring and summer months. The average seasonal snowfall for the reach is around 30 inches. Thunderstorms can be expected to occur about

45 days out of the year. Tornado and severe weather pass through the region infrequently. Temperatures can exceed 100 degrees Fahrenheit in summer and drop to below zero degrees in the winter months. The average summer daily temperature is 72 degrees and the average winter daily temperature is 24 degrees. The winds are predominantly from the south-southwest during the summer and from the northwest during the winter months. Wind speeds vary greatly, and it is not uncommon to have winds up to 50 mph during the year.

Human activities within the reach include recreation, agriculture, bank stabilization projects, water intakes for cities, and housing developments. Recreational use includes fishing, both from shore and boats, pleasure boating, jet skis, canoeing, swimming and sunbathing. In 1980 the Congress designated this stretch of the Missouri as a National Recreation River.

An important function of this reach is its service as a corridor to provide water for the Missouri River navigation channel. The navigation channel extends from Sioux City, Iowa (river mile 732.3) to the confluence of the Missouri and Mississippi Rivers (river mile 0.0) just north of St. Louis, Missouri. Normally the navigation season on the Missouri runs for eight months, from April 1 to December 1. The season can be lengthened or shortened depending upon ice conditions on the river, water storage in the mainstem reservoirs, and water inflows from tributaries downriver from Gavins Point. To provide for minimum navigation service, releases from Gavins Point Dam must average 24,800 cfs in May, 24,000 cfs in June, 26,700 cfs in July, and 28,200 cfs in August. For full navigation service, releases must average 30,800 cfs in May, 30,000 cfs in June, 32,700 cfs in July, and 34,200 cfs in August.

INITIAL HABITAT OBSERVATIONS & NEST INITIATIONS

Habitat use surveys to locate active nesting colonies and nest sites for monitoring purposes were conducted from May to July on the reaches. Surveys were conducted with the aid of binoculars or spotting scope. Potential nesting areas were typically observed from a boat. Large islands or beach areas accessible from land were searched on foot using bird behavior to indicate active nesting colonies. Sites found to have terns or plovers actively exhibiting nesting or courting behavior were recorded on U.S. Army Corps of Engineers aerial mosaic maps (Appendix C) and monitored during production surveys. Initial habitat conditions and nest initiations on the reaches are as follows.

Fort Peck Lake: The lake elevation of Fort Peck Lake on April 1, 1995 stood at 2231.5 feet msl, 5.4 feet lower than on May 1, 1994. This exposed more potential habitat for the two species compared to the previous year. However throughout the nesting season the lake steadily came up, rising to 2244.0 feet by late July. As a result of this 12.5 foot rise, several of beaches used by the nesting birds were inundated.

Piping plovers were observed during the first survey of May 2 and probably arrived at the lake during the last week in April. Nest initiation dates for the plovers ranged from May 10 to June 5. The first least tern sighting was made during the week of June 4. The earliest tern nest initiation for the terns was on June 12 with the last occurring on June 16.

Fort Peck River: Releases out of Fort Peck Dam were increased to 7,000 cfs at the beginning of May and were maintained at that level through early August. This left adequate amounts of habitat available for the birds when they arrived in the spring. The first survey of the west (RM 1714.0 - 1673.0) subsample was completed on June 6 with both species being observed. The terns undoubtedly had arrived earlier for a tern nest was initiated on June 1. The latest nest initiation for least terns on the west subsample was June 27. For the west subsample the earliest plover nest was initiated on June 7, the latest on July 1.

On the east subsample (RM 1581.4 - 1568.1) the first survey was completed on May 9. Neither species was seen that day or during other surveys in May. Due to high flows from the Yellowstone River that flooded all habitat in the subsample, surveys were suspended until July when the river flows fell. On July 20 a least tern colony was discovered at RM 1580.2. The earliest nest initiation for this colony was July 10, with the latest occurring on July 14.

Lake Sakakawea: Habitat conditions on Lake Sakakawea proved to be deleterious for the terns and plovers during the 1995 nesting season. The lake rose from 1835.2 feet mean sea level (msl) in February to a peak of 1851.9 feet msl in August. The August peak was the second highest on record for Lake Sakakawea. Though plenty of habitat was available for the birds in May the continued rising of the lake from May through August inundated almost all the beach habitat used by the birds within the reach.

Surveys of the birds began on Lake Sakakawea on May 3 and piping plovers were found at two locations. Plover nests were initiated on the lake from the first week in May through the second week in June. Hatching for the plovers began as early as June 10. Least terns were not observed on the reach until June 3. The earliest nest initiation by a tern on the reach was the first week in June. The latest nest initiation was the first week of July.

Garrison River: The plan to simulate the natural hydrograph of the Missouri River by increasing releases from Garrison Dam in May and then decreasing flows in June was canceled due to flooding in South Dakota, Nebraska, and Missouri. Instead releases were reduced to diminish the flood threat in the lower basin. In May releases averaged around 13,000 cfs, in June around 11,000 cfs, and around 13,000 cfs in July. Normal releases throughout the summer average around 24,000 cfs. The reduced releases left exposed many sandbars and beaches that are normally submerged, greatly increasing the amount of habitat for the two species. This fortuitous circumstance ended in late July. High water levels on Lake Sakakawea required an increase in releases from Garrison Dam. Releases from Garrison were gradually increased to a peak average of 37,000 cfs by mid August. This

effectively ended the nesting season on the reach by eliminating most of the habitat in the reach.

Monitoring on this reach began on May 10 but no terns or plovers were observed. However the plovers were already in the area for it was later determined that two plover nests were initiated the week of May 7. Two plovers and five terns were observed on May 16 and both species were regularly seen throughout the rest of the monitoring period. Nest initiation for the terns began the week of May 21. The latest initiation of a plover nest within the reach occurred the week of June 25. The latest nest initiation for a tern nest was the week of July 16.

Lake Oahe: Flooding in the Missouri River's lower basin severely impacted habitat availability on Lake Oahe. To reduce flooding, releases from Oahe Dam were reduced to a record low average of 1,900 cfs for May and an average of 11,100 cfs for June. As a result Lake Oahe rose to a record level of 1618.6 feet msl in June. This rise inundated most of the beach habitat on the lake, leaving very little for the terns and plovers.

Piping Plovers were first observed at Lake Oahe during the second week of May. This week saw the earliest nest initiations by the plovers. The latest nest initiation for the plovers was the week of June 12. Least terns were first observed on the lake during the first week of May. The earliest nest initiation for terns however did not occur until the first week in June. The latest nest initiation for the terns was the week of July 26.

Fort Randall River: Releases from Fort Randall Dam paralleled the downriver Gavins Point Dam. In the spring and early summer water was held back due to flooding in the lower Missouri River Basin. Releases averaged 10,600 cfs in April, 9,300 cfs in May, 24,700 cfs in June and 32,300 cfs in July. These releases initially left good beach habitat available along the few sandbars found within the reach.

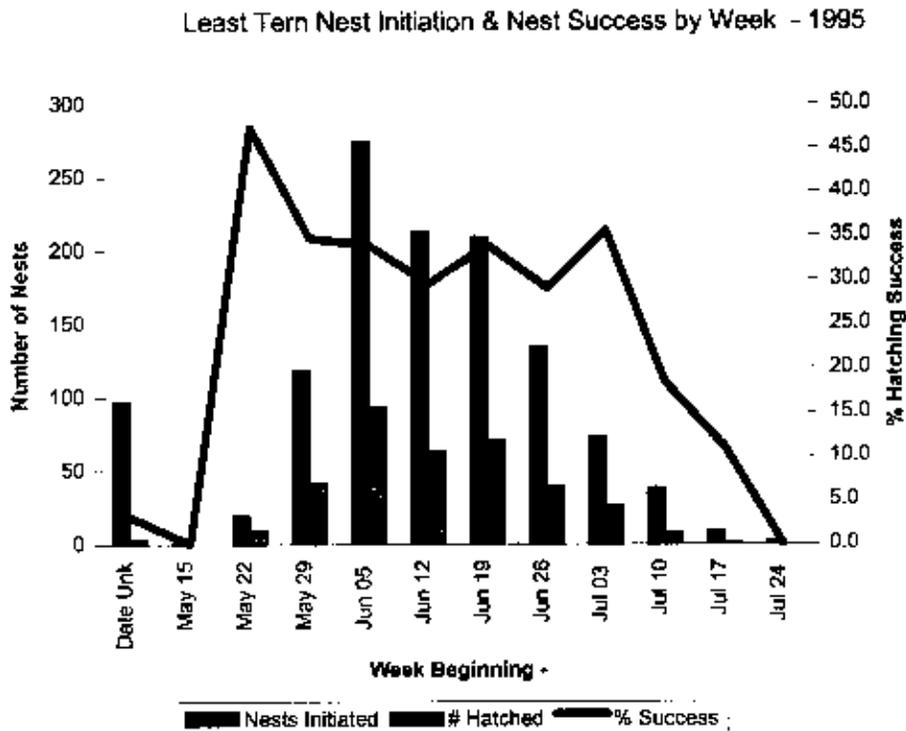
Piping plovers were first observed on May 3 during the initial survey of the reach. Least terns were first seen on the reach on May 23. The plovers nest initiation dates represented a narrow band with the earliest occurring on June 4 and the latest on June 6. Least tern nest initiations occurred between June 6 and June 20.

Lewis & Clark Lake: The lake elevation for Lewis & Clark Lake was targeted for 1206 feet msl for the spring and summer of 1995. This level could not be maintained as the May runoff into the river between Fort Randall Dam and Lewis & Clark was the highest on record. Consequently the lake rose to 1209.53 and came within six inches of overtopping the spillway gates at Gavins Point Dam. This eliminated a good portion of the habitat in May. The lake was drawn down to 1206 feet msl in early June and maintained at that level through July.

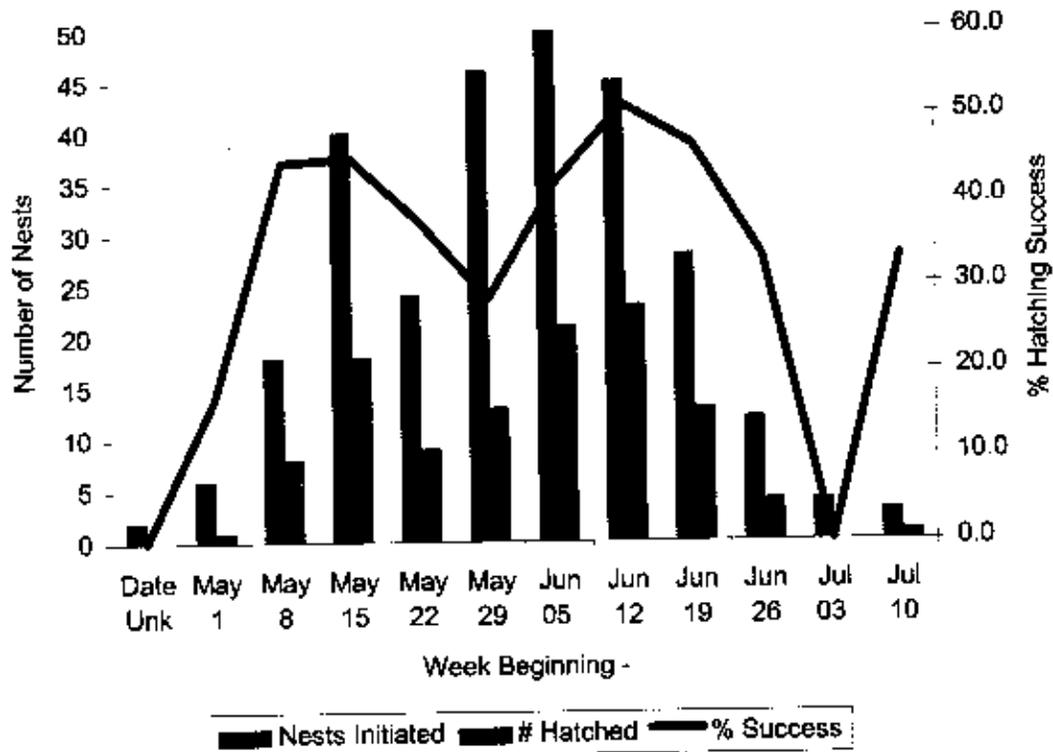
Due to the high lake level the first survey was not conducted until May 30. A pair of plovers was seen that day. Terns were on the lake as early as June 4, the date of the first

known nest initiation. The earliest nest initiation for plovers on Lewis Clark was May 30, with the latest occurring on June 23. Terns nested as late as June 25 on the lake.

Gavins Point River: Releases from Gavins Point Dam were kept well below normal during the months of April, May, and June due to high inflows into the Missouri River Basin below the dam. Releases from the dam averaged 17,400 cfs in April and 18,500 cfs in May. As a result large areas of natural and created beach habitat were available for the birds when they arrived at the reach. Piping plovers returned to the Gavins Point Reach in late April. The earliest known nest initiation for the plovers on the reach was May 8. The latest nest initiation for the plovers was July 3. The least terns began showing up in the reach in late May. The earliest recorded tern nest initiation was May 29. The latest tern nest initiation on the reach was July 17. See the following figures for weekly nest initiations and nest successes for least terns and piping plovers on the Missouri River System for 1995.



Piping Plover Nest Initiation & Nest Success by Week - 1995



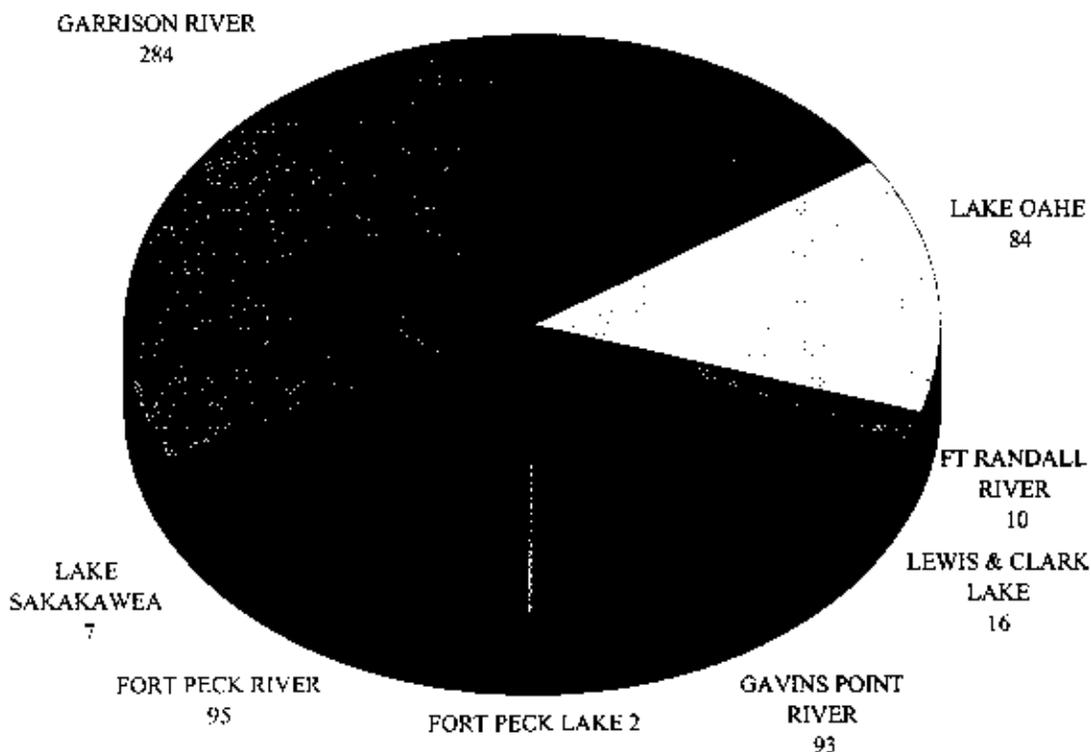
ADULT CENSUS

The adult census, as in previous years, was conducted during the last week in June and the first week in July. Census activities were conducted with the aid of a boat and binoculars or spotting scope. Adults were counted either while incubating clutches, loafing on the sandbar, or flying overhead near the natal areas. If heavy vegetation existed on an area preventing observation of adults on the ground, sites were entered, causing the birds to flush where they were then counted in the air. On sites with large nesting colonies, where bird activity makes actual counts improbable, the census count was recorded as twice the number of active nests plus the brooding pairs. Date, time, observers, and site location was recorded during entry of each census record. All terns and plovers observed on the Missouri River having adult plumage were recorded as breeding adults. The dates when the adult census was conducted, by reach, are listed below.

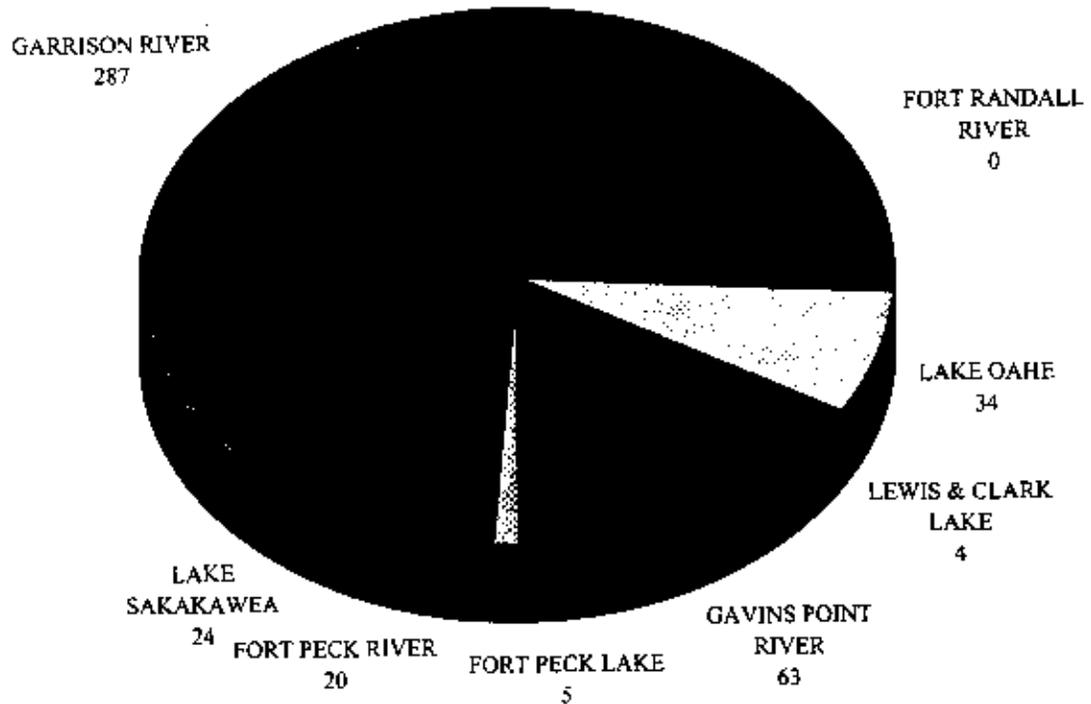
Fort Peck Lake	June 28
Fort Peck River	June 29, July 3-7
Lake Sakakawea	June 25, 26, 29, July 1-3, 6
Garrison River	June 23, 25-27, 29, 30
Lake Oahe	June 29-30, July 1-2
Fort Randall River	June 26
Lewis and Clark Lake	June 26
Gavins Point River	June 27-29, July 6

The 1995 adult census for the Missouri River showed an increase in piping plover numbers for the first time in four years and a substantial decline in least tern numbers. The adult census showed 407 plovers and 591 terns within the system, an increase of 16% (407/352) for the plovers and a decline of 24% (591/777) for the terns. The overall numbers however do not reflect the dynamic changes that occurred in the system in 1995. The majority of birds for both species were found on one reach, the Garrison River. Nearly two thirds of all plovers in the system (64%, 261/407) and little less than half of all terns (48%, 284/591) were located within the reach. Both counts were record numbers for the Garrison Reach. The high numbers were most likely the result of low releases from Garrison Dam during the summer. The low releases exposed large areas of sandbars and beaches on the river that the birds favor. Also high water levels on Lakes Sakakawea and Oahe that eliminated habitat on those two reaches may have moved the birds to the Garrison Reach. The following pie charts show the results of the adult census by reach for the terns and plovers.

LEAST TERN ADULT CENSUS BY REACH - 1995



PIPING PLOVER ADULT CENSUS BY REACH - 1995



The tables on the following page show the adult censuses for piping plovers and least terns from 1995 to 1986.

ADULT PIPING PLOVER POPULATION COUNTS, 1986-1995

<u>SURVEY REACH</u>	<u>1985</u>	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>	<u>1989</u>	<u>1988</u>	<u>1987</u>	<u>1986</u>
FORT PECK LAKE	5	4	30	26	25	22	12	20	10	18
FORT PECK RIVER	20	9	4	0	13	17	11	5		
LAKE SAKAKAWEA	24	45	8	108	150	132	57	143		
GARRISON RIVER	261	119	127	77	124	71	84	113	151	125
LAKE OAHÉ	30	85	66	143	87	88	140	55	16	13
FORT RANDALL RIVER	0	17	12	8	25	12	0	0	5	3
LEWIS & CLARK LAKE	4	12	32	6	33	30	18	31	11	8
GAVINS POINT RIVER	63	62	109	112	186	144	122	212	177	172
TOTAL	407	353	388	480	623	516	444	579	370	339

ANNUAL ADULT LEAST TERN POPULATION COUNTS, 1986-1995

<u>SURVEY REACH</u>	<u>1995</u>	<u>1994</u>	<u>1993</u>	<u>1992</u>	<u>1991</u>	<u>1990</u>	<u>1989</u>	<u>1988</u>	<u>1987</u>	<u>1986</u>
FORT PECK LAKE	2	9	7	0	10	6	4	3	4	
FORT PECK RIVER	95	58	31	110	66	92	49	18		
LAKE SAKAKAWEA	7	35	17	29	9	6	15	7		
GARRISON RIVER	284	217	145	198	195	174	121	142	166	147
LAKE OAHÉ	64	160	125	124	143	100	97	82	30	38
FORT RANDALL RIVER	10	43	38	13	32	25	4	0	32	11
LEWIS & CLARK LAKE	16	44	76	29	55	83	29	45	28	14
GAVINS POINT RIVER	93	211	272	187	193	166	210	252	232	181
TOTAL	591	777	711	690	702	632	528	549	492	391

PRODUCTIVITY AND RECRUITMENT OF FLIGHTED CHICKS

Productivity monitoring provides a standard of measurement onto which success or failure of implemented management practices can be evaluated. The most critical scale of any recovery effort must be rated with the return gained from annual reproductive efforts or in the recruitment of young to the adult population. No matter how much habitat is created or prudent measures implemented, nothing will recover piping plover and least tern populations unless annual productivity exceeds annual mortality. In light of this, fledge ratio goals (number of juveniles produced annually per pair of breeding adults) were established by the Biological Opinion to give the Corps a target to meet in implementing management activities on the Missouri River. Correct estimates of these ratios are essential to evaluate the success of efforts applied towards meeting recovery goals. Every effort was made to accurately collect and report all aspects of the productivity monitoring activities during 1995.

Sites identified, through early habitat use surveys, to contain active nesting colonies were revisited every seven - ten days during the duration of the summer to record nesting activity and chick survival. (The exception was the Fort Peck River Reach where productivity was geographically subsampled.) Active nesting sites were searched to determine the number of nests and principle causative factors responsible for any nest being prematurely terminated. Each colony was searched on foot with the aid of binoculars. Nests were located by observing adult behavior or by doing systematic searches of the colony site. Each nest was identified by placing a numbered wooden tongue depressor one meter from the nest. Nests were relocated every seven to ten days until the nest was terminated. All on site activity was limited to thirty minutes or less including any passive predator management activities.

Information collected for each nest was recorded on corps standardized nest cards and included species, number of eggs, stage of incubation-obtained through use of the egg flotation method, nest location, nest initiation date, and nest fate. Cause of nest termination was recorded as hatched or destroyed, with hatched nests being determined by the presence of piping fragments or chick excrement in the nest bowl. A nest was considered successful if it hatched a single egg from the clutch. Destroyed nests were identified to a principle causative factor including but not limited to, flooding, weather, human disturbance, predation, and abandonment. If a cause could not be determined the nest was listed as destroyed - unknown. If it could not be determined if a nest had hatched the nest was listed as fate unknown.

Chick survival was recorded during weekly nest searches of nesting areas. As the breeding season progressed, efforts were concentrated on locating chicks and keeping track of fledged chicks using natal areas. Chicks were typically flushed ahead of observers on the nesting sites and were aged by visual observation of size and primary feather development. Care was taken to prevent chicks from fleeing into the water in efforts to escape from the observers. Chicks were tracked during the fledging period by recording each observation on

a chick record portion of the adult census card. Because of a high probability of fledging before the next week's visit twenty-two days old plovers and fifteen days old least terns were considered fledged.

Productivity varied dramatically within the system. High lake levels on Fort Peck Lake, Lake Sakakawea, Lake Oahe, and Lewis & Clark Lake eliminated most of the nesting habitat for the terns and plovers. Likewise high releases from Fort Randall Dam and Gavins Point Dam had the same effect on the river reaches below the two dams. Conversely the low releases out of Garrison Dam for most of the summer proved to be a bonanza for the birds. Results of the 1995 production surveys are given for terns (Table Page 30) and for plovers (Table Page 30). See Appendix B for a site by site synopsis of the mainstem system. A reach by reach summary of productivity follows.

Fort Peck Lake: Least terns nested on two beaches in 1995. Four of the nests were located on the same beach used by terns in 1994. A single nest was located on another beach. All five nests were lost by flooding from the rising lake. The piping plovers were more widely distributed than the terns with nests being found at eight sites around the lake. Only two of the ten plover nests on the lake successfully hatched eggs with a total of three chicks fledging from these nests. As with the terns, flooding was the primary cause for the loss of nests with six nests succumbing to the rising lake. The other two nests were predated.

Fort Peck River: For the first time two subsamples of this reach were monitored. The west subsample contained seven occupied least tern nesting sites; up two compared to 1994. Tern nesting success was exceptional with 80% (20/25) of the nests hatching. From this group a total of 21 tern chicks fledged for a subsample fledge ratio of 1.00 chicks per pair of adults. Weather events had an adverse effect on the terns. At least three chicks and one adult were killed in a hail storm. Two nests were lost to rain storms. A third nest was lost to flooding. Predators took the other two destroyed nests. The major predator appears to have been mink.

For the east subsample, no habitat was available during May and June due to high inflows from the Yellowstone River. After flows from the Yellowstone decreased in July, a tern colony of six nests was discovered at RM 1580.3. None of the eggs from this colony hatched. All the nests were destroyed from rain and hail storms that hit the area in late July.

Piping plovers were found only in the west subsample of the reach. There the birds tripled the number of nests found on the subsample compared to 1994. However this represented just three nests, each at a different location. All three nests hatched with a total of seven chicks fledging. The fledge ratio for the plovers was a robust 2.33 chicks per pair of adults.

Lake Sakakawea: Only two least terns nests were found on Lake Sakakawea in 1995. By the time of the arrival of terns to the area in June, the majority of the beach habitat in the reach was already under water. Both nests were lost to inundation by the lake.

The piping plovers were widely distributed across Lake Sakakawea with nests found at twelve sites around the lake. Five of these sites represent nests at locations that did not have any known plover nests in 1994. Four of these nest site locations were in the northern half of the lake. Nest success for plovers on the lake was poor with a hatching success of 11.9% (5/42). This poor rate was due to high lake levels experienced on Sakakawea in 1995. Fifteen nests were lost to flooding from the rising lake. Another fourteen nests that were collected in June would have been lost to flooding. A disturbing occurrence was the loss of six plover nests to human disturbance. All six nests were located near recreation areas. No known fledged chicks were produced off the reach.

Garrison River: The Garrison River Reach had 29 occupied least tern nesting sites including seven major colonies of more than ten nests apiece, four moderate sized colonies of between five to nine nests, and eighteen sites of between one to four nests. The number of nesting sites used by the terns increased 53% (29/19) compared to 1994. This undoubtedly was the result of more habitat being available due to low releases out of Garrison Dam. Another possible contributing factor was a lack of habitat on Lakes Sakakawea and Oahe. The high water levels on these lakes may have forced the terns to move to the reach. Nest success was 45.3% (72/159). A total of 126 tern chicks fledged off the reach for a very good fledge ratio of 0.89 (126 chicks/142 adult pairs). The high releases out of Garrison in late July and August made necessary the removal of eggs from the reach. Twenty-eight eggs from fifteen tern nests were removed and transported to the Gavins Point Project in Nebraska. There the eggs were incubated and the resulting chicks were captively raised. (See captive rearing program.)

Piping plovers nested at 41 sites within the reach. This represents an increase of 241% (41/17) compared to 1994. Thirteen sites contained between five to nine nests, and twenty-eight sites had between one to four nests. The plovers had a very good nest success of 63% (85/136). This in turn led to a fledge ratio of 0.93 (122 fledged chicks/130 adult pairs). The leading cause of known nest failure was predation (8). As with the terns, plover eggs and chicks were removed in late July before high releases from Garrison Dam inundated the low lying sandbars in the reach. Forty eggs from fourteen nests and nine chicks were collected and transported to the Gavins Point Project for incubation and rearing.

Lake Oahe: Tern and plover numbers on the Lake Oahe Reach fell substantially in 1995 compared to 1994. This probably resulted from the record high water level the lake experienced in 1995. Least terns nested at two sites on the lake, Dredge Island, (RM 1270.0) and Indian Creek (RM 1192.3). Dredge Island was the site of a large tern colony in 1994 and was the only site on the North Dakota side of the lake that had nesting habitat available for the birds. The Indian Creek tern colony was located in a cul-de-sac just off the Indian Creek Campground. Overall nest success at the two colonies was 37.1% (13/35). The Indian Creek colony was hard hit by predators, losing seven nests. Abandonment (7), was the leading cause of nest failures. No tern chicks were known to have fledged off the reach.

Piping plovers nested at six locations on Lake Oahe and on one site below Oahe Dam. The largest concentrations of plover nests were at Dredge Island (9) and Okobojo Point (5). Nest success for the plovers was 33.0% (7/21). Flooding resulted in the loss of four nests. Despite the poor nest success the fledge ratio for the reach was a very good 0.93 (14 chicks/15 adult pairs). Three plover nests were collected off the lake in June. The eggs from these nests were transported to the Lincoln Park Zoo in Chicago, Illinois and the Milwaukee County Zoo in Milwaukee, Wisconsin. There the eggs were incubated and the resulting chicks were captively reared by zoo personnel.

Fort Randall River: The low releases from Fort Randall Dam in May created favorable nesting conditions for the terns and plovers on the river below the dam. These conditions ended in June as the need to evacuate water from Lake Francis Case and upriver reservoirs became necessary. On June 1, Lake Francis Case behind Fort Randall Dam set a record high elevation of 1367.9 feet msl. Increased releases throughout June and July eliminated all nesting habitat within the reach.

There were 26 tern nests at two locations within the reach. None were successfully hatched. Eleven nests were flooded and eleven more were collected for incubation at the Gavins Point Project. The remaining four nests were lost to predation. Seven plover nests shared the two nesting sites with the terns. All seven plover nests were lost to flooding.

Lewis & Clark Lake: Least terns nested at three locations on Lewis & Clark Lake. These sites included one major colony of eleven nests, a minor colony of five nests and one solitary nest. There were three piping plover nests at three locations on the lake. Inflows into the upper lake disrupted tern and plover nesting. Five tern nests were destroyed by inundation by the lake. Eggs from twelve tern nests and two plover nests were collected off the lake and removed to the Gavins Point Project for incubation. The remaining plover nest was lost to predation. There was no successful hatching of any nests from the lake in 1995.

Gavins Point River: Though some nests were inundated when releases from Gavins Point Dam were increased to 25,000 cfs on May 31, habitat conditions on the reach remained favorable for the birds through the first month of the nesting season. This situation changed in mid June. Above average runoff in the upper Basin and low releases from the dams due to lower Basin flooding caused the water levels of the lakes formed by Garrison Dam, Oahe, Dam and Fort Randall Dam to rise into the exclusive flood control zones. Lake Oahe and Lake Francis Case rose to record levels and Lake Sakakawea rose to its second highest level. This required the evacuation of water in the reservoir system and the increase of releases out of Gavins Point. Consequently Corps personnel began moving nests to higher elevations and removed eggs from nests endangered by inundation. The eggs were transported to the Gavins Point Project where they were incubated. Releases from Gavins Point were gradually raised throughout the summer to a peak of 54,000 cfs on August 16.

The increased releases suppressed nesting success of the two species on the Gavins Point Reach. The plovers nested at eleven sites on the reach compared to eighteen for 1994. Nesting sites for terns were likewise down, nine for 1995 compared to fourteen for 1994. Only nine of fifty-six plover nests successfully hatched. The eggs of half of all plover nests on the reach were collected (28/56). These would have been otherwise lost to flooding. Predators were also very destructive of plover nests, destroying twelve nests. A quarter of all tern nests on the reach (30/118) successfully hatched. The eggs of about a third of the tern nests were collected (40/118) and incubated at the Gavins Point Project. As with plovers the terns suffered large losses to predators with 31 nests being destroyed.



Tern Adult & Chick

HABITAT MANAGEMENT

Due to high reservoir levels and high releases from Garrison and Gavins Point Dams very little habitat improvement work could be done in 1995. What work was done is summarized in a reach by reach description.

Fort Peck Reservoir: No habitat improvement work was done.

Fort Peck River: In September 1995 Corps personnel from the Garrison Project cleared about one acre of willows from an island at RM 1578.5. The willows were removed from a high point on the island's west end. The purpose of the project was to provide habitat for the terns and plovers during high river flows that occur due to the confluence with the Yellowstone River at RM 1582. In the spring of 1996 the cleared area will be herbicided with Rodeo after the willows sprout, but before the plovers return to the area.

Lake Sakakawea: Due to the extremely high lake level in 1995 no habitat work was done on Lake Sakakawea.

Garrison River: Due to high releases from Garrison Dam from August through the winter of 1995, no habitat work was done in this reach. It is expected that the high releases had a beneficial effect on the reach by scouring beaches of vegetation and by building up sandbars.

Lake Oahe: In April the sites that had been chemically treated the previous fall were dragged and leveled. These areas included sites at Mission Island, Mission Peninsula, Okobojo Island, Plum Creek, and Dry Creek.

Fort Randall River: No habitat improvement work was done.

Lewis & Clark Lake: No habitat improvement work was done.

Gavins Point River: No habitat improvement work was done.

MANAGEMENT ACTIONS

Several management actions were undertaken to protect nesting sites, increase productivity, and increase public awareness. Some of these measures have been ongoing for several years. Others have been done on a limited basis previously, but were expanded in 1995. Still others were tried for the first time in 1995. These management actions are discussed below except for the Captive Rearing Program which is discussed under it's own section.

Predator Aversion Measures

Predator exclosure cages were used to increase survival of piping plover nests. Cages were constructed of either 2"x 4" welded wire mesh or 2"x 2" wire mesh and were 2' x 2' x 2' in size. The cages were held in place with electric fence t-posts or by 14" wire hook stakes. Assembly and installation time was approximately five minutes. Cages were assembled on site during the time allowed for productivity monitoring activities. Hands were washed with no scent soap before the handling of any cage components. After cage installation the nest was monitored to ensure that the nesting adult returned to the nest. In one case at Lake Sakakawea a nesting adult refused to enter the cage. The cage was then removed and the adult resumed nesting. Otherwise there was no apparent avoidance of caged nests by piping plovers.

Piping plover nest cages were used on four of the eight reaches. (Cages were not used on the Fort Peck Reservoir, Fort Peck River, Fort Randall River, and Lewis & Clark Lake Reaches.) Overall 49% (137/278) of the piping plover nests on the Missouri River System were caged. Excluding the four reaches where cages were not used the figure rises to 54% (137/255). There are several reasons why cages were not placed over every plover nest. In some cases it was not possible to place a cage due to the proximity of vegetation or other features next to the nest. Cages were not placed over nests where the eggs were pipping or already hatching. On several occasions cages were not available when the nest was discovered. Also when it became evident that eggs were going to need to be collected for captive rearing program, newly discovered nests were not caged.

Nests that were caged had a higher success, 58% (62/114), than uncaged nests, 42% (45/107). (These numbers do not include nests where the eggs were collected.) The survival of uncaged nests in the four reaches where cages were used was markedly higher, 41% (40/97), than in the four reaches where cages were not used, 25% (5/20). Results of cage use during 1995 by reach are shown on the following chart.

MAINSTEM MISSOURI RIVER PIPING PLOVER NESTS - CAGED 1995

BEACH	NESTS CAGED	NEST HATCHED	NAT & COLL	NEST COLL	NEST SUCC*	FLOOD	PREY	TRAP	BEHN	NESTS CAGED	NEST HATCHED	NEST COLL	NEST SUCC*
KSKRE	28	2	0	8	10.0	10	1	6	0	1	0	0	0
JARRIV	81	53	4	4	74.0	1	6	0	3	0	3	4	3
KOHRE	15	7	0	1	50.0	3	0	0	0	0	2	2	0
JAPTRIV	13	0	0	10	0.0	0	2	1	0	0	0	0	0
OTAL	137	62	4	23	57.9	14	9	7	3	1	5	6	3

*NEST SUCCESS = ((NESTS HATCHED/NESTS CAGED) - NEST COLLECTED)100

MAINSTEM MISSOURI RIVER PIPING PLOVER NESTS - UNCAGED 1995

BEACH	NESTS UNCAGED	NEST HATCHED	NAT & COLL	NEST COLL	NEST SUCC*	FLOOD	PREY	TRAP	BEHN	NESTS UNCAGED	NEST HATCHED	NEST COLL	NEST SUCC*
TPKRE	10	2	0	0	20.0	6	2	0	0	0	0	0	0
TPKRIV	3	3	0	0	100.0	0	0	0	0	0	0	0	0
KSKRE	14	3	0	6	37.5	4	0	0	0	0	0	0	1
JARRIV	55	28	0	6	57.1	3	2	0	0	0	9	5	2
KOHRE	6	0	0	2	0.0	1	1	0	2	0	0	0	0
TRLRIV	7	0	0	0	0.0	7	0	0	0	0	0	0	0
ECLRES	3	0	0	2	0.0	0	1	0	0	0	0	0	0
JAPTRIV	43	9	0	18	36.0	3	10	0	0	0	1	1	1
OTAL	141	45	0	34	42.1	24	16	0	2	0	10	6	4

*NEST SUCCESS = ((NESTS HATCHED/NESTS UNCAGED) - NEST COLLECTED)100

A negative consequence of caging plover nests may have occurred at Lake Sakakawea. Six caged nests in this reach were destroyed by human disturbance. All of these nests were located near recreation areas and it is probable that the cages acted as attractants to the public. The public was informed that the nest sites were protected through the placement of warning signs, barricades, and roping off the area around the caged nests.

Strobe light systems were not used in 1995. Though effective in 1994, the elimination of habitat and collecting of eggs precluded the use of the strobe lights.

Predator Removal

No predator removal measures were undertaken during the normal course of productivity monitoring on the eight reaches. (See Captive Rearing section for a discussion of predator removal measures associated with that program.)

Sign Posting and Fencing

Nest sites close to or within recreation areas or areas with the high potential for human disturbance were posted with restriction signs. These signs informed the public of the presence of endangered species and prohibited entry into the restricted area. The restricted area could further be delineated with orange twine strung on steel posts. A reach by reach description follows.

Lake Sakakawea Reach: Barricades were placed across vehicle trails near the Steinke Bay and Little Egypt Recreation Areas. The barricades were placed to prevent vehicles from traveling onto beaches occupied by plover nests. The barricades were also signed informing the public of the presence of the plovers and that disturbing the birds was a violation of federal law. Plover nests at Little Egypt and Tobacco Garden Bay were also "fenced off" with string to delineate a "No Trespassing" boundary. The two areas were also posted with signs

Garrison River: The northern part of the island at RM 1374.5 was signed due to the presence of a large tern colony. There was no evidence that the colony was disturbed by humans, but all the signs on the island were stolen. Due to high recreation use near Bismarck signs were placed to protect nesting sites on islands at RM 1319.8, RM 1309.5, RM 1308.7, and 1307.5.

Lake Oahe: On May 31 a piping plover nest was discovered in the boat trailer parking lot of the Indian Creek boat ramp. The area around the nest was roped off with fence posts and orange twine and "Do Not Enter" signs were posted. About 60% of the parking lot was blocked off to protect the nest. The nest was later successfully moved. (See nest relocation section.) On June 1 Oahe Project personnel observed least tern nesting activity in a road cul-de-sac near the B loop of the Indian Creek Campground. The road

cul-de-sac was blocked off with orange construction fence and Do Not Enter signs were posted. The fence was then extended into the campground to cover campsites 7, 9, 11, 13, & 15. A tern colony formed at the cul-de-sac and peaked with ten active nests. The area remained closed until July 7 when it was determined that the terns had abandoned the site.

Gavins Point River: Signs were placed to protect nesting sites on islands at RM 804.6, RM 804.5, RM 802.0, and RM 801.0.

Nest Relocation

Nest moving was done to prevent the destruction of nests by rising lake or river levels. Nests were moved by various means including moving the entire nest and surrounding substrate to creation of a new nest. Though it was recommended that the nests be moved a maximum of nine feet, moves of up to twenty feet were successfully completed. After a nest was moved it was watched to see if the adult found the new location. If the adult was unable to locate the new site the nest was returned to the old location.

Fort Peck Lake: One tern nest was moved at Fort Peck Lake. It was later lost to flooding. Three plover nests were moved at Fort Peck Lake. One was moved five times but was lost to flooding. Another nest was moved three times and was successfully hatched. One plover chick from this nest was known to fledge. The third nest was moved once, but was later lost to flooding.

Lake Sakakawea: Both tern nests on the lake were successfully moved. Both were later lost to flooding. Plover nest moving had a success rate of 79% (15/19). The greatest success for the movement of plover nests were those that had been previously caged. Ten of the nineteen move attempts involved caged nests. All ten were successfully moved. The success rate for moves of uncaged nests was 56% (5/9). Most likely the adult bird used the cage as a visual cue for relocating the nest. Subsequently one of the successfully moved nests hatched, nine were collected for captive rearing, and five were lost to flooding from the lake. All four of the nests involved in unsuccessful moves were lost to flooding.

Garrison River: Two plover nests were moved in this reach. One subsequently hatched, the other was collected for captive rearing.

Lake Oahe: Personnel at the Mobridge and Pierre Resource Offices constructed nest platforms as a means of moving plover nests. At Mobridge it was decided to move the plover nest to afford it more protection and to open up part of the parking lot for boaters. Mobridge personnel built a 14"x12"x1" tray. The nest was then moved onto the tray but duplicating the surrounding substrate and using the pebbles from the original nest lining. A cage was then placed over the platform. The nesting adult readily returned to the nest. Over a period of three days the nest platform was moved about thirty feet. Two of the three eggs from the nest successfully hatched.

Nest platforms were constructed by Pierre personnel to move plover nests endangered by the rising of Lake Oahe. The nest platform was thirty inches square and two inches deep. A cord was attached to facilitate moving the platform. Like the Moberge platform, surrounding substrate and pebbles from the original nest lining were used to replicate the nest. The platform was buried so that it was level with the surrounding terrain. The nest was then caged. Initially nest moves were limited to one to two feet to acclimate the nesting adult to the procedure. Eventually moves of up to 25 feet were accomplished.

Chick Relocation

Transportation of unfledged piping plover chicks to a new location was done only in cases where threat of destruction was imminent due to the inundation of the chick's former location.

Fort Peck Lake: On June 25 USFWS and Corps personnel captured and removed two plover chicks from an island in Fort Peck Lake that was in danger of inundation. The two chicks were released on the shore of the mainland 150 yards from the island. The adult plover that was with the chicks on the island was driven off by the crew. The adult tried to return to the island and was driven off a second time. The adult eventually landed on the mainland near the chicks. On June 28 the mainland site was visited and two adults and two chicks were observed. Both chicks fledged in July.

Garrison River: The increase of releases from Garrison Dam in late July and early August threatened several nearly fledged plover chicks by inundating their island habitat. On August 8 nineteen plover chicks; three from an island at RM 1308.7, five from RM 1320.0, three from RM 1345.5, three from RM 1347.5, and five from RM 1357.0, were captured and transported to an island at RM 1369.8. This island was not in danger of inundation and contained large areas of suitable habitat for the birds. The birds were released on the island and fledged there.

Berm or Island Building

Earth moving measures were done either to build up an area to survive a flood situation or done to protect a nest site in danger of inundation.

Fort Peck River: A berm was constructed to partially surround a least tern nest in danger of inundation. The berm was constructed with sandbags and built in a crescent shape with both ends tying into existing high ridges. A small trench was dug on the inner side of the berm to collect any water that breached or bypassed the berm. The tern returned the nest after the berm was finished. The berm prevented the nest from being flooded and the eggs in the nest were successfully hatched.

Garrison River: Due to increases in releases from Garrison Dam in late July and early August two islands at RM 1308.7 and an island at RM 1345.5 were built up. The

purpose of the island building was to give the unfledged plover chicks on the islands an escape area that would survive the higher water levels resulting from the increased releases. The islands were built up with shovel power and by using all terrain vehicles equipped with blades to push up sand. The areas were built up about two feet high. The built up area on the island at RM 1345.5 was about 25 feet square in size (625 square feet). The built up areas on the other two islands were slightly smaller. The built up areas were stabilized with logs placed on the upstream side.

The project proved to be unsuccessful. The built up area on one island at RM 1308.7 was washed away. The plover chicks were then removed to the island at RM 1369.8. The built up area on the other island at RM 1308.7 was not used. The chicks were either predated or fledged off the island. The island at RM 1345.5 was divided into three separate islands by the rising river and the plover chicks were cut off from the built up area. These chicks were then captured and removed to the island at RM 1369.8.

Public Awareness: Public awareness of the status of the least terns and piping plovers on the Missouri River System was accomplished by several means including interpretive programs at Corps of Engineers campgrounds and off site, newspaper articles, television and radio interviews, and information signs.

Specimen Collection for Contaminate Analysis

A total of 3 adult terns, 10 tern chicks, 39 tern eggs, 1 adult plover, 3 plover chicks, and 34 plover eggs were collected during field activities and will be forwarded to respective federal contaminate labs for analysis.

A total of 8 tern juveniles, 5 tern chicks, 6 plover juveniles, and 7 plover chicks were collected during captive rearing program and will be forwarded to respective federal contaminate labs for analysis.

CAPTIVE REARING PROGRAM

The Missouri River main stem system above Sioux City Iowa experienced runoff of 151 percent of normal (37.2 million acre feet) during 1995. Lake Oahe behind Oahe Dam and Lake Francis Case behind Fort Randall Dam experienced record lake elevations in 1995. Lake Sakakawea behind Garrison Dam recorded it's second highest lake elevation. This above average runoff required the Corps to enter into flood water evacuation service level on the river. With these unstable conditions and daily changes to system releases, availability of nesting habitat changed rapidly and subsequently jeopardized nesting efforts on several reaches of the Missouri River. To prevent dramatic losses of nests initiated on unsecure habitats, the Corps, under authority of the amended

1995 subpermit 93-07, conducted an egg salvage operation and captively reared chicks for release back into the wild.

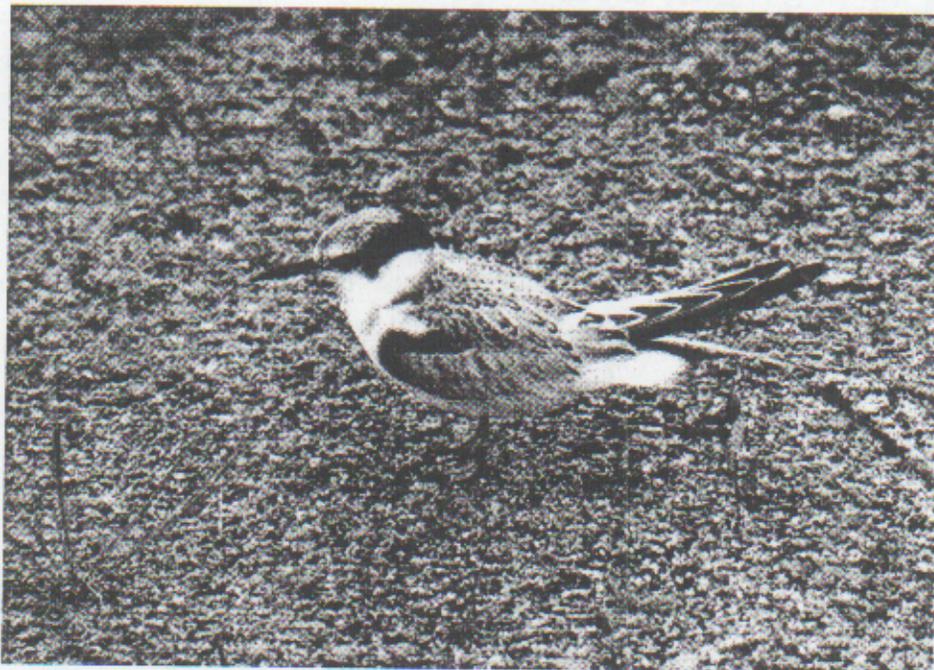
Eggs collected during 1995 were only those ultimately determined to be in imminent danger of being inundated during the evacuation of stored flood waters. All efforts were made to retain viability of natural nesting sites. Nests predicted (through UNET modeling) to be inundated by a scheduled flood water evacuation release were collected along with nests predicted to be flooded by rising reservoir elevations. Attending adults were allowed to incubate the eggs until just prior to the inundating flow. This ensured that the birds did not attempt to renest on the jeopardized habitat prior to it being covered. Egg incubation, rearing of chicks, and release of fledged juveniles were conducted according to the "Incubation, Propagation, and Release of Least Tern and Piping Plover Eggs Collected During the 1995 Missouri River Flood Control Operation Plan."

During the 1995 salvage effort, 20.6% of the plover eggs (197/956) and 18.0% of the tern eggs (160/888) located on the Missouri River, were collected. Hatching success for the piping plover eggs was 70.0% with 96.0% of the chicks hatched eventually fledging and being released. Least tern hatching success was 70.0% with 70.0% of the chicks hatched fledging and being released. The table below contains a reach by reach account of the 1995 collection and captive rearing efforts.

	Piping Plovers				Least Terns			
	<u>Collect</u>	<u>Hatch</u>	<u>Release</u>	<u>Re/Hat</u>	<u>Collect</u>	<u>Hatch</u>	<u>Release</u>	<u>Re/Hat</u>
Lake Sakakawea	51	47	44	94%	0	0	0	0
Garrison Reach	40	33	33	100%	28	16	13	81%
Lake Oahe	8	6	4	67%	0	0	0	0
Fort Randall Reach	0	0	0	0	17	10	9	90%
Lewis & Clark Lake	5	4	4	100%	23	14	6	43%
Gavins Point Reach	93	78	76	97%	92	72	50	69%
Total	197	168	161	96%	160	112	78	70%

Fledged least terns and piping plovers were released on secure habitats once they had shown the ability to be able to procure their own food. In 1995, least tern and piping plover fledglings were released at sites on the Missouri River below Gavins Point Dam, on Lewis and Clark Lake, along the lower ten miles of the Niobrara River in north central

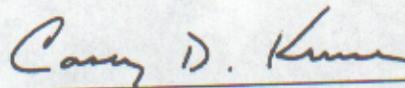
Nebraska. In addition, several least terns were released on the Platte River in central Nebraska near Ashland and several plovers were released on the Missouri River below Garrison Dam in central North Dakota. Prior to release, all piping plovers were banded with an aluminum or stainless steel 1A or 1B USFWS leg band on their left tarsometatarsus and with a light blue Darvic™ flag on their right tibiotarsus. Least terns were banded with an aluminum or stainless steel 1A USFWS leg band on their left tarsometatarsus.



Released Least Tern Fledgling

Thank you to the following people and their crew of dedicated staff who have diligently conducted the surveys, compiled the data, and submitted the annual field report.

MR. GORDON WARRICK - FTPKRES and FTPKRIV
MR. KEITH GORDON - FTPKRIV and LKSKRES
MR. GREG PAVELKA - LKSKRES and GARRRIV
MR. BILL MAY - GARRRIV and LKOARES
MS. TERRI THOMAS - LKOARES
MR. JIM SUEDKAMP - LKOARES
MR. MERRITT STEGMEIER - FTRLRIV
STAFF OF LEWIS AND CLARK LAKE



Casey D. Kruse
Casey D. Kruse
Wildlife Biologist/Field Coordinator

APPENDIX A

Nest Record & Adult Census Cards

NEST RECORD

1 2 3 <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
SPECIES		SITE SUMMARY (DATA CONTROL 1)	
7 8 9 <input type="text"/>	10 11 12 13 <input type="text"/>	14 15 <input type="text"/>	16 <input type="text"/>
NEST	YEAR	HABITAT	REACH
(For Reservoir Use Only)			
22 23 <input type="text"/>	24 25 26 27 <input type="text"/>	28 29 30 <input type="text"/>	31 32 <input type="text"/>
STATE	TOWNSHIP	RANGE	SECTION
33 34 35 36 37 38 <input type="text"/>			
1/4-1/4 SECTION			

NEST DATA (DATA CONTROL 2)										
VISIT 39	DATE			OBSERVER		WEATHER		WHOLE EGGS		NEST STATU 53
	MO 40	DAY 41	DAY 42	43	44	45	TEMP 46	WIND 48	NO. 50	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
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54 <input type="text"/>	55 <input type="text"/>	56 57 58 <input type="text"/>	NEST SUMMARY 59 60 61 <input type="text"/>	62 63 64 <input type="text"/>	65 66 <input type="text"/>	67 <input type="text"/>
EGGS HATCH	EGGS ADDL	NEST INITIATION	EXACT TERM DATE	ESTIMATED HATCH DATE	EXPOSURE DAYS	CHICK FLEGG
NEST FATE				PREDATOR MANAGEMENT		
68 <input type="text"/>	69 70 <input type="text"/>	71 <input type="text"/>	72 <input type="text"/>	73 74 75 <input type="text"/>	76 77 78 <input type="text"/>	79 80 81 <input type="text"/>
FATE	CAUSE	PRED	REASON	CAGE DATE	STROBE DATE	OTHER

COMMENTS: _____

NEST SITE MAP



Threatened & Endangered
Species Program 1994

NEST RECORD PROCEDURES

SPECIES

Box 1-3

A.O.U. Species No.
277 Piping Plover
074 Least Tern

SITE

Box 4

River Reach (See Box 16)

Box 5-6

Site Number

SITE SUMMARY

(Data Control 1)

Box 7-9

Total Nests w/in Reach

Box 10-13

Year Nest Located

Box 14-15

Nest Site Habitat

River Systems

01 Sandbar

02 Beach or Shore

03 Island

04 Island Beach

Reservoir Systems

05 Beach

06 Peninsula/Point

07 Island

08 Island Beach

09 Isl. Peninsula/Point

10 Other

Box 16

Reach Nest Located In

1 Fort Peck Reservoir

2 Fort Peck River

3 Lake Sakakawea

4 Garrison River

5 Lake Oahe, ND

6 Lake Oahe, SD

7 Fort Randall River

8 Lewis and Clark

9 Gavins Point River

Box 17-21

River Mile of Colony Site
to Nearest 10th of Mile

Box 22-38

Legal Description of
Colony Site (Reservoirs)

NEST DATA

(Data Control 2)

Box 39

Number of Nest Visit

T Final Nest Visit

Box 40-42

Date of Nest Visit

Box 43-45

Observers Initials

Box 46-47

Temp to Nearest 5°F

Box 48-49

Wind to Nearest 5mph

Box 50

No. Eggs in Nest

Box 51-52

Incubation Stage

(See Diagram Below)

00 Laying Stage

nn Number Days Inc.

44 Pipped

55 Hatched

Box 53

Status of Nest

0 Unknown

1 Undist/Normal

2 Abandoned

3 Eggs Missing from
Previous Visit

4 Hatched

5 Destroyed

6 Other

NEST SUMMARY

Box 54

Number of Eggs Hatched

Box 55

Nonviable Eggs in Nest

Box 56-58

Nest Initiation Date

Plovers

((2(50)-1)+51&52)-41&42

Terns

(1(50)+51&52)-41&42

Box 59-61

Exact Term Date

(Only if Known)

000 Unknown

Box 62-64

Computer Generated

Box 65-66

Computer Generated

Box 67

From Productivity Rec.

NEST FATE

Box 68 Fate

1 Hatched

2 Destroyed

3 Abandoned

4 Nonviable Eggs

5 Unknown

Box 69-70 Cause

Hatched

10 Other (explain)

11 Chicks in Bowl

12 Chicks on Site

13 Hatched Egg Shells

14 Pipping Fragments

15 Chick Droppings

Destroyed Flooded

20 Other (explain)

21 Eggs Washed Out

22 Nest Filled,
No Eggs

23 Flood Debris

Destroyed Weather

30 Other (explain)

31 Eggs Suspended

32 Eggs Smashed

33 Eggs Blown Out

Destroyed Predator

40 Other (explain)

41 Tracks w/in 2m
of Nest

42 Des. Egg Shells

43 Egg Yolk in Bowl

44 Predator Observed

Destroyed

50 Sandbar Erosion

60 Human Disturbance

70 Other (explain)

Abandoned

80 Other (explain)

81 Observer Disturb.

Box 71 Known Predator

1 Mink

2 Raccoon

3 Coyote

4 Red Fox

5 Domestic Dog

6 Striped Skunk

7 Ring-billed Gull

8 American Crow

9 Other

Box 72 Factor For

Predator Identification

1 Predator Observed

2 Tracks Near Nest

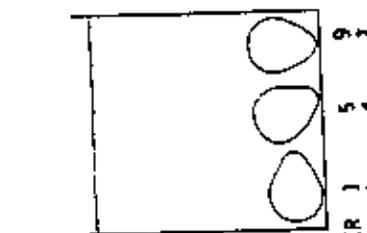
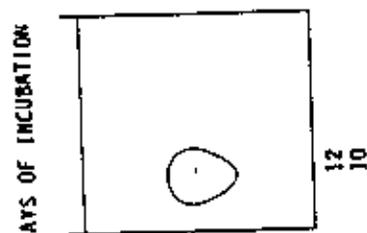
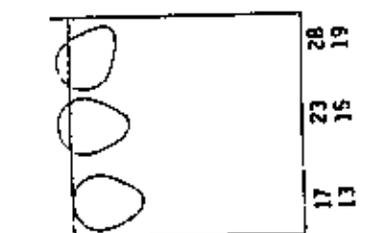
3 Destroyed Egg
Characteristics

PREDATOR MANAGEMENT

Box 73-81

Date of Management

Applications



DAYS OF INCUBATION

PIPING PLOVER 1
LEAST TERN 1

ADULT CENSUS SITE RECORD WITH PRODUCTIVITY ESTIMATES

1 2 3 <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	4 5 6 7 8 9 <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
SITE	SITE SUMMARY	MONTH DAY YEAR
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14 <input type="text"/>	15 16 <input type="text"/> <input type="text"/>	17 18 <input type="text"/> <input type="text"/>
19 20 21 <input type="text"/> <input type="text"/> <input type="text"/>	22 23 24 <input type="text"/> <input type="text"/> <input type="text"/>	
SURVEY TYPE	SURVEY TECH	HABITAT REACH
	TEMP WEATHER	OBSERVERS INITIALS

(For River Use)					(For Reservoir Use Only)																	
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>					
RIVER MILE					STATE		TOWNSHIP			RANGE			SECTION		1/4-1/4 SECTION							

PIPING PLOVERS						LEAST TERNS					
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TOTAL ADULTS		NESTS		BROODS		TOTAL		NESTS		BROODS	

PRODUCTIVITY RECORD

DATE			AGE OF CHICKS OBSERVED																
MO	DAY	SPECIES	0-5		5-7		7-10		10-15		15-20		20-24		FLEDGE				
59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
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<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Additional Record Space on Back



Threatened & Endangered
Species Program 1994

79 80 <input type="text"/> <input type="text"/>
PLOVERS FLEDGE

81 82 <input type="text"/> <input type="text"/>
TERNS FLEDGE

CENSUS RECORD PROCEDURES

SITE SUMMARY

Box 1
River Reach (See Box 14)

Box 2-3
Site Number

Box 4-9
Date of Census

Box 10
Survey Type
1 Walking
2 Automobile
3 Boat
4 Airplane/Helicopter
5 Other (explain)

Box 11
Survey Technique
1 Total Adult Count
2 Visual Estimate
3 Best Guess Estimate
4 2X Nests + Broods
(Must Fill in boxes 50-53 & 56-59)

Box 12-13
Habitat Type
01 Sandbar
02 Beach
03 Island
04 Peninsula
05 Feeding/Flying
10 Other (explain)

Box 14
Reach Site Located In
1 Fort Peck Reservoir
2 Fort Peck River
3 Lake Sakakawea
4 Garrison River
5 Lake Oahe, ND
6 Lake Oahe, SD
7 Fort Randall River
8 Lewis & Clark Res.
9 Gavins Point River

Box 15-16
Temp to Nearest 5° F

Box 17-18
Wind to Nearest 5 mph

Box 19-24
All Observers Initials

Box 25-29
River Mile of Colony Site
to Nearest 10th of Mile

Box 30-46
Legal Description of
Colony Site (Reservoirs)

Box 51-52
Number of Plover Broods
on Site

Box 53-54
Total Adult Terns
Observed on Site

Box 55-56
Number of Active Tern
Nests on Site

Box 57-58
Number of Tern Broods
on Site

PRODUCTIVITY RECORD

Box 59-61
Date of Site Visit

Box 62-64
277 Piping Plover
074 Least Tern

Box 65-78
Age of Chicks Observed
(Use separate row for each
species)

Box 79-82
Total Plovers and Terns
Fledged at the Site

Box 83-88
Computer Generated

CENSUS

Box 47-48
Total Adult Plovers
Observed on Site

Box 49-50
Number of Active Plover
Nests on Site

COMMENTS:

DATE		SPECIES	PIPING PLOVER						FLEDGE
MO	DAY		0-5	5-7	7-10	10-15	15-20	20-24	
Total on Front									

83	84	85	SITE FLEDGE RATIO PIPING PLOVER
86	87	88	SITE FLEDGE RATIO LEAST TERN

APPENDIX B

Site by Site Productivity Records

MISSOURI RIVER PIPING PLOVER PRODUCTIVITY MONITORING & ADULT CENSUS, 1995.

RIVER MILE	LAKE LOCATION	NESTS		NEST HAY		NEST EGGS		EGGS COLL.		CHICKS COLL.		FATE DESTROYED		WITHD. INVEST.		DEL. UNW. FATE		ADULT CENSUS		ADULT CHICKS PER 1000		
		MAT.	HAY	MAT.	HAY	MAT.	HAY	MAT.	HAY	MAT.	HAY	MAT.	HAY	MAT.	HAY	MAT.	HAY	MAT.	HAY			
1354.6		1	0	0	0	1	100.0	4	3	1	1	3	0	0	0	0	0	0	0	0	4	
1354.2		6	2	0	0	0	33.3	21	8	0	0	0	0	0	0	0	1	0	10	3	0	
1352.3		3	2	0	0	0	66.7	10	7	0	0	0	1	0	0	0	0	0	8	1	0	
1351.5		0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1351.0		0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1350.6		1	1	0	0	0	100.0	4	4	0	0	0	0	0	0	0	0	0	1	0	0	
1347.5		9	7	0	0	0	77.8	35	26	0	0	0	0	0	0	0	1	1	18	4	0	
1345.5		5	2	1	0	0	40.0	15	8	4	4	0	0	0	0	0	0	2	8	4	5	
1345.0		3	1	0	0	1	66.7	12	5	3	1	5	0	0	0	0	0	6	3	5	0	
1343.5		1	1	0	0	0	100.0	6	4	0	0	0	0	0	0	0	0	0	6	1	0	
1341.0		0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1340.0		1	1	0	0	0	100.0	6	1	0	0	0	0	0	0	0	0	0	2	0	0	
1338.0		1	1	0	0	0	100.0	4	4	0	0	0	0	0	0	0	0	0	2	4	0	
1338.8		1	1	0	0	0	100.0	3	3	0	0	0	0	0	0	0	0	0	5	3	0	
1338.5		0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
1338.0		8	3	1	0	0	37.5	28	11	3	3	0	0	0	0	0	2	0	12	4	2	
1335.5		7	3	1	0	0	42.9	25	10	4	3	0	0	0	0	0	2	1	0	14	3	
1328.0		5	1	0	0	0	20.0	16	4	0	0	1	2	0	0	0	1	0	10	1	0	
1327.5		1	0	0	0	0	0.0	4	0	0	0	1	0	0	0	0	0	0	2	0	0	
1327.0		0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
1325.5		2	1	0	0	0	50.0	6	2	0	0	0	0	0	0	0	1	0	2	0	0	
1324.2		1	1	0	0	0	100.0	4	4	0	0	0	0	0	0	0	0	0	2	2	0	
1322.0		2	1	1	0	0	50.0	6	3	3	2	0	0	0	0	0	0	0	4	3	0	
1321.4		0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
1320.0		4	2	0	0	0	50.0	15	6	0	0	0	0	0	0	0	0	0	12	5	0	
1319.8		4	2	2	0	0	50.0	13	8	5	4	0	0	0	0	0	0	0	8	5	3	
1310.5		1	0	0	0	0	0.0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	
1308.5		3	1	1	0	0	33.3	11	3	4	4	0	0	0	0	0	0	0	4	0	3	
1308.7		9	2	0	0	0	28.8	24	8	0	0	1	3	0	0	0	0	1	6	5	0	
1308.4		9	8	0	0	0	66.7	36	23	0	0	0	0	0	0	0	0	0	20	0	0	
1307.5		6	4	0	0	0	66.7	24	14	0	0	0	0	0	0	0	0	0	10	7	0	
TOTAL		138	81	10	4	0	62.5	500	282	40	33	8	4	8	0	0	11	10	5	261	122	33
LAKHRES	1270.0	9	4	0	0	0	44.4	30	14	0	0	0	0	1	0	0	1	1	0	14	8	0
	1192.3	1	1	0	0	0	100.0	3	1	0	0	0	0	0	0	0	0	0	0	2	0	0
	1136.3*	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
	1134.8*	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1106.6	2	0	0	0	0	0.0	8	0	0	0	0	0	0	0	0	1	0	4	0	0	
	1104.5	2	0	1	0	0	0.0	5	0	4	4	0	1	0	0	0	0	0	2	0	0	0
	1081.1	5	1	2	0	0	20.0	17	3	4	2	0	0	0	0	0	2	0	2	2	1	1
	1060.0	1	0	0	0	0	0.0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	1070.4	1	1	0	0	0	100.0	3	3	0	0	0	0	0	0	0	0	0	0	2	3	0
TOTAL		21	7	3	0	0	33.3	70	21	8	8	0	3	1	0	0	4	1	0	30	14	4
FTRLRW	869.0	4	0	0	0	0	0.0	5	0	0	0	0	4	0	0	0	0	0	0	0	0	0
	866.7	3	0	0	0	0	0.0	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0
TOTAL		7	0	0	0	0	0.0	9	0	0	0	7	0	0	0	0	0	0	0	0	0	0
LEGLRES	843.0	1	0	0	0	0	0.0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	840.0	1	0	1	0	0	0.0	3	0	3	2	0	0	0	0	0	0	0	0	0	0	0
	828.5	1	0	1	0	0	0.0	2	0	2	2	0	0	0	0	0	0	0	0	4	0	2

APPENDIX C

Nesting & Adult Census Site Maps

FORT PECK LAKE

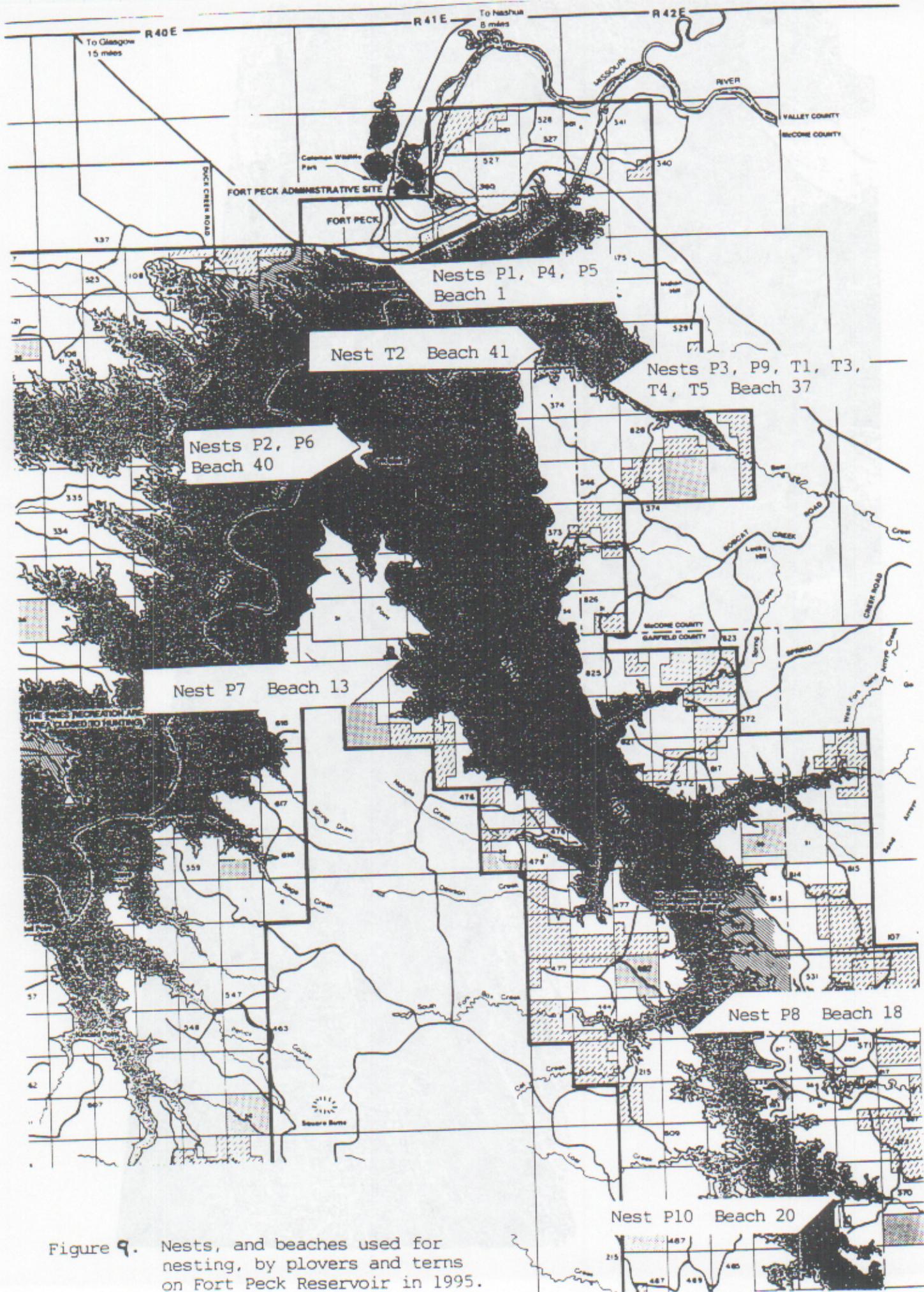


Figure 9. Nests, and beaches used for nesting, by plovers and terns on Fort Peck Reservoir in 1995.

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HOOPER & LING CO
Mc CONE CO

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16886

115

16884

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22





Tern nest 019, Plover nest 021

22



12

• 1618

ROOSEVELT CO
— RICHLAND CO

R56 E

R57 E

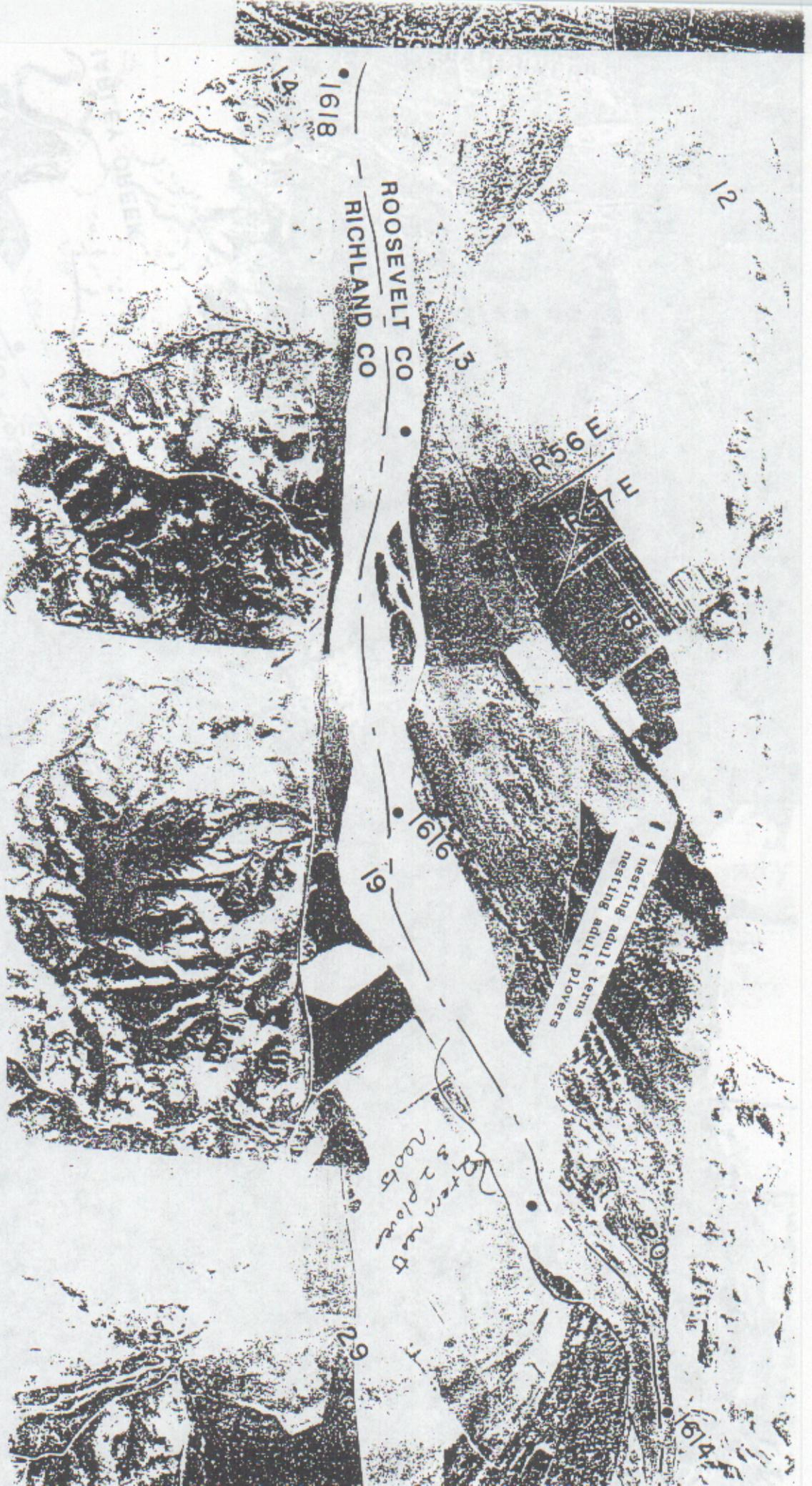
4 nesting adult terns
4 nesting adult plovers

1616

2 tern nests
2 plovers
2005

1619

1614



02
26

1603

35

600

25

36

1599

36 nesting adult terns
6 nesting adult plovers

2

Adams

RICHMOND CO
ROOSEVELT CO

R58N

R59N

1597

6

2 adult plovers with nest scrapes

T26N

30

595

597

599

5





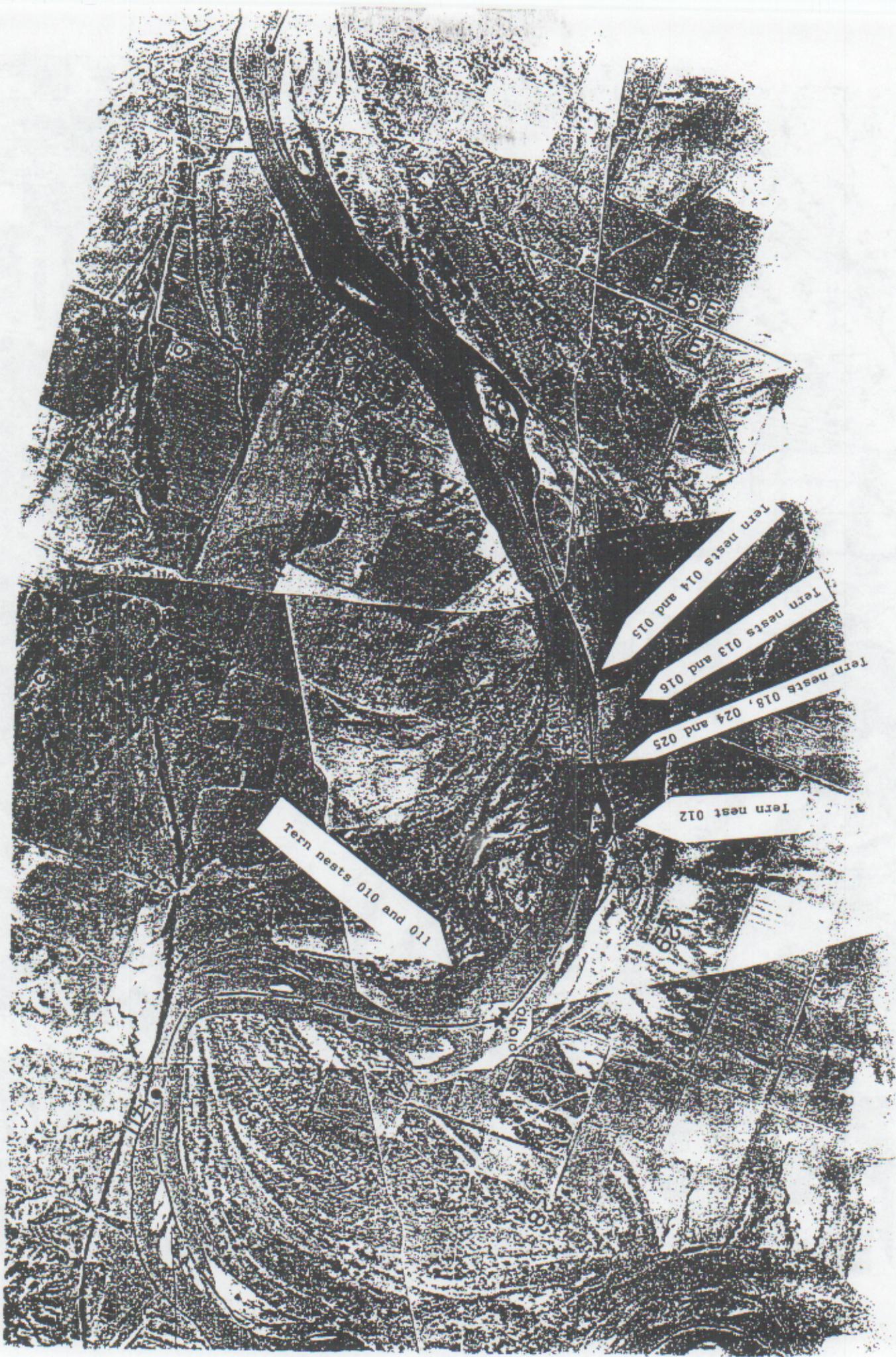
28

Tern nest 027

ROOSEVELT
NO ONE

1998





Tern nests 010 and 011

Tern nests 014 and 015

Tern nests 013 and 016

Tern nests 018, 024 and 025

Tern nest 012



Site # 5
6 LT Nests
Riv. Mile - 1580.2

Habitat
1 acre of
Wooded Stream
Cleared brush
P. m. Miles

FT. BUFOUR STATE HISTORIC SITE
MILES

FT. UNION NATIONAL HISTORIC SITE
MILES

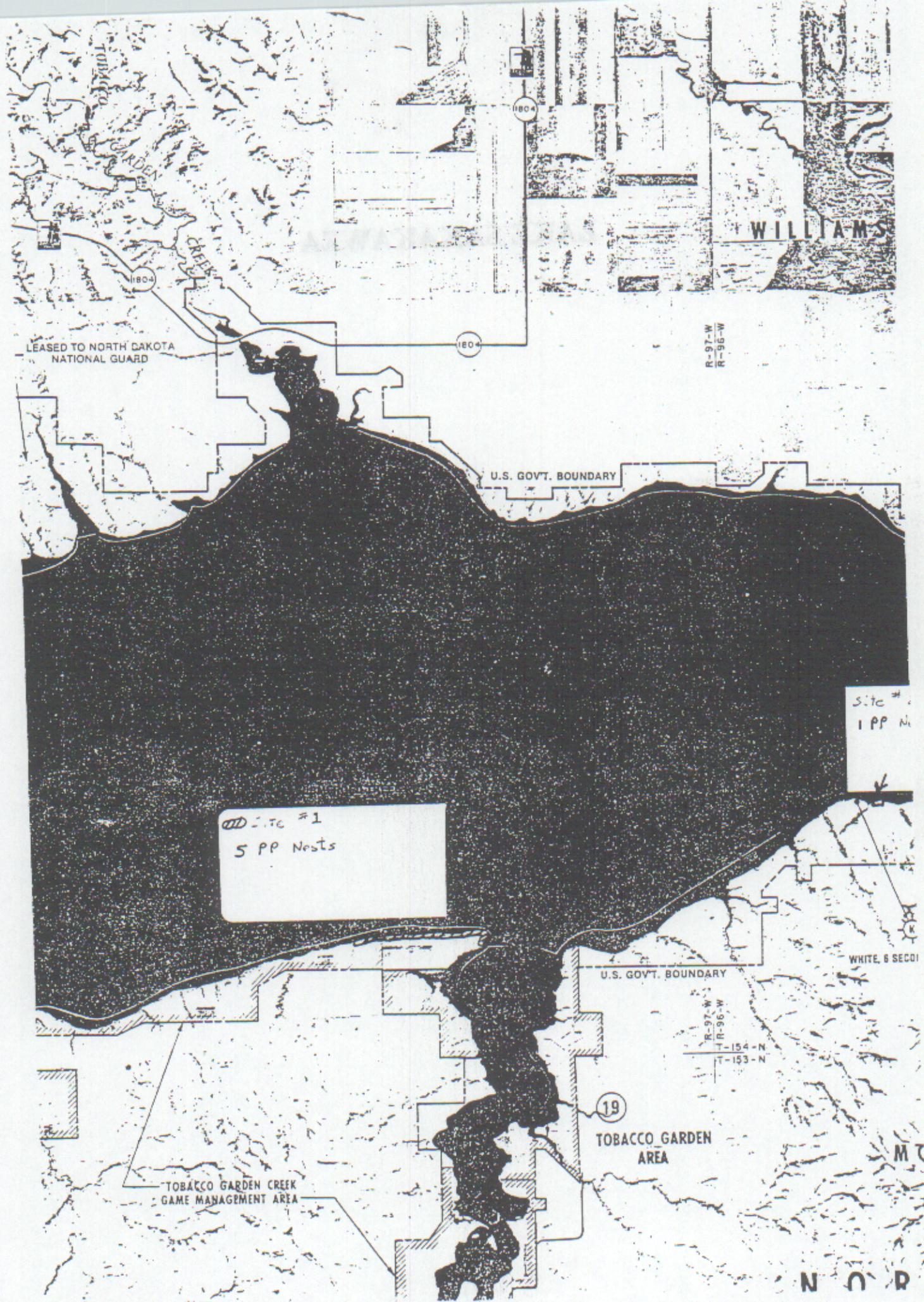
WEST VIRGINIA COUNTY

H. J. B. N. H. J. B. N.

R-104

R-103

LAKE SAKAKAWEA



WILLIAMS

LEASED TO NORTH DAKOTA NATIONAL GUARD

U.S. GOVT. BOUNDARY

R-97-W
R-96-W

Site # 1
1 PP Nest

Site # 1
5 PP Nests

WHITE, 8 SECT

U.S. GOVT. BOUNDARY

R-97-W
R-96-W
T-154-N
T-153-N

19

TOBACCO GARDEN AREA

TOBACCO GARDEN CREEK GAME MANAGEMENT AREA

N O R

LEGEND:

COUNTY

HOFFLUND
GAME MANAGEMENT
AREA

Site #3
PP Nests

Little Egypt

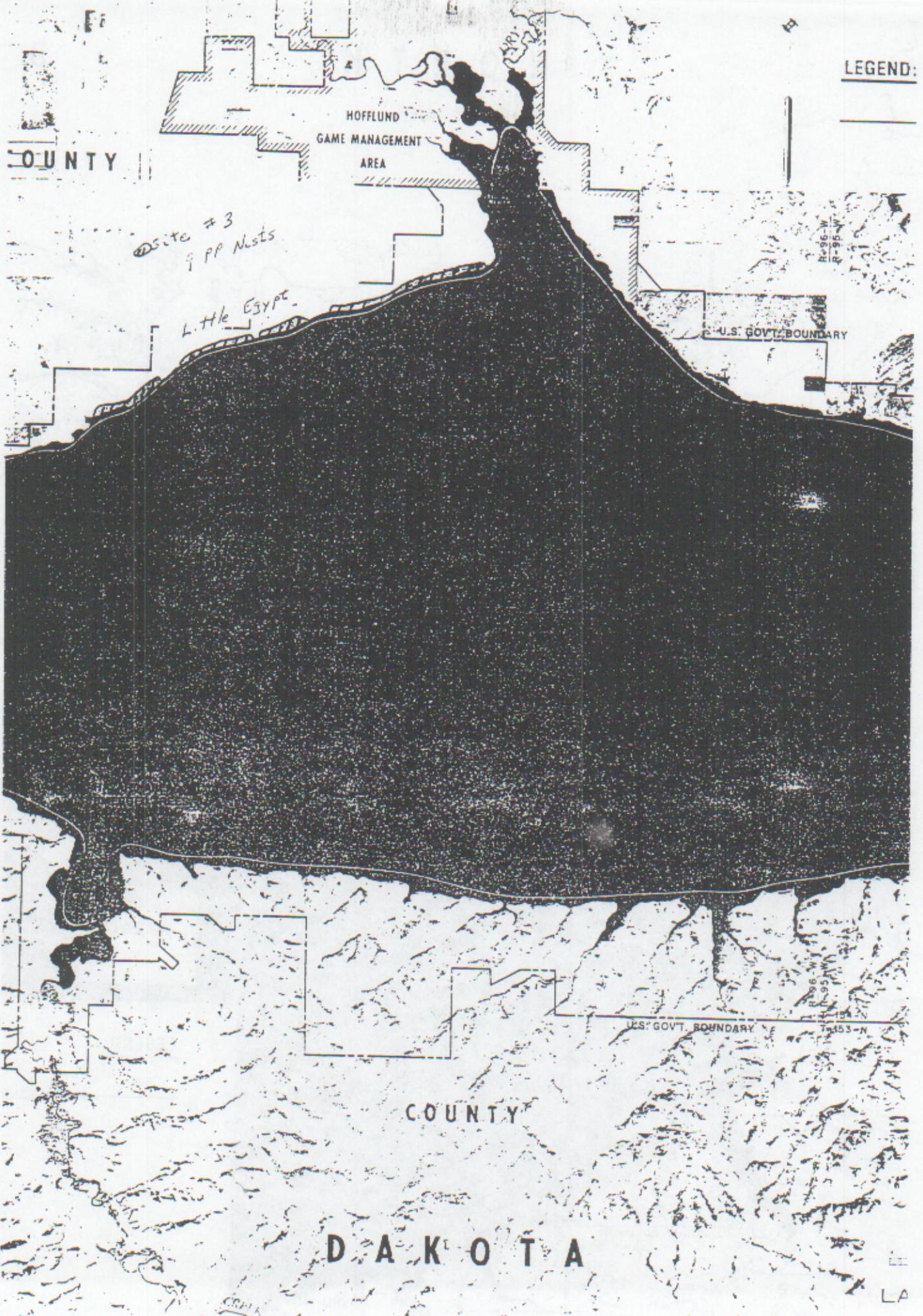
U.S. GOVT. BOUNDARY

U.S. GOVT. BOUNDARY

COUNTY

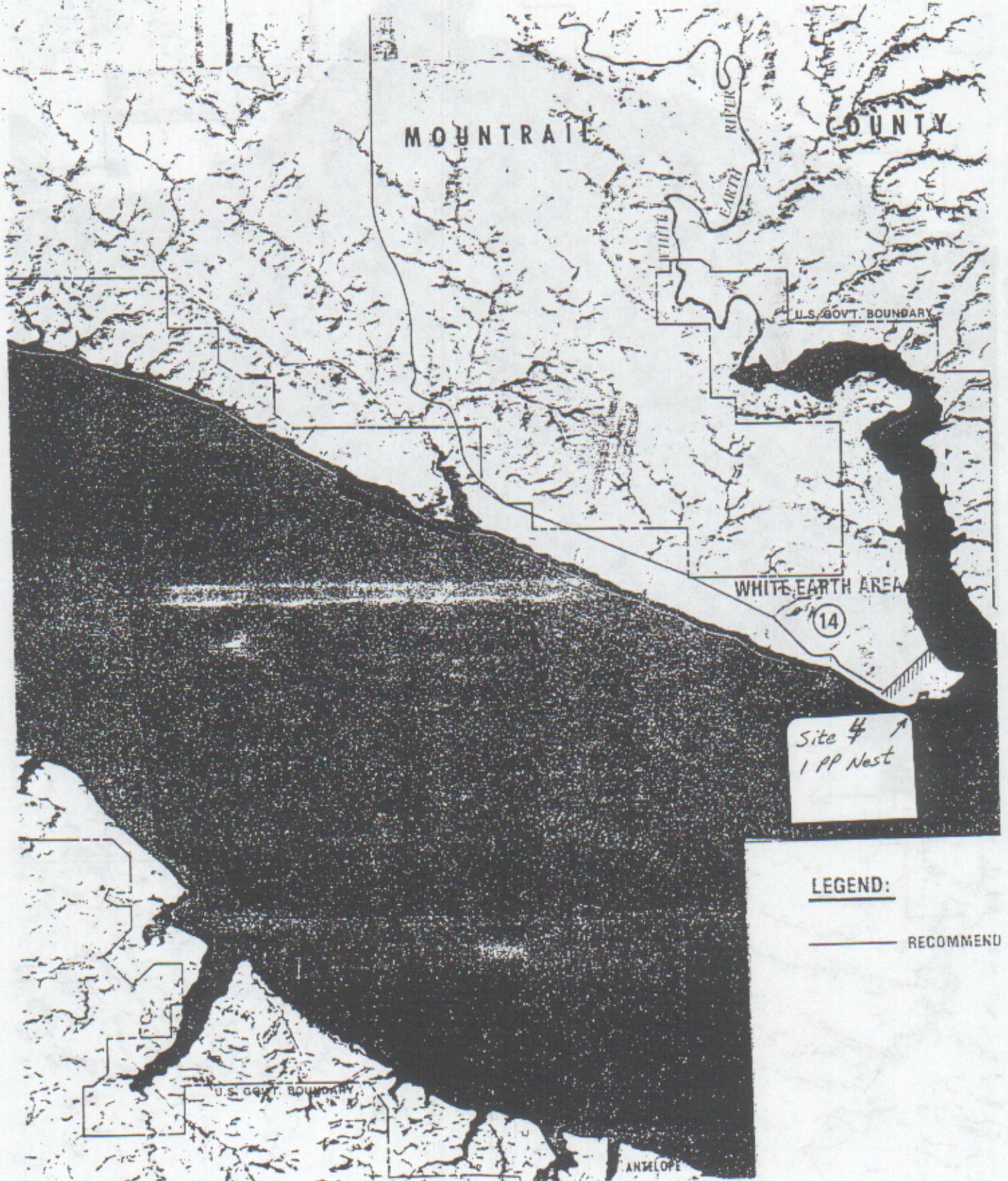
DAKOTA

LA



N O R T H

D



MOUNTRAIL COUNTY

COUNTY

WHITE EARTH RIVER

U.S. GOVT. BOUNDARY

WHITE EARTH AREA

14

Site 4 ↑
1 PP Nest

LEGEND:

————— RECOMMEND

U.S. GOVT. BOUNDARY

ANGLOPE

U.S. GOVT. BOUNDARY

FORT BERTHOLD INDIAN RESERVE

500

R.R.

12

VAN HOOK AREA

VAN HOOK GAME MANAGEMENT AREA

BOAT RAMP

VAN HOOK ISLANDS
P.P. 3 NESTS

VAN HOOK ARM

HAZARD AREA
SUBMERGED ISLAND

ON

ON

ON

ON

ON

N O R T H D A K

FORT

BERTHOLD

INDIAN

RESERVATION

U.S. GOVT. BOUNDARY

DEEPWATER CREEK
GAME MANAGEMENT
AREA

DEEPWATER CREEK
COTTAGE AREA

U.S. GOVT. BOUNDARY

DEEPWATER

DEEPWATER BAY
P.P. 1 NEST

DEEPWATER CREEK
GAME MANAGEMENT AREA

IRISH

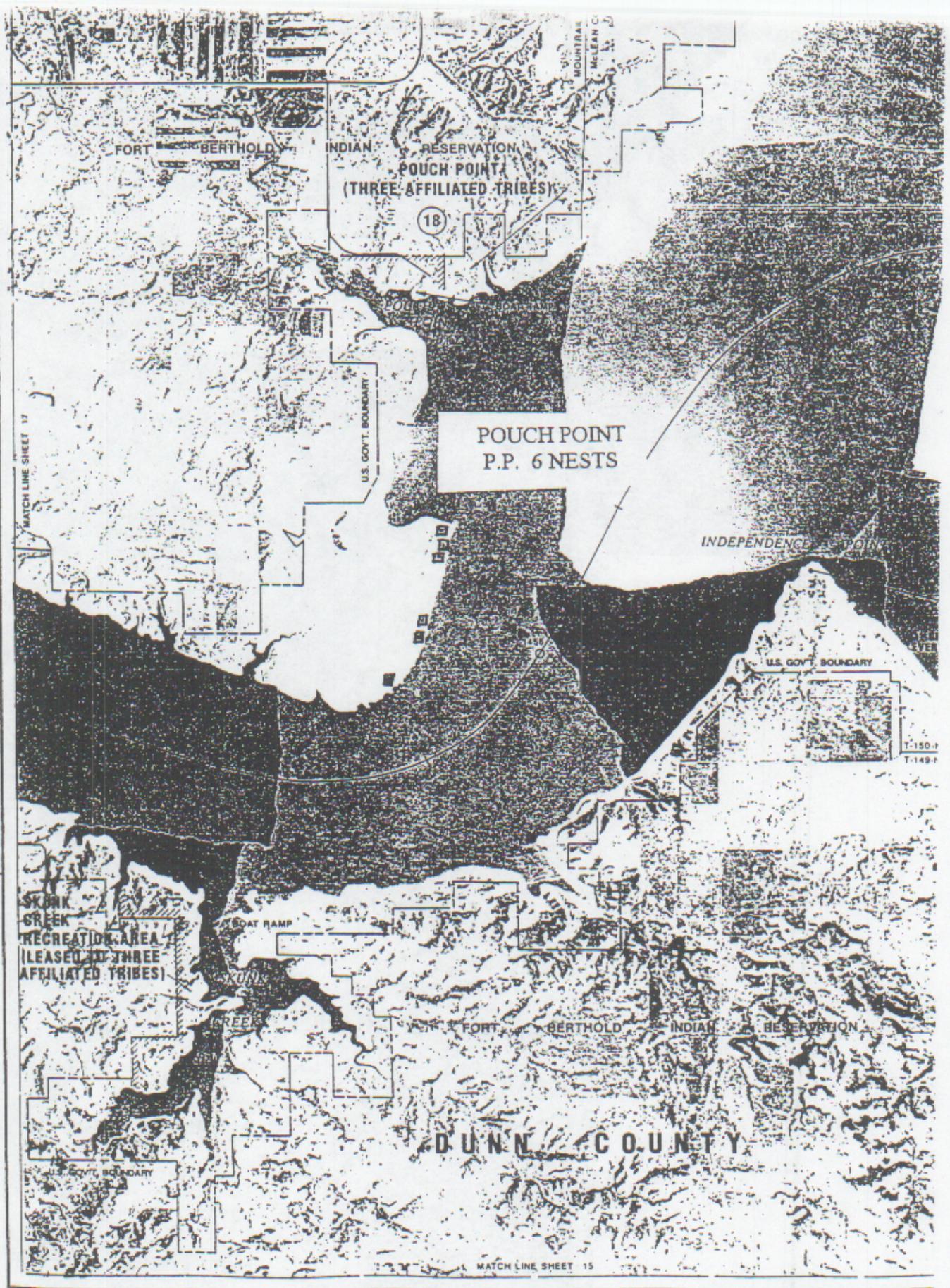
M. C. LEAN

U.S. GOVT. BOUNDARY

FORT

BERTHOLD

IN



DUNN CO.

RECOMMENDED ACCESS ROADS

U.S. GOVT. BOUNDARY
FORT BERTHOLD
INDIAN RESERVATION

MATCHLINE SHEET 21

MATCHLINE SHEET 19

INDEPENDENCE POINT
P.P. 7 NESTS
L.T. 1 NEST

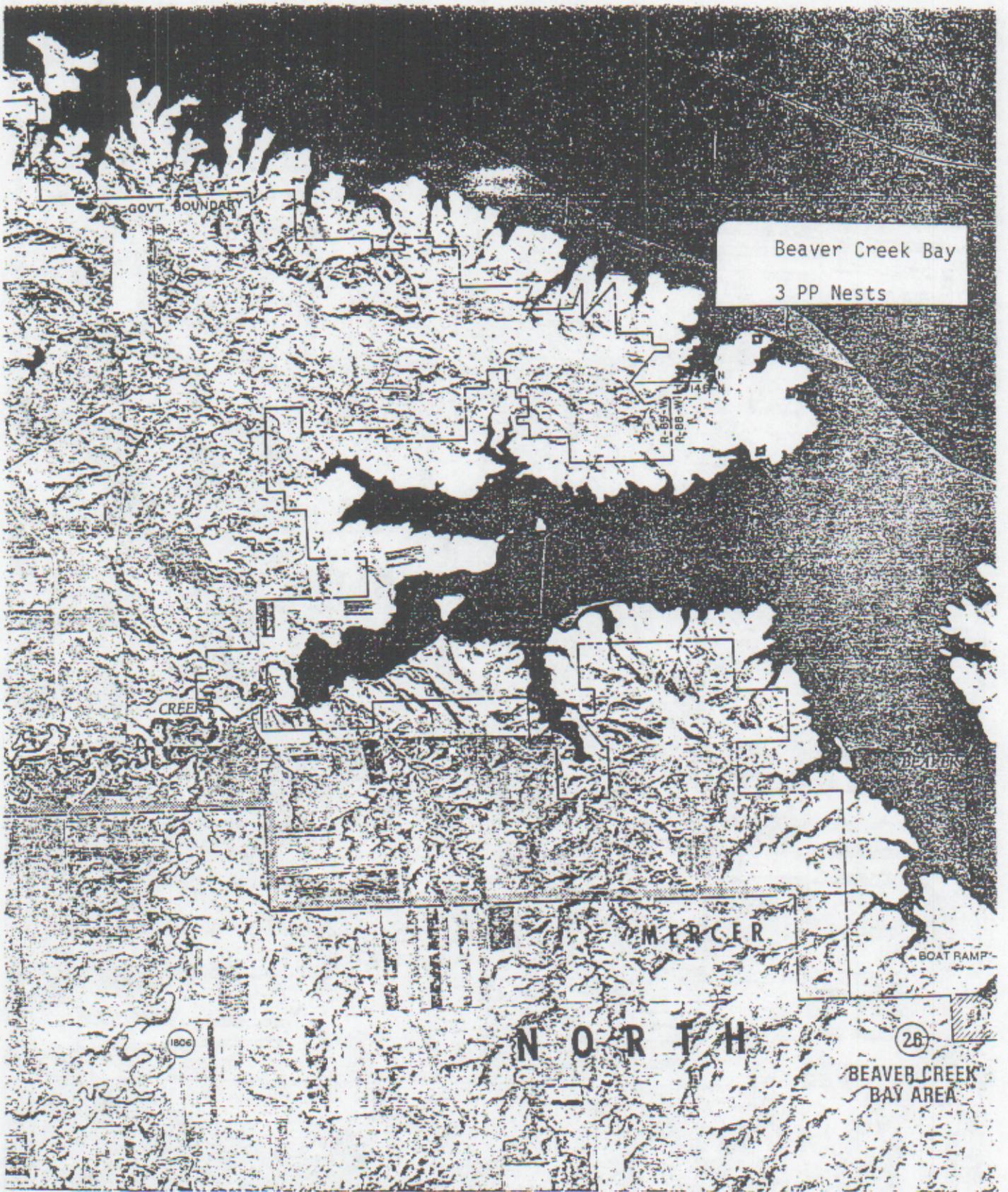
U.S. GOVT. BOUNDARY

FORT BERTHOLD
INDIAN RESERVATION

DUNN COUNTY

149-N





Beaver Creek Bay
3 PP Nests

GOVT. BOUNDARY

CREEK

MERCER

NORTH

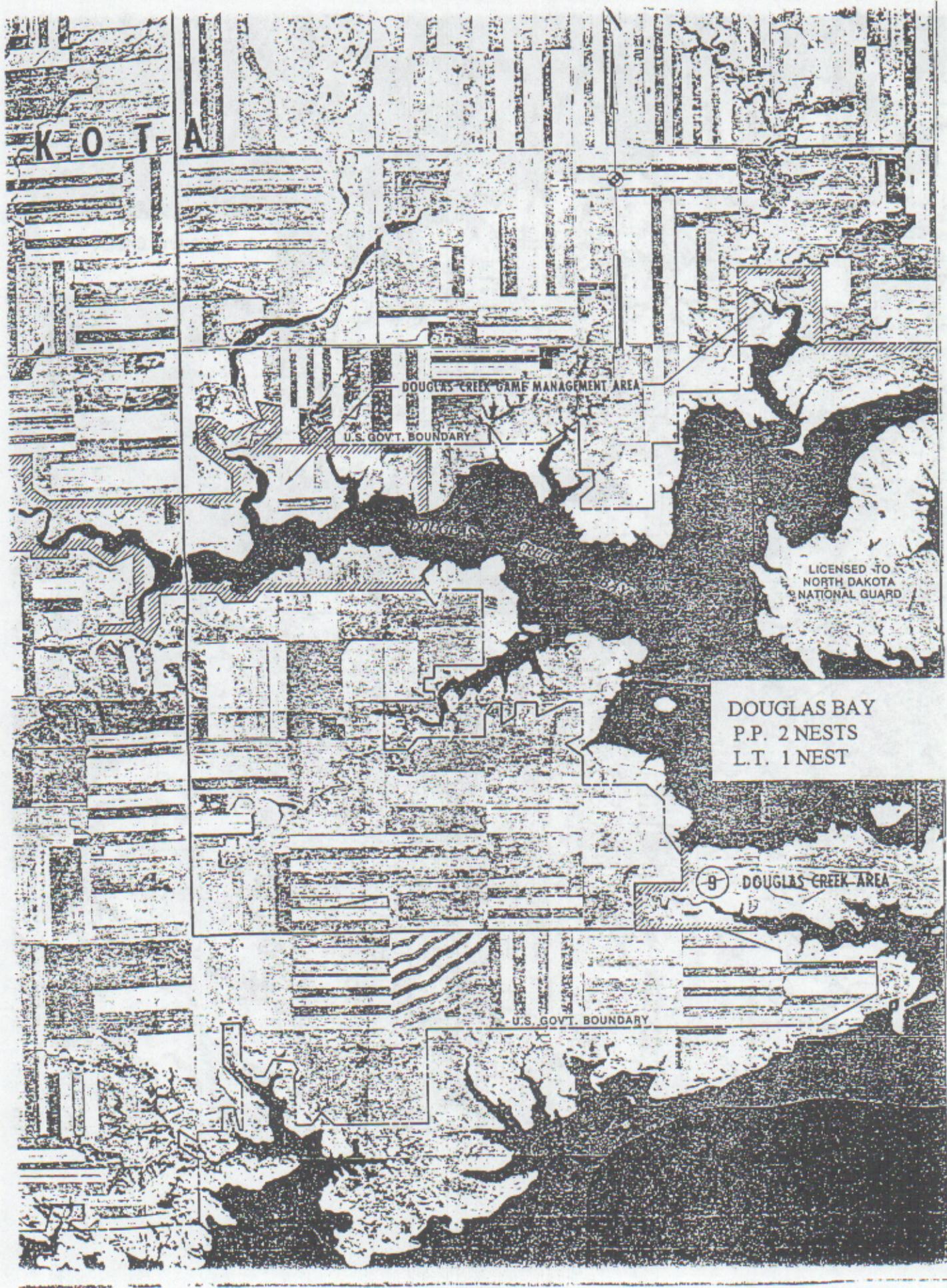
26

BEAVER CREEK BAY AREA

BOAT RAMP

BEAVER

R-88-W
R-88-N



K O T A

DOUGLAS CREEK GAME MANAGEMENT AREA

U.S. GOVT. BOUNDARY

DOUGLAS CREEK
DOUGLAS BAY

LICENSED TO
NORTH DAKOTA
NATIONAL GUARD

DOUGLAS BAY
P.P. 2 NESTS
L.T. 1 NEST

9 DOUGLAS CREEK AREA

U.S. GOVT. BOUNDARY

D A K O T A

COUNTY

U.S. GOV'T. BOUNDARY

LEASED TO GARRISON SPORTSMEN'S CLUB

STEINKE BAY
P.P. 3 NESTS

DE TROBRIAND

GAME MANAGEMENT AREA

BOYERAMP MARINA

DE TROBRIAND

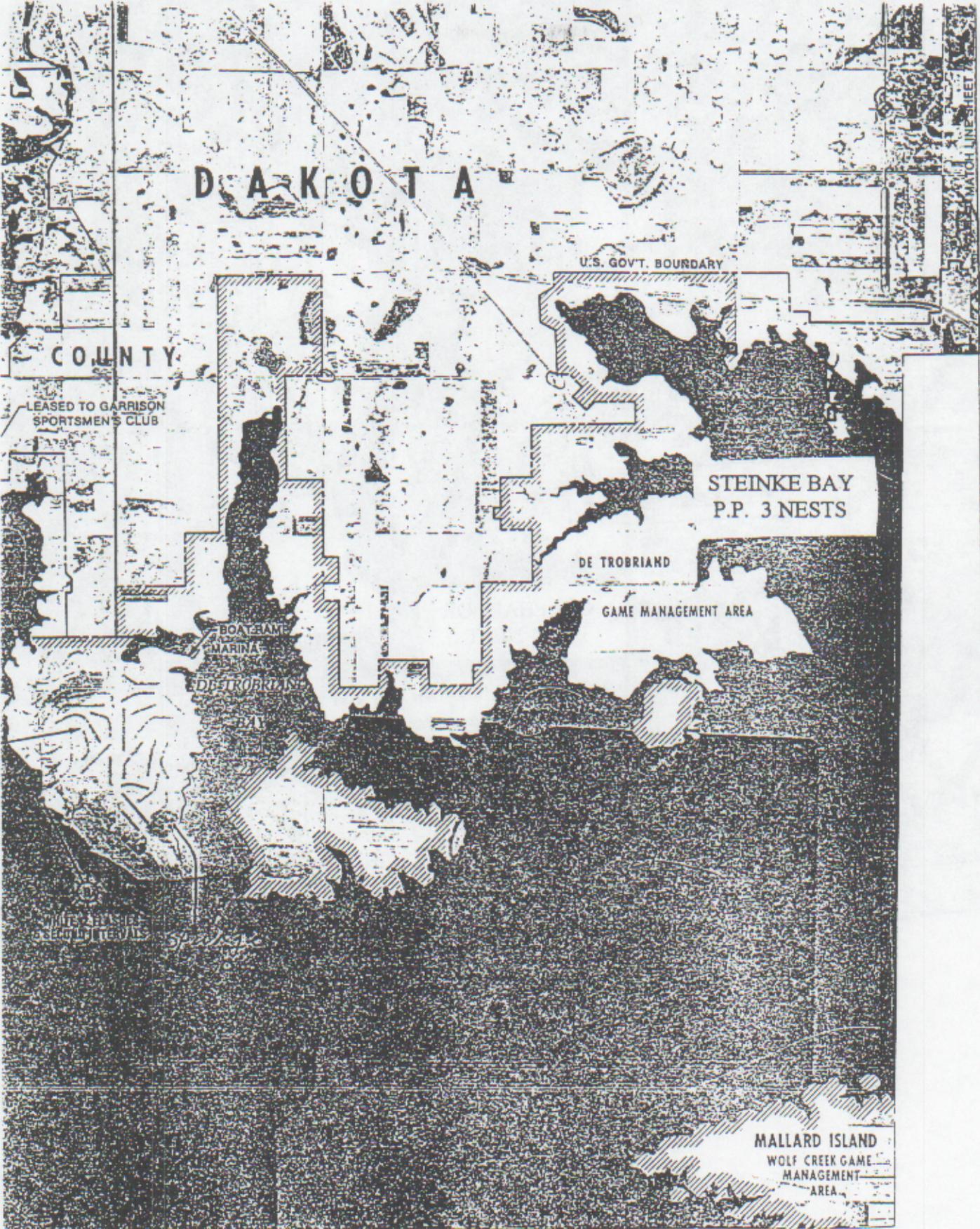
WHITE PINE ISLAND
SEASONAL INTERVALS

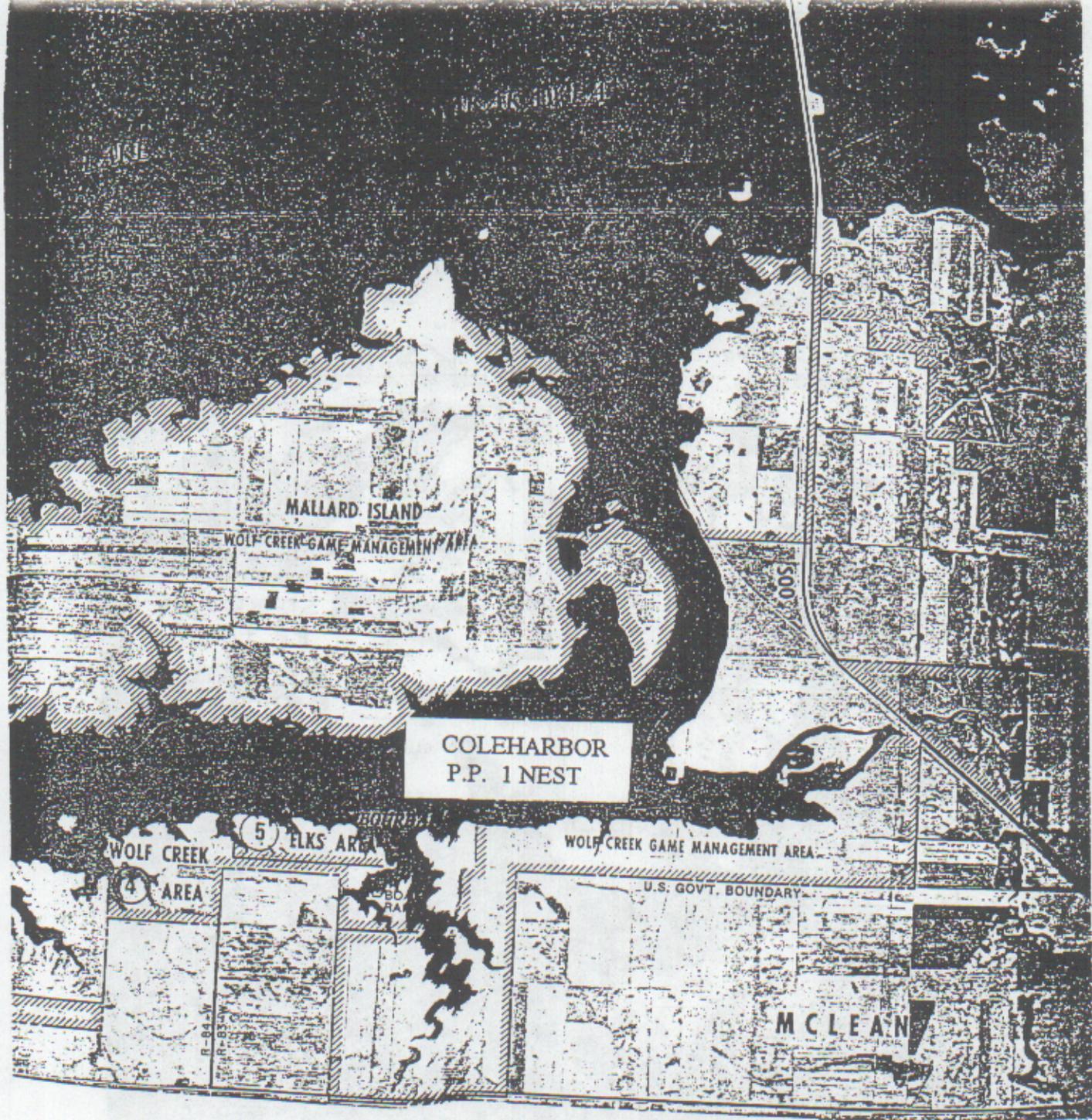
MALLARD ISLAND
WOLF CREEK GAME
MANAGEMENT
AREA

LEGEND:

— RECOMMENDED ACCESS ROADS

MATCH LINE SHEET

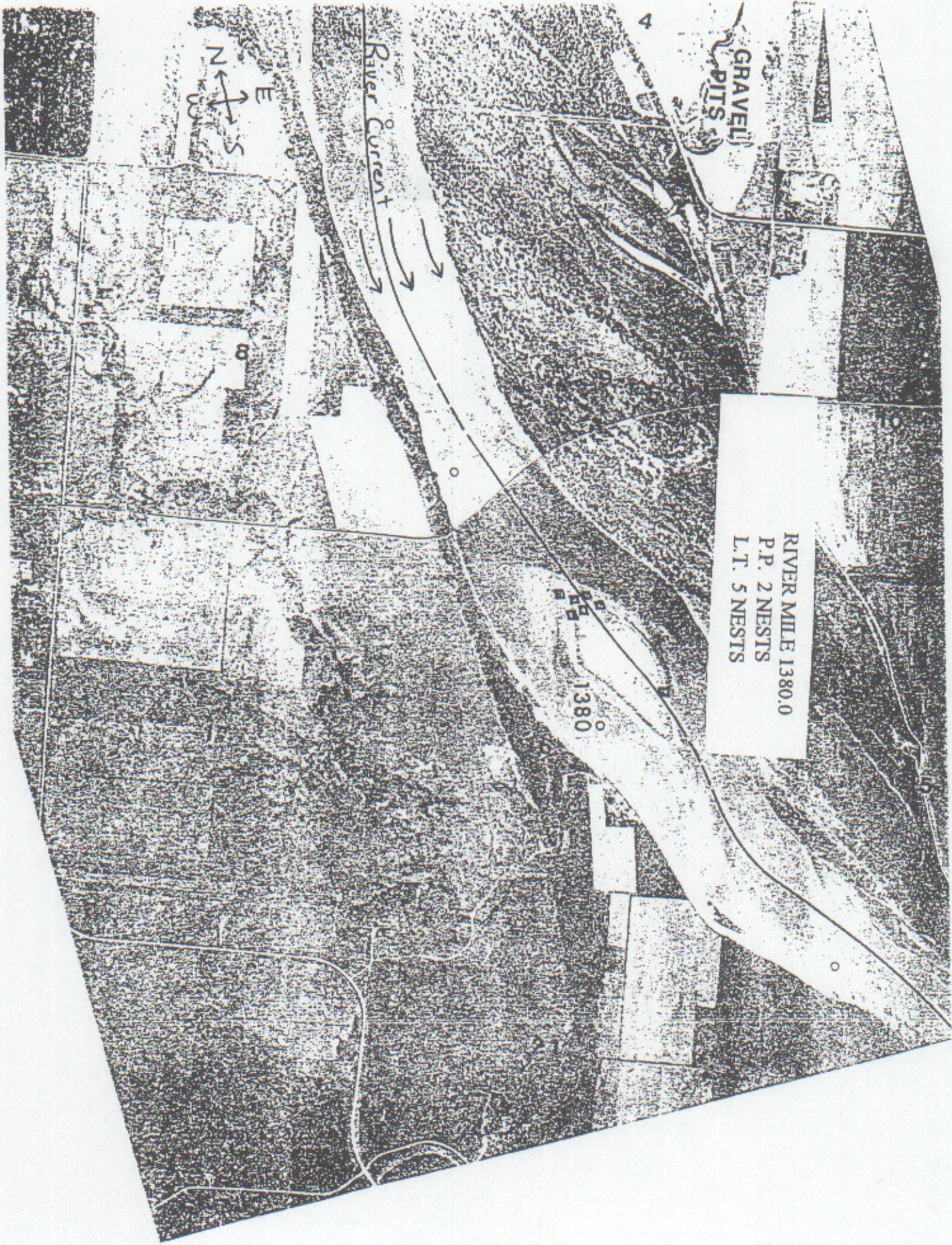




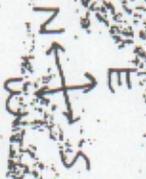
COLEHARBOR
P.P. 1 NEST

N O R T H

GARRISON RIVER



GRAVEL
PITS



RIVER MILE 1380.0
P.P. 2 NESTS
L.T. 5 NESTS

1380

RIVER MILE 1378.2
P.P. 2 NESTS

378.0

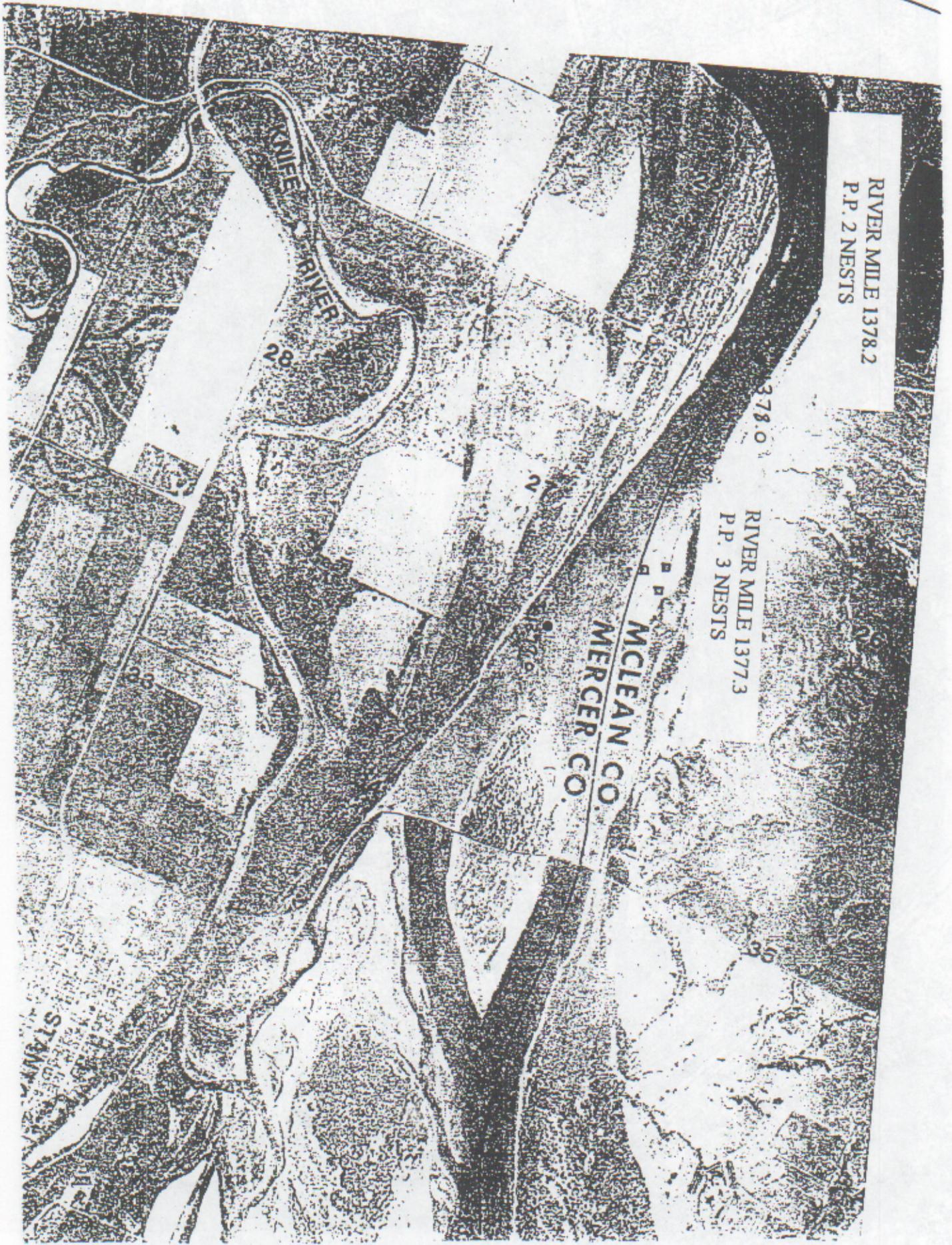
RIVER MILE 1377.3
P.P. 3 NESTS

MCCLEAN CO.
MERCER CO.

KNIFE RIVER

28

STANLEY





E: 41H
RIVER MILE: 1354.6
LEAST TERN NESTS: 1
LEAST TERN FLEDGE: 2
PIPING PLOVER NEST: 1
PIPING PLOVER FLEDGE: 4

SITE: 41A
RIVER MILE: 1354.2
LEAST TERN NEST: 0
LEAST TERN FLEDGE: 0
PIPING PLOVER NEST: 6
PIPING PLOVER FLEDGE: 3

RIVER MILE 1378.2
P.P. 2 NESTS

378.0

RIVER MILE 1377.3
P.P. 3 NESTS

MCCLEAN CO.
MERCER CO.

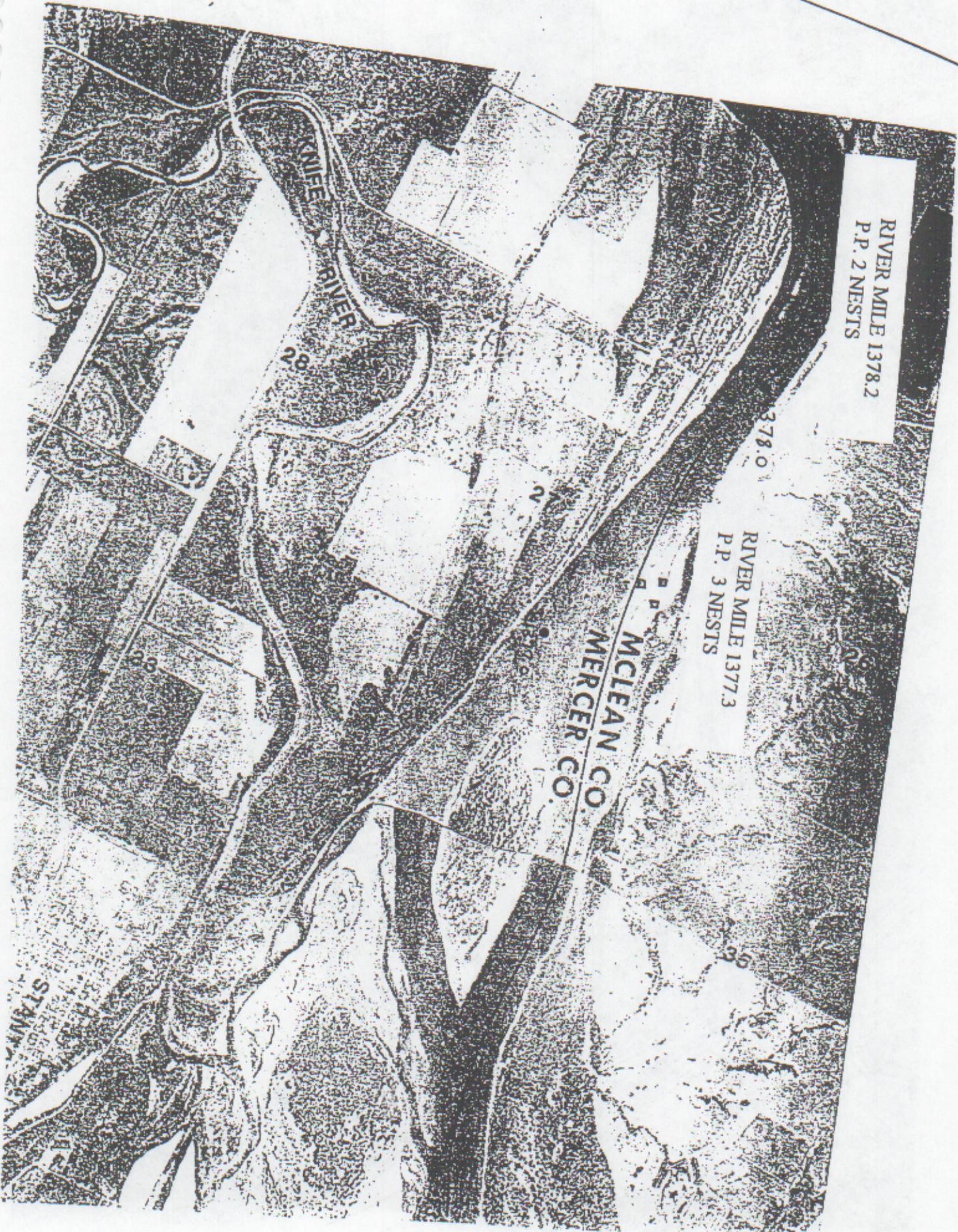
KNEE RIVER

28

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39

STANLEY



EA
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CO

1145N
1174N

STANTON
R. 83W
R. 84W

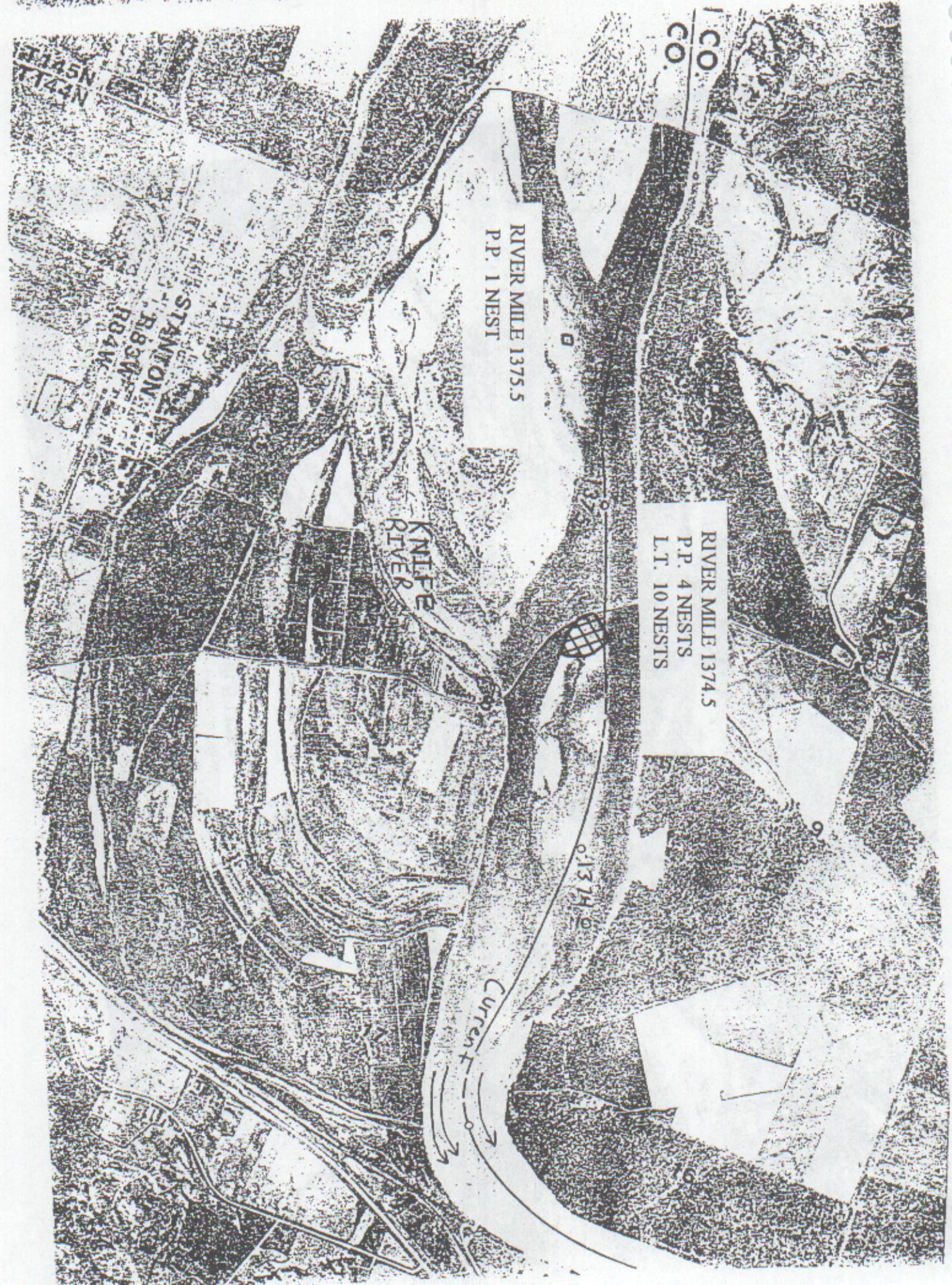
RIVER MILE 1375.5
P.P. 1 NEST

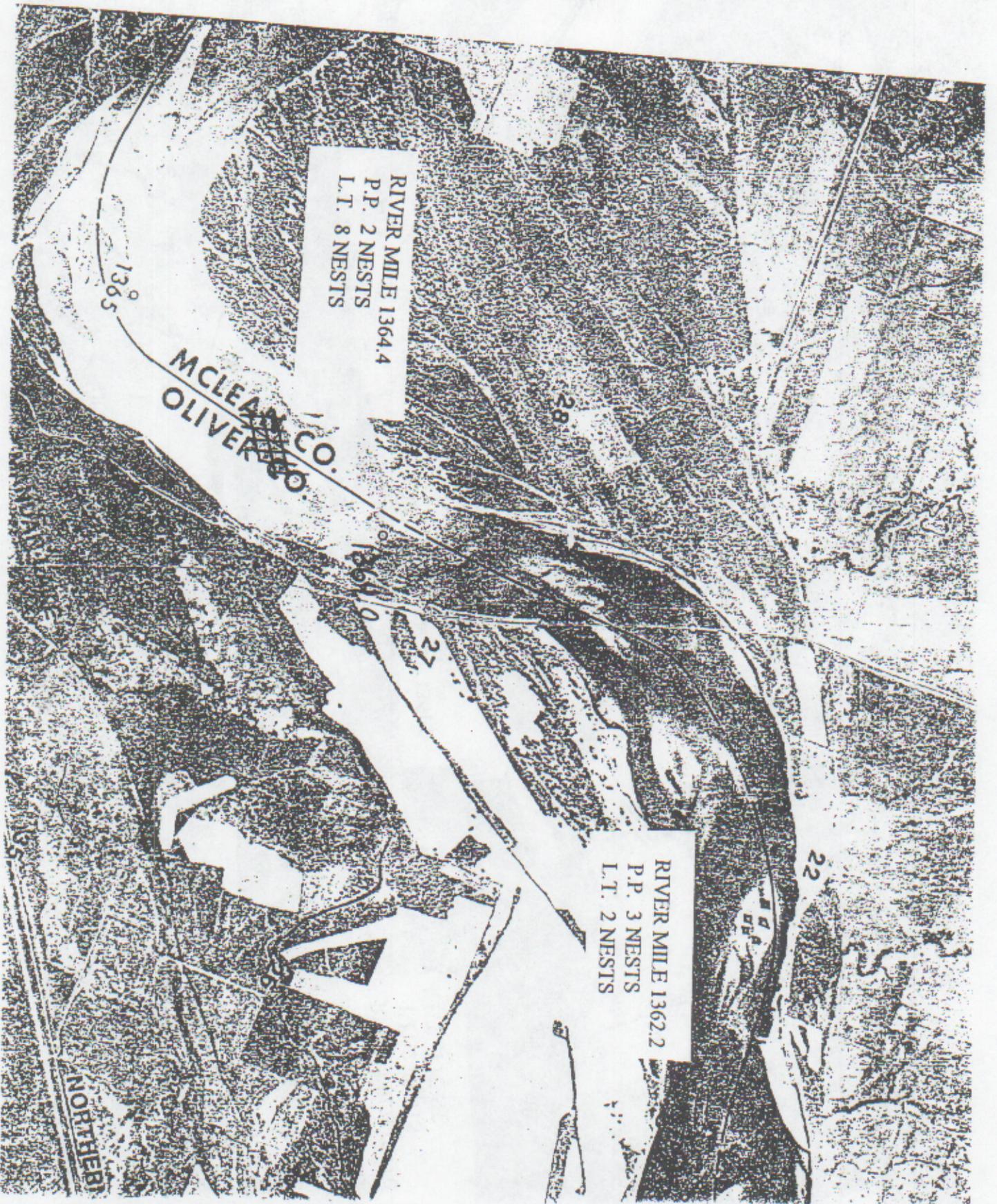
KNIFE
RIVER

RIVER MILE 1374.5
P.P. 4 NESTS
L.T. 10 NESTS

0.1374

Current





RIVER MILE 1364.4
P.P. 2 NESTS
L.T. 8 NESTS

MCLEAN CO.
OLIVER CO.

RIVER MILE 1362.2
P.P. 3 NESTS
L.T. 2 NESTS

NORTHERN



NORTHERN PACIFIC

R83W
R82W

RIVER MILE 1361.0
P.P. 4 NESTS
L.T. 7 NESTS

RIVER MILE 1359.0
P.P. 2 NESTS
L.T. 1 NEST

22

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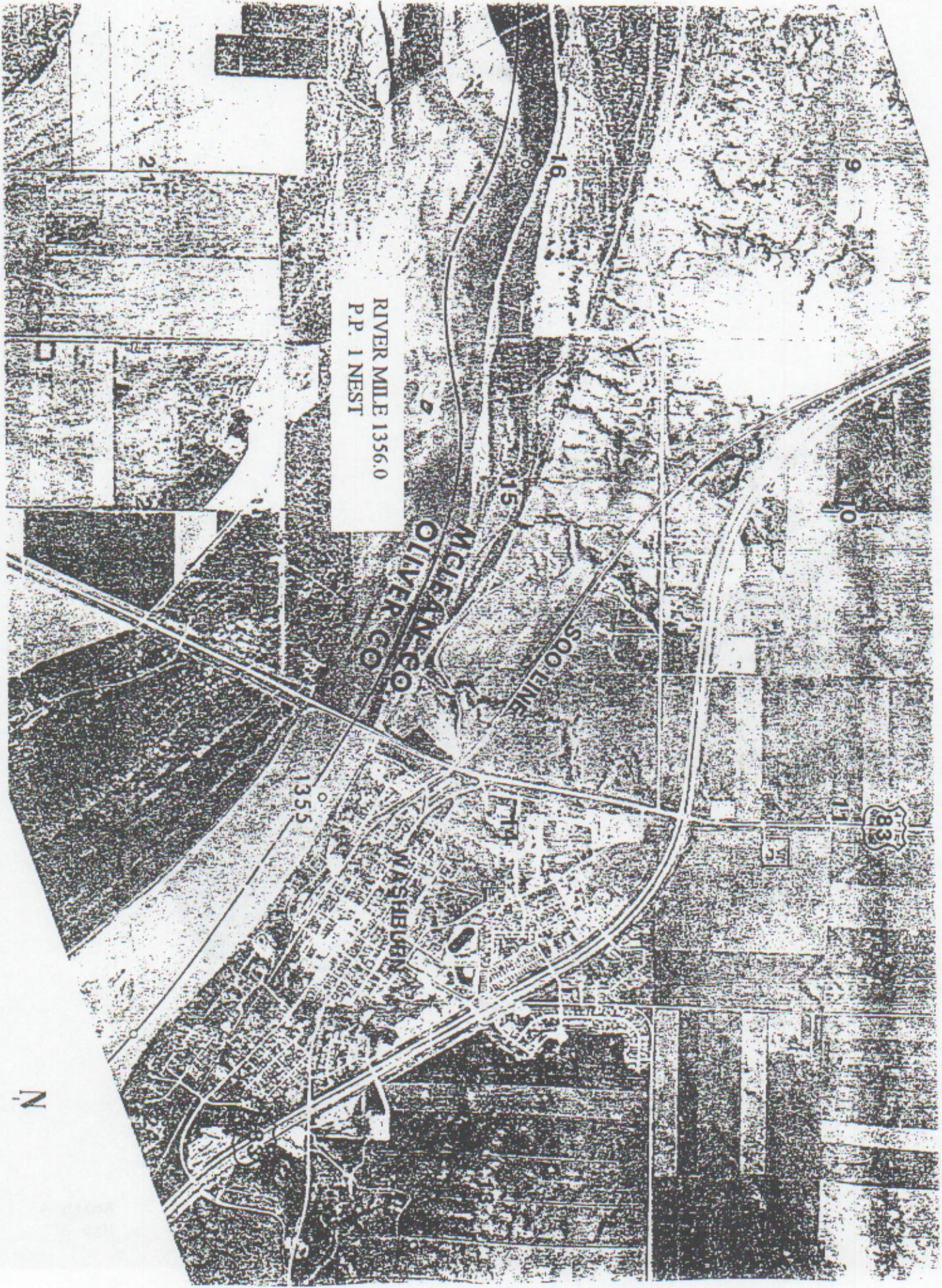
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1400



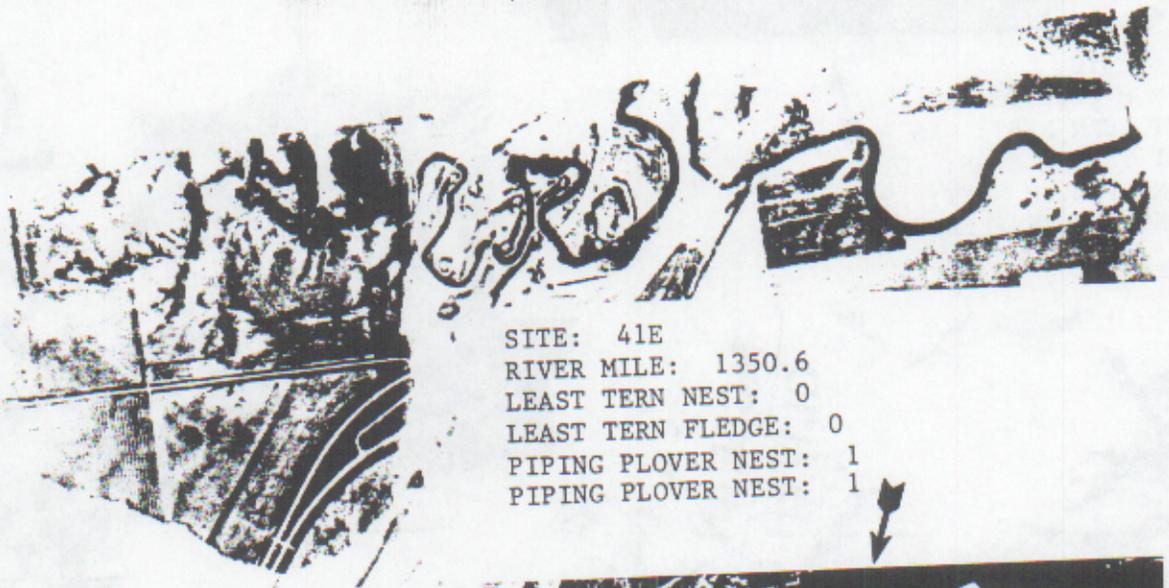
RIVER MILE 1356.0
P.P. 1 NEST

N



E: 41H
 RIVER MILE: 1354.6
 LEAST TERN NESTS: 1
 LEAST TERN FLEDGE: 2
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 4

SITE: 41A
 RIVER MILE: 1354.2
 LEAST TERN NEST: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 6
 PIPING PLOVER FLEDGE: 3



SITE: 41E
 RIVER MILE: 1350.6
 LEAST TERN NEST: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 1

E: 41I
 RIVER MILE: 1351.5
 LEAST TERN NEST: 1
 LEAST TERN FLEDGE: 2
 PIPING PLOVER NEST: 0
 PIPING PLOVER FLEDGE: 0



E: 41B
 RIVER MILE: 1352.3
 LEAST TERN NEST: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 3
 PIPING PLOVER FLEDGE: 1

18

17

Reach

GOOSE

CREAK

: 41C
 R MILE: 1347.5
 T TERN NEST: 15
 T TERN FLEDGE: 0
 NG PLOVER NEST: 9
 NG PLOVER FLEDGE: 4



: 41G
 R MILE: 1345.5
 T TERN NEST: 11
 T TERN FLEDGE: 17
 NG PLOVER NEST: 5
 NG PLOVER FLEDGE: 9



29

WILDPOOL LAKE

28

: 41F
 R MILE: 1345.0
 T TERN NEST: 0
 T TERN FLEDGE: 0
 NG PLOVER NEST: 3
 NG PLOVER FLEDGE: 8



SITE: 41D
 RIVER MILE: 1343.5
 LEAST TERN NEST: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 1



MCLEAN COUNTY
BURLEIGH

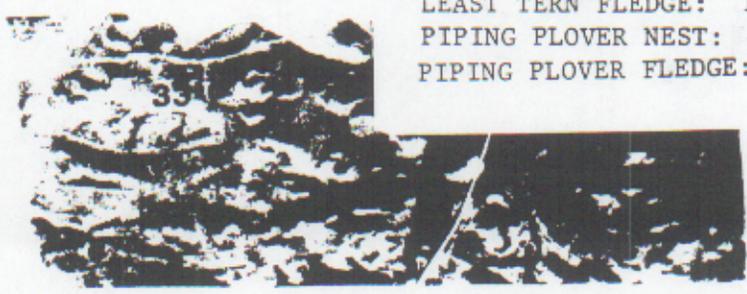


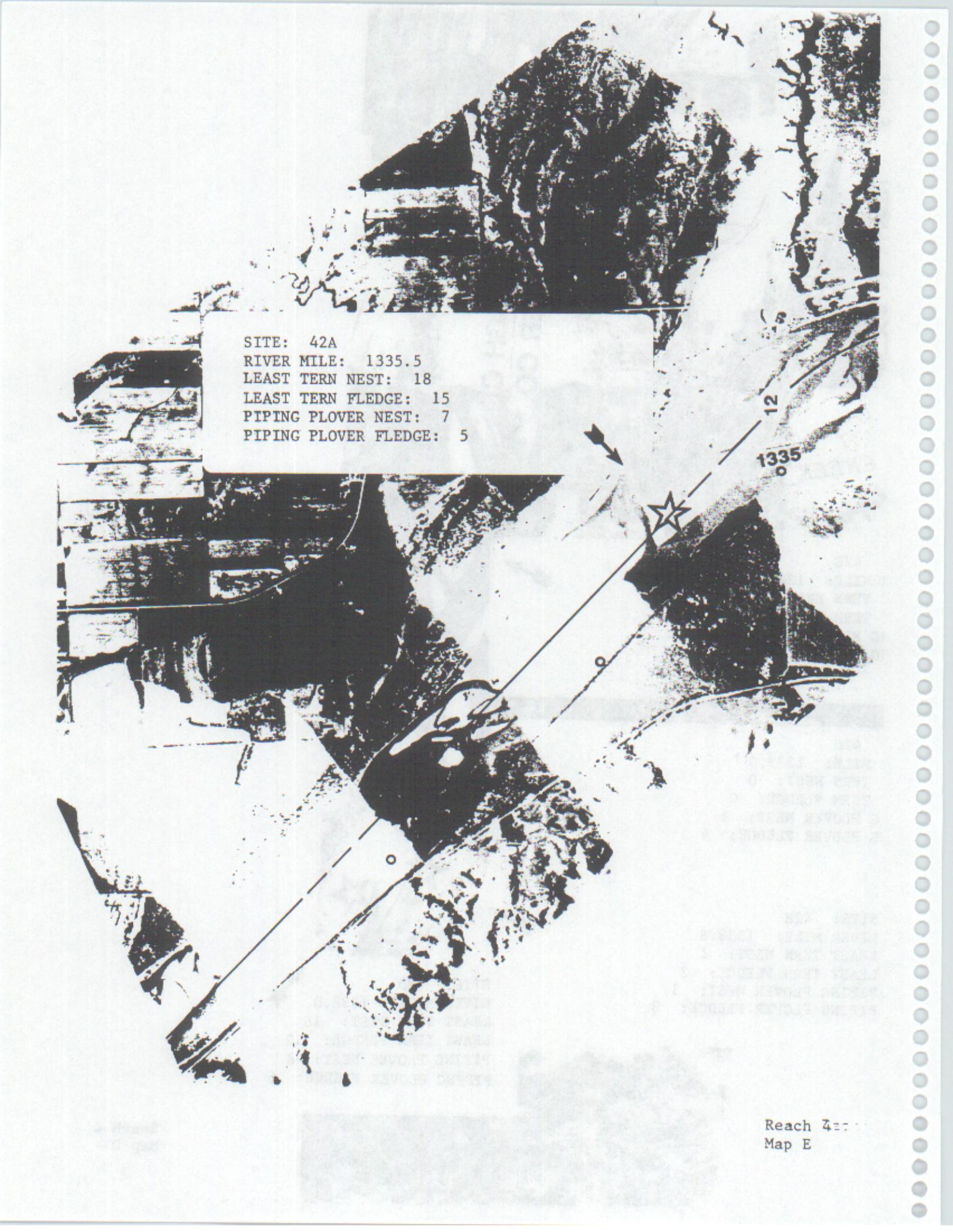
42G
 RIVER MILE: 1340.0
 LEAST TERN NEST: 1
 LEAST TERN FLEDGE: 3
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 0

42G
 RIVER MILE: 1339.0
 LEAST TERN NEST: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 4

SITE: 42H
 RIVER MILE: 1338.8
 LEAST TERN NEST: 1
 LEAST TERN FLEDGE: 2
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 3

SITE: 42D
 RIVER MILE: 1338.0
 LEAST TERN NEST: 16
 LEAST TERN FLEDGE: 12
 PIPING PLOVER NEST: 8
 PIPING PLOVER FLEDGE: 6



An aerial photograph of a river reach, likely the Colorado River, showing a bend in the river. A white rectangular data box is overlaid on the upper left portion of the image. A dashed line with arrows at both ends runs along the river's path, with a star symbol marking a specific location. The number '12' is written near the top of this line, and '1335' is written near the star. The terrain is rugged and appears to be a mix of sandbars and rocky banks.

SITE: 42A
RIVER MILE: 1335.5
LEAST TERN NEST: 18
LEAST TERN FLEDGE: 15
PIPING PLOVER NEST: 7
PIPING PLOVER FLEDGE: 5

SITE: 42M
RIVER MILE: 1325.5
LEAST TERN NEST: 2
LEAST TERN FLEDGE: 1
PIPING PLOVER NEST: 2
PIPING PLOVER FLEDGE: 0

SITE: 42N
RIVER MILE: 1327.0
LEAST TERN NEST: 2
LEAST TERN FLEDGE: 0
PIPING PLOVER NEST: 0
PIPING PLOVER FLEDGE: 0

SITE: 42O
RIVER MILE: 1327.5
LEAST TERN NEST: 1
LEAST TERN FLEDGE: 0
PIPING PLOVER NEST: 1
PIPING PLOVER FLEDGE: 0

5

EIGH CO.
1327.0

FE: 42B
RIVER MILE: 1328.0
LEAST TERN NEST: 3
LEAST TERN FLEDGE: 3
PIPING PLOVER NEST: 5
PIPING PLOVER FLEDGE: 1

22

ITE: 42L
RIVER MILE: 1324.2
EAST TERN NEST: 3
EAST TERN FLEDGE: 11
PIPING PLOVER NEST: 1
PIPING PLOVER FLEDGE: 2

26

ITE: 42K
RIVER MILE: 1322.0
EAST TERN NEST: 1
EAST TERN FLEDGE: 2
PIPING PLOVER NEST: 2
PIPING PLOVER FLEDGE: 3

T140

T139

SITE: 42Q
RIVER MILE: 1319.8
EAST TERN NEST: 2
EAST TERN FLEDGE: 0
PIPING PLOVER NEST: 4
PIPING PLOVER FLEDGE: 8

SITE: 42E
RIVER MILE: 1320.0
EAST TERN NEST: 2
EAST TERN FLEDGE: 5
PIPING PLOVER NEST: 4
PIPING PLOVER FLEDGE: 5

MARK

DAKOTA

SITE: 43A
 RIVER MILE: 1310.5
 LEAST TERN NEST: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 0

SITE: 43Be
 RIVER MILE: 1308.7e
 LEAST TERN NEST: 0
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 6
 PIPING PLOVER FLEDGE: 2

SITE: 43E
 RIVER MILE: 1309.5
 LEAST TERN NEST: 1
 LEAST TERN FLEDGE: 0
 PIPING PLOVER NEST: 3
 PIPING PLOVER FLEDGE: 3

SITE: 43C
 RIVER MILE: 1307.5
 LEAST TERN NEST: 13
 LEAST TERN FLEDGE: 8
 PIPING PLOVER NEST: 6
 PIPING PLOVER FLEDGE: 7

SITE: 43Bw
 RIVER MILE: 1308.7w
 LEAST TERN NEST: 3
 LEAST TERN FLEDGE: 7
 PIPING PLOVER NEST: 1
 PIPING PLOVER FLEDGE: 3

SITE: 43D
 RIVER MILE: 1308.4
 LEAST TERN NEST: 18
 LEAST TERN FLEDGE: 4
 PIPING PLOVER NEST: 9
 PIPING PLOVER FLEDGE: 0

U.S. GOVT BOUNDARY
SANITARY DUMP STATION

MATCH LINE SHEET 29

ND:

- RECOMMENDED ACCESS ROADS, PA
- - - RECOMMENDED ACCESS ROADS, GR

4 1964
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LAKE OAHÉ

ATOKAS

STATION 100
LAKE OAHÉ
LAKE OAHÉ
LAKE OAHÉ
LAKE OAHÉ
LAKE OAHÉ

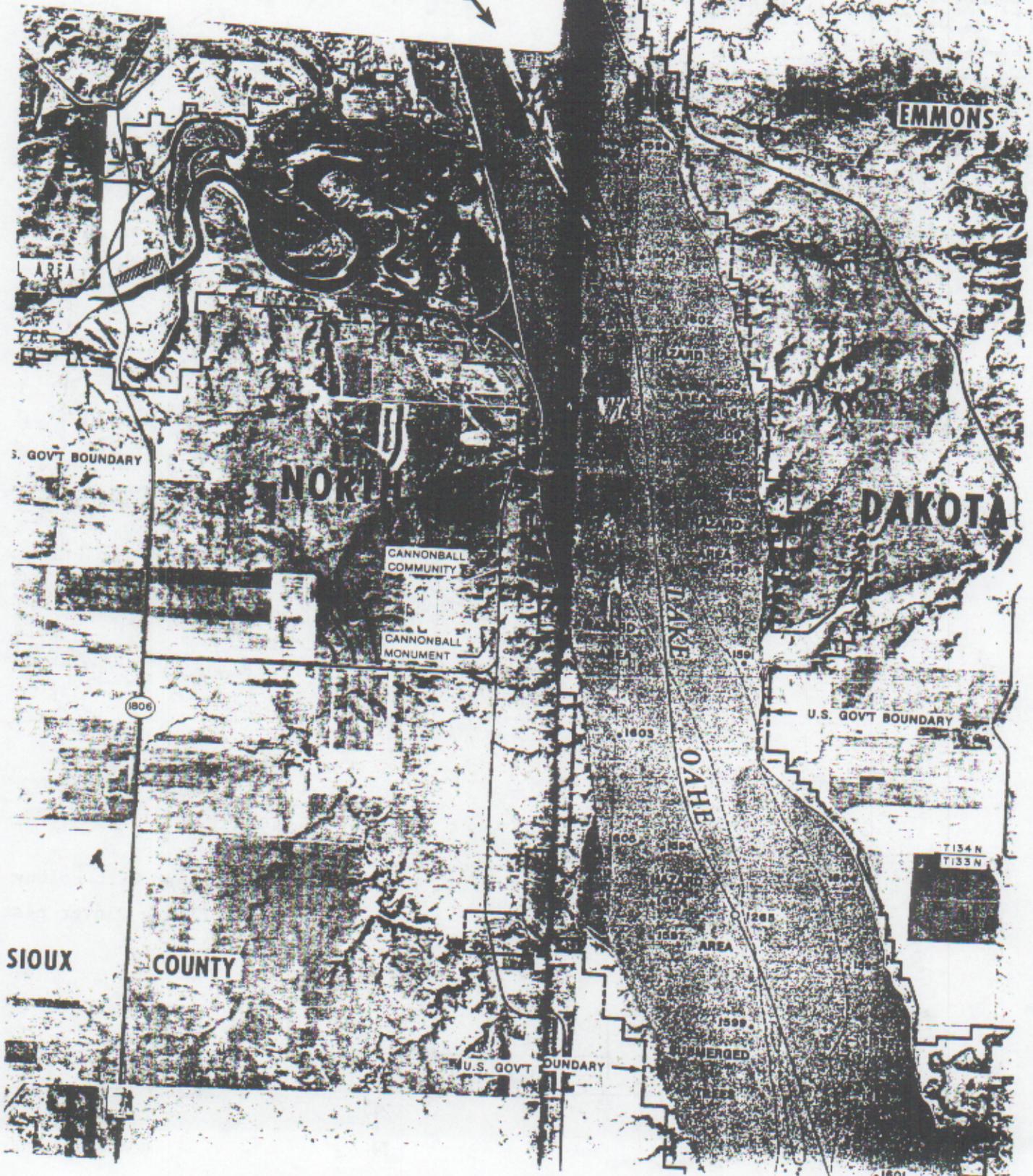
STATION 100
LAKE OAHÉ
LAKE OAHÉ
LAKE OAHÉ
LAKE OAHÉ
LAKE OAHÉ

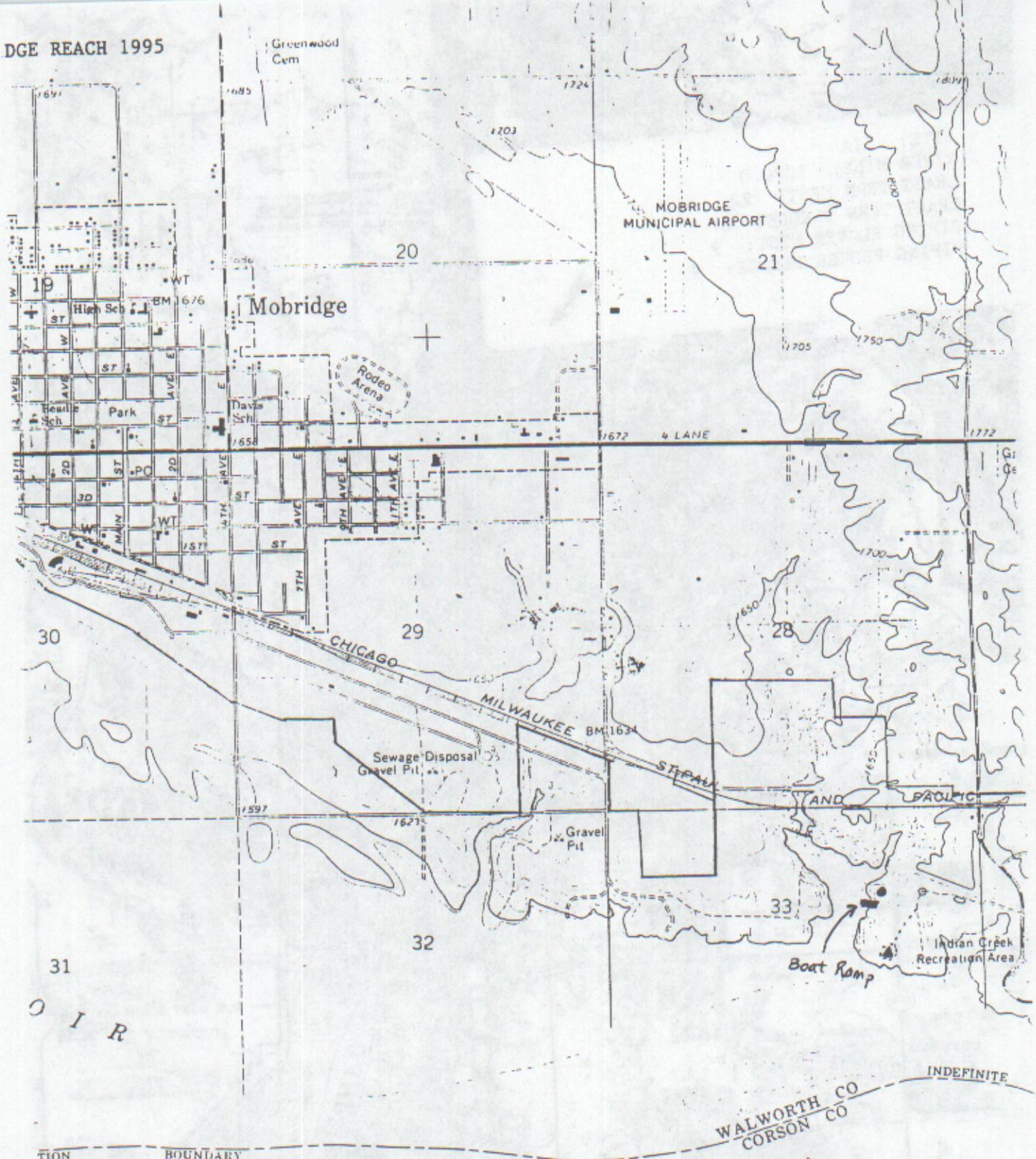
STATION 100
LAKE OAHÉ
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STATION 100
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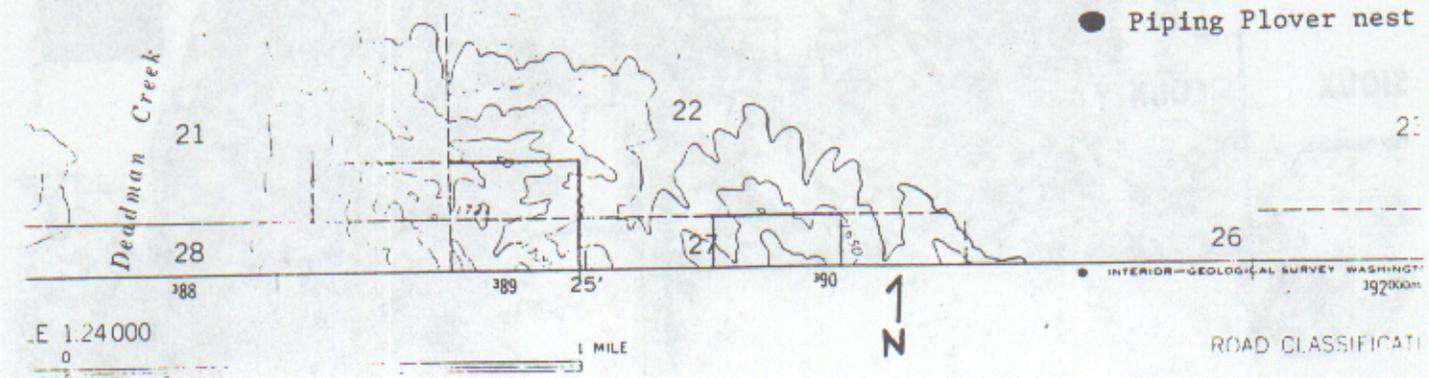
STATION 100
LAKE OAHÉ
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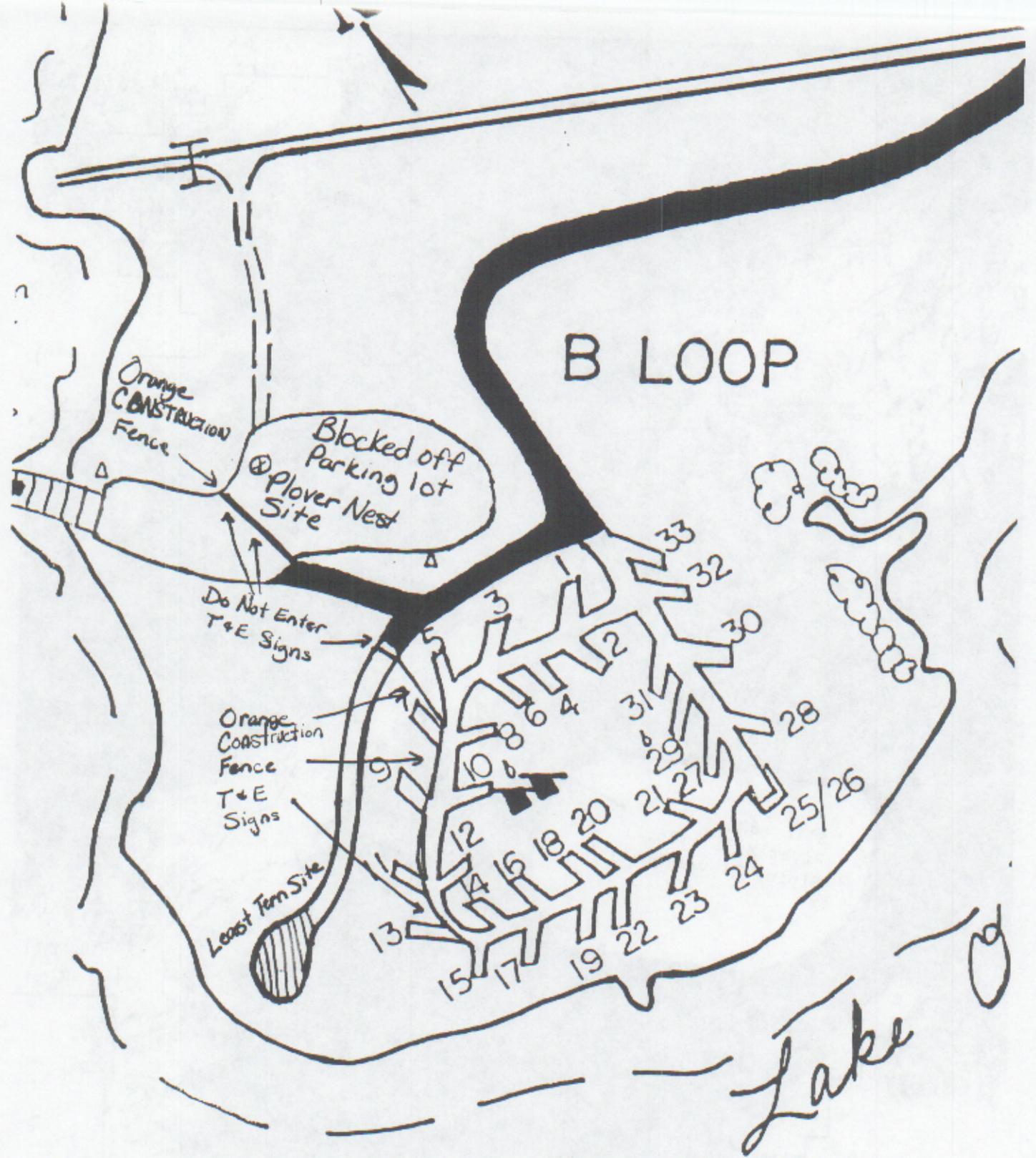
SITE: 51A
RIVER MILE: 1270.0
LEAST TERN NEST: 22
LEAST TERN FLEDGE: 0
PIPING PLOVER NEST: 9
PIPING PLOVER FLEDGE: 9

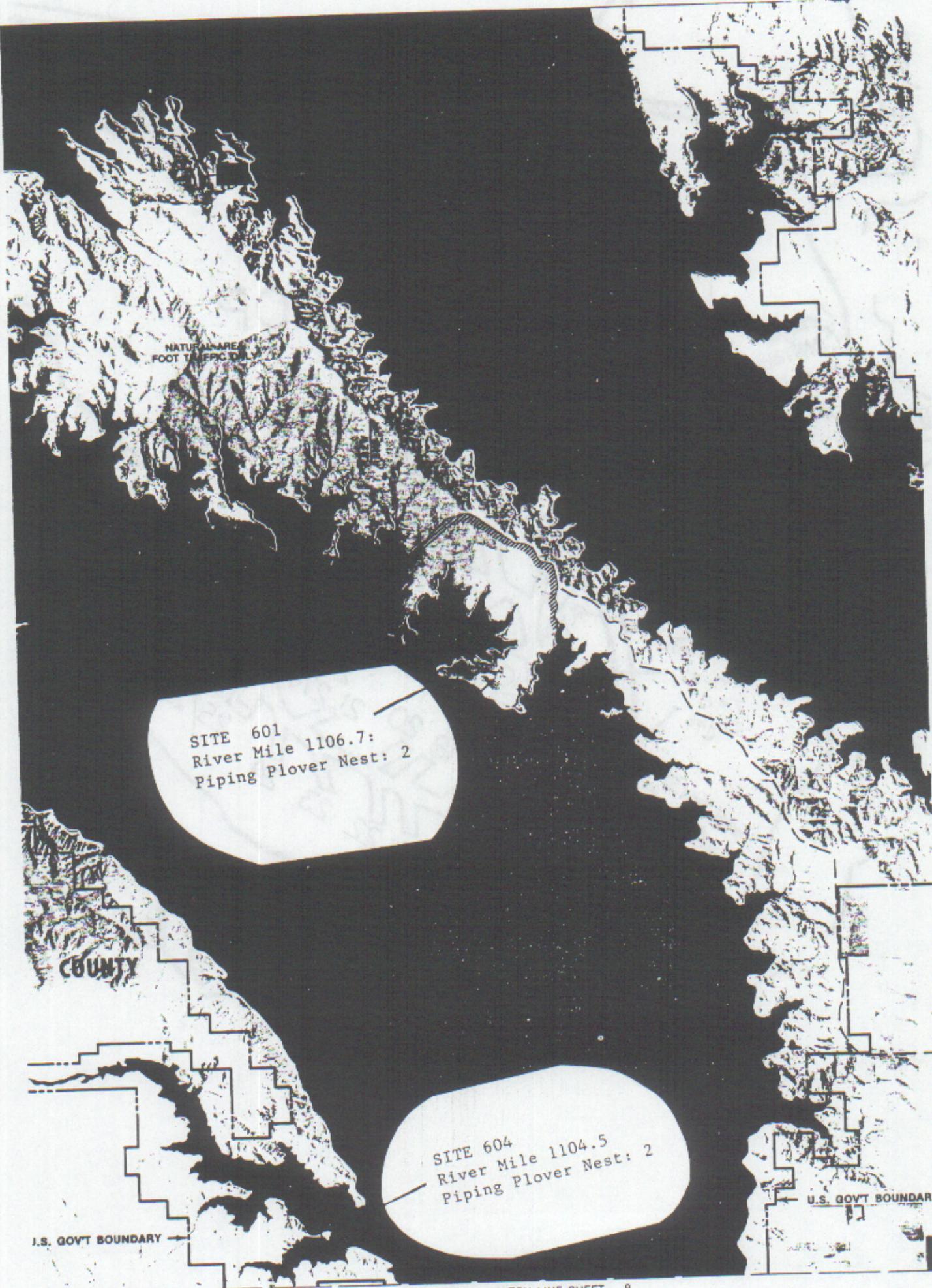




- ▲ Least Tern colony
- Piping Plover nest







SITE 601
River Mile 1106.7:
Piping Plover Nest: 2

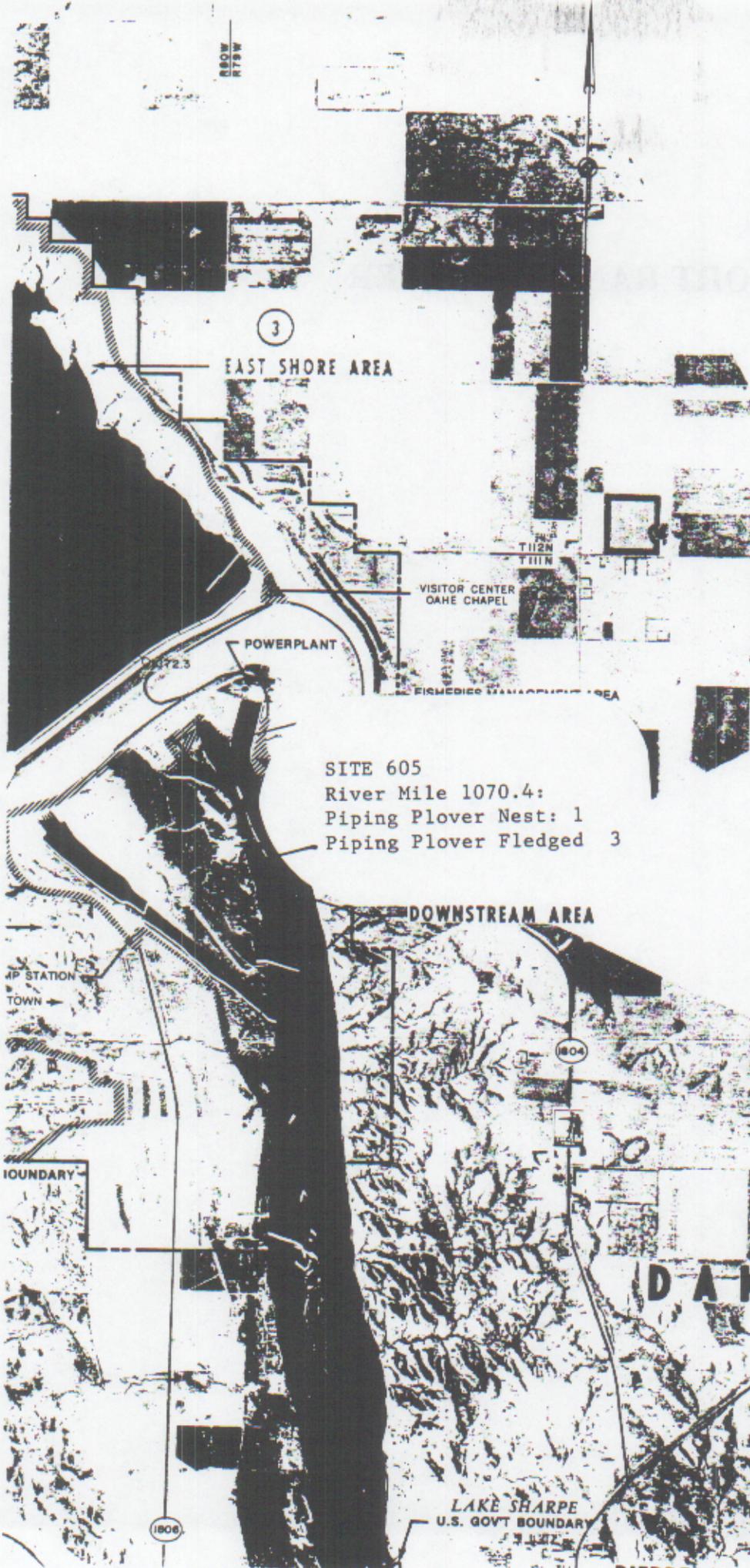
SITE 604
River Mile 1104.5
Piping Plover Nest: 2

U.S. GOVT BOUNDARY

U.S. GOVT BOUNDARY

COUNTY

NATURAL AREA
FOOT TRAFFIC ONLY



Shore Line (Elev. 1607.5)

THE LAND

Acreage Above:
 Base Flood Control (Elev. 1607.5)

Maximum Normal Operating Pool (Elev. 1617)

THE DAM

Type

Height

Length of Top

Elevation of Top (above sea level)

Width at Top

Width at Base (Max.)

Volume of Earth Fill9

Volume of Concrete (all structures)

THE POWERPLANT

Total Capacity

Seven Generators Each with 85,0X

Seven Conduits

THE SPILLWAY

Spillway Capacity (cu. feet per second)

Number of Gates

Width

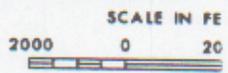
STATISTICS

LEGEND:

————— RECOMMENDED ACCESS

- - - - - RECOMMENDED ACCESS

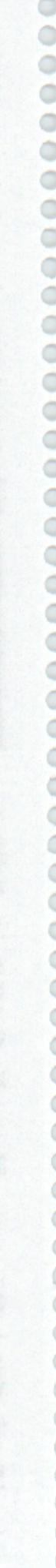
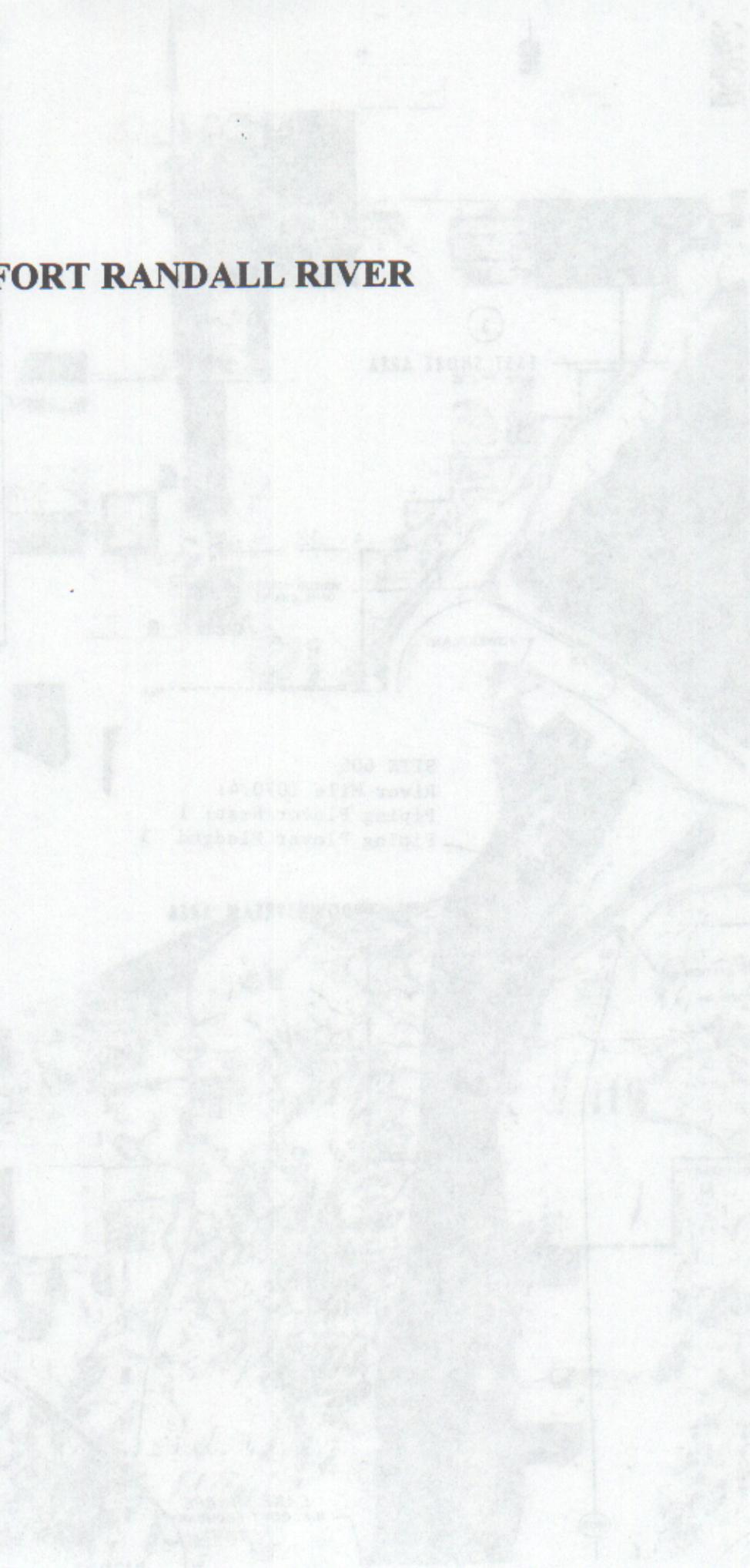
SITE 605
 River Mile 1070.4:
 Piping Plover Nest: 1
 Piping Plover Fledged 3

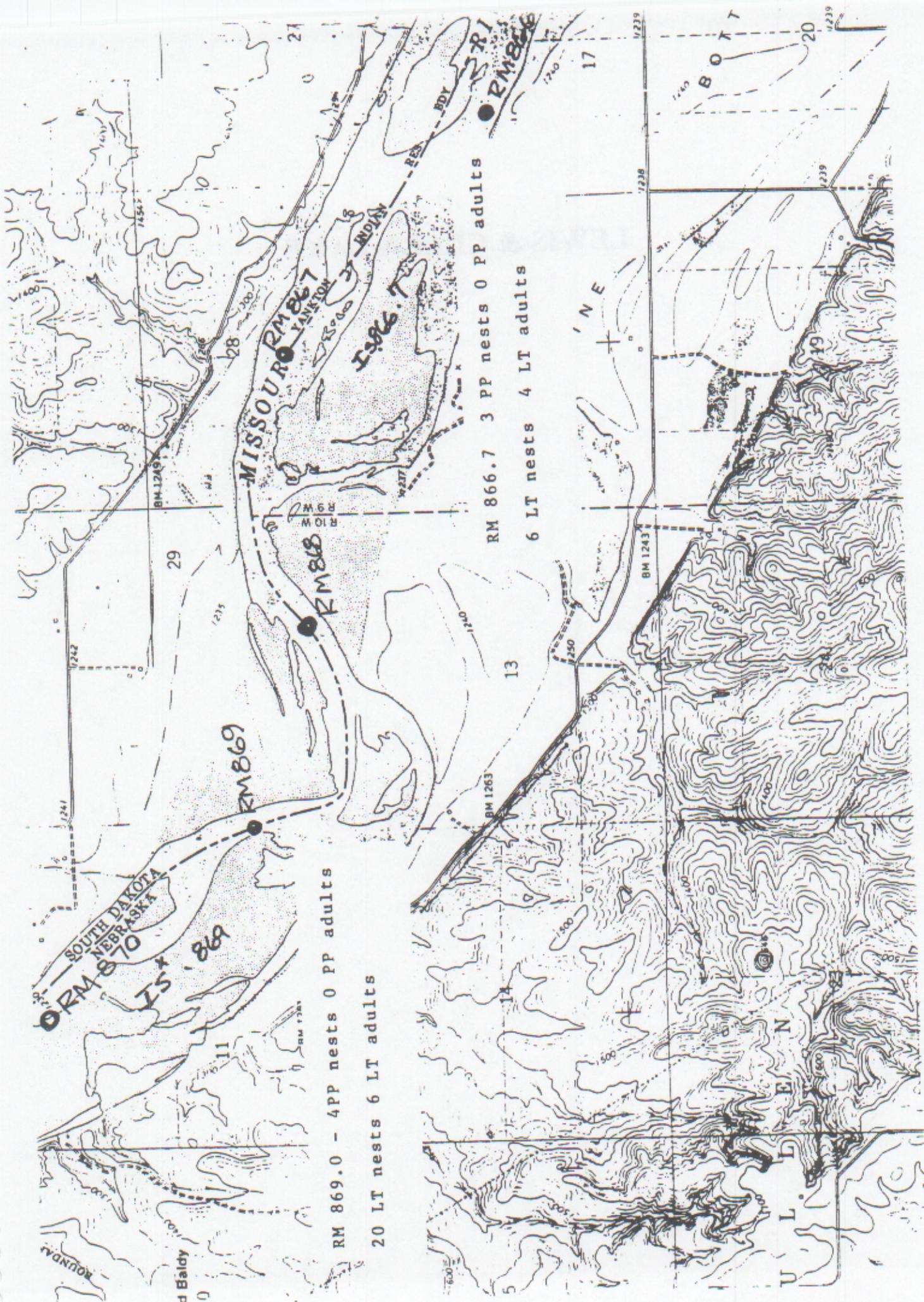


LAKE O

FORT RANDALL RIVER

STATIONING	...
THE SWAY	...
THE FISH	...
THE LAMP	...





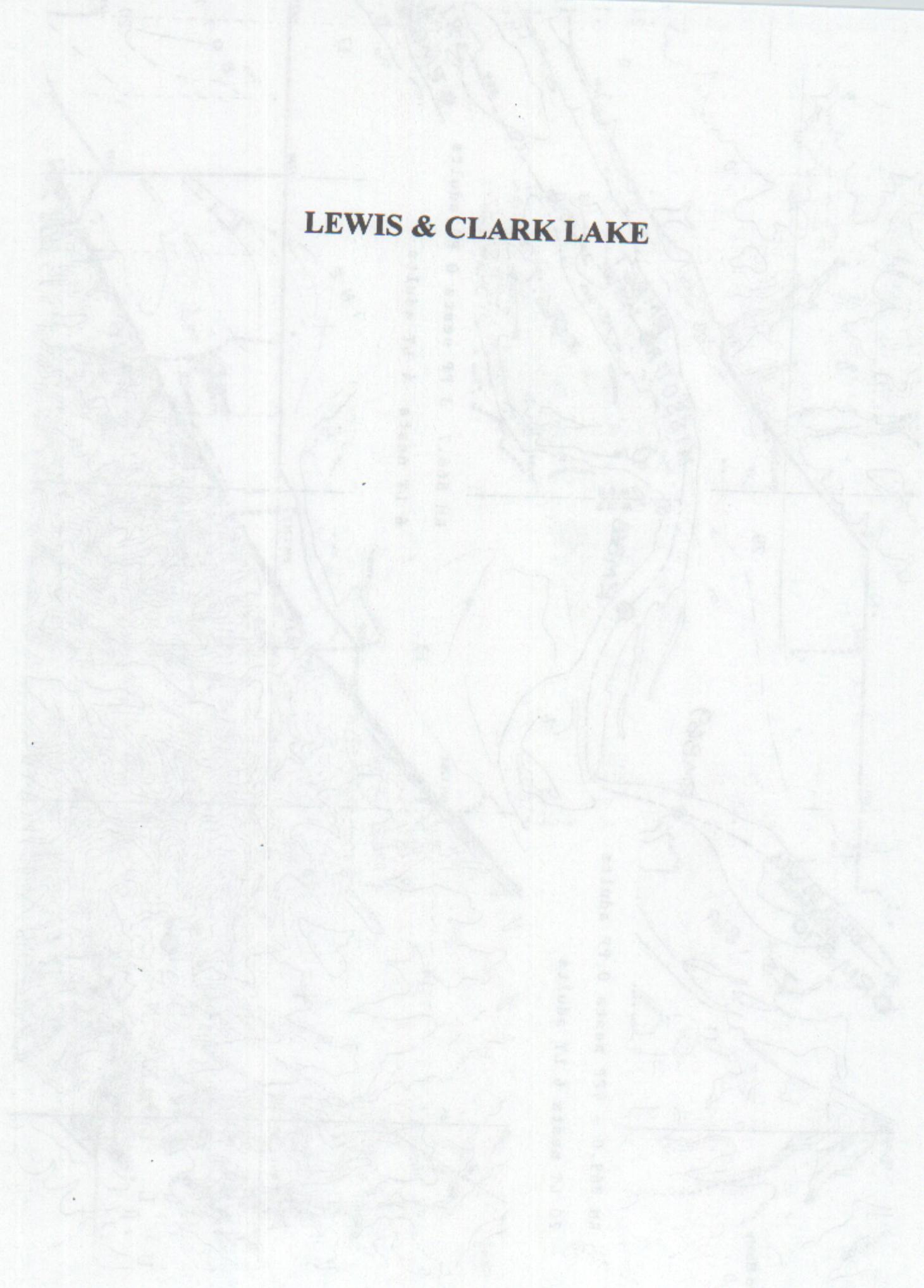
RM 869.0 - 4pp nests 0 PP adults
20 LT nests 6 LT adults

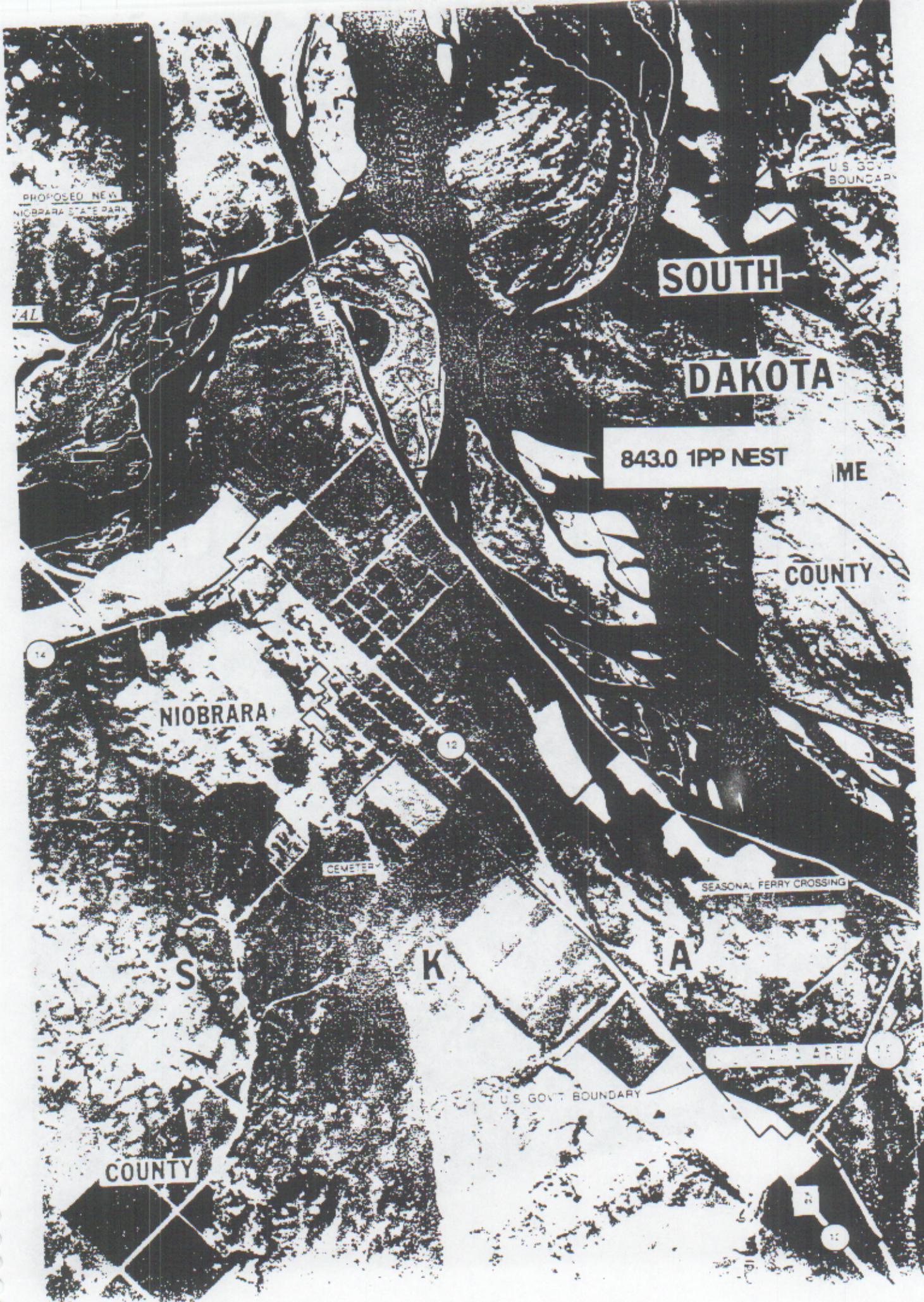
RM 866.7 3 PP nests 0 PP adults
6 LT nests 4 LT adults

RM 866.6

RM 870
SOUTH DAKOTA
NEBRASKA

LEWIS & CLARK LAKE





PROPOSED NEW
NIOBRARA STATE PARK

U.S. GOV'T
BOUNDARY

SOUTH

DAKOTA

843.0 1PP NEST

ME

COUNTY

NIOBRARA

CEMETER

SEASONAL FERRY CROSSING

S

K

A

SEASONAL FERRY CROSSING

U.S. GOV'T BOUNDARY

COUNTY

14

12

15

24

11



BON

840.0 1PP 11LT nests

2

U.S. B&W
P&W
A-2

DIAN RESERVATION

L S GOV'T BOUNDARY

CREEK

BAZILLE

N E B

KNOX

BON

HOMME

CO

SEWAGE LAGOON

UNIVERSITY OF
SOUTH DAKOTA
AT SPRINGFIELD

SPRINGFIELD

8325 1LT nest

37

O.V.T. BOUNDARY

MATCH LINE SHEET 6

BLUFF HEIGHTS

N

SARTEE

U.S. STATE BOUNDARY

COUNTY

828.5 1PP 5LT nests

SANTEE

CEMETERY

CEMETERY

U.S.

E B R A S K A

CEMETERY

KNOX

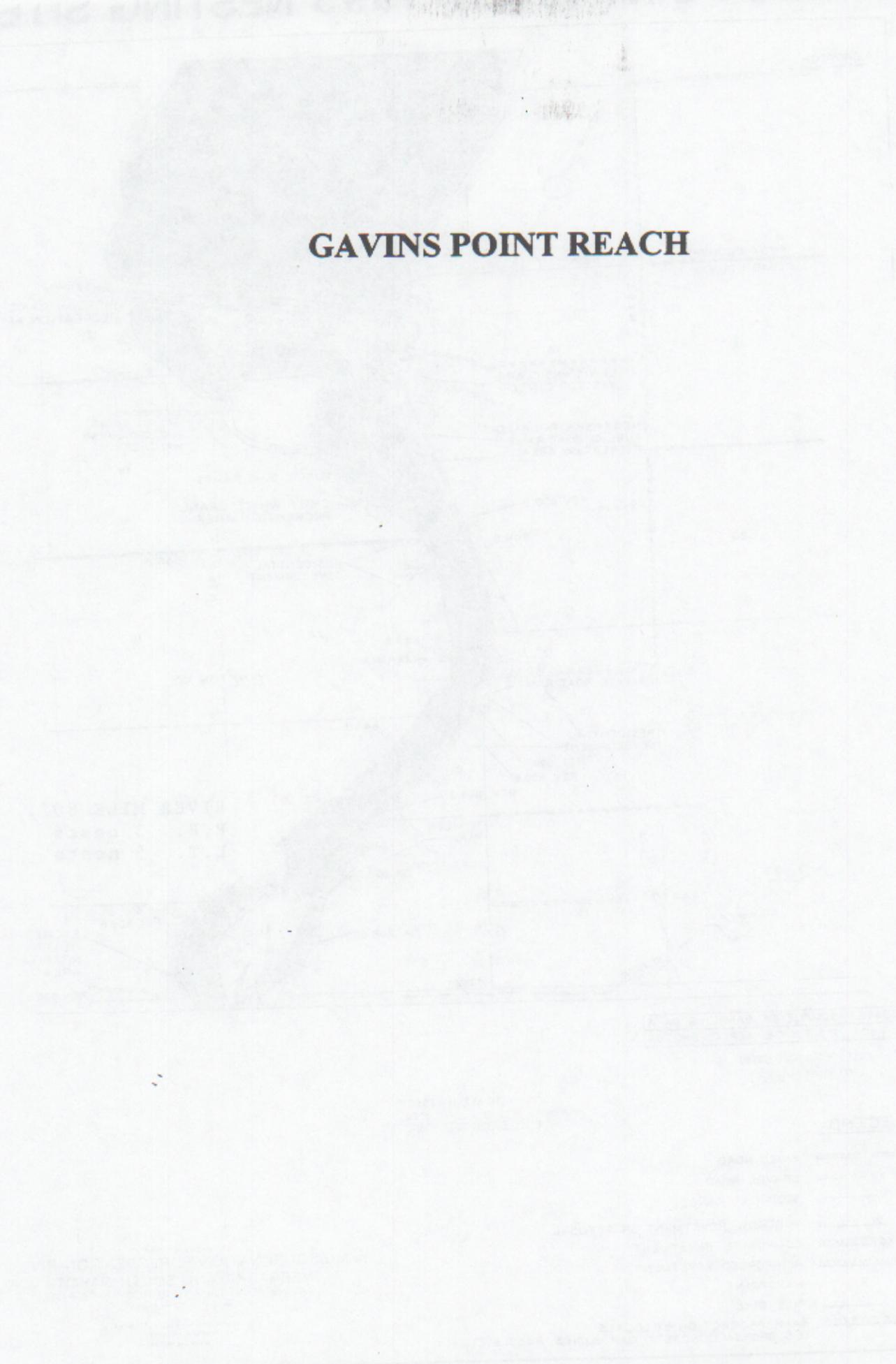
COUNTY

INDIAN

RESERVATION

LEWIS AND NEBRASKA AND

GAVINS POINT REACH



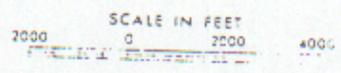
GAVINS POINT RIVER 1995 NESTING SITE



RIVER MILE 807.1
 P.P. 3 nests
 L.T. 5 nests

DATE	SOURCE OF BANKLINE DATA
1980	U.S.C. OF E. AERIAL PHOTOS

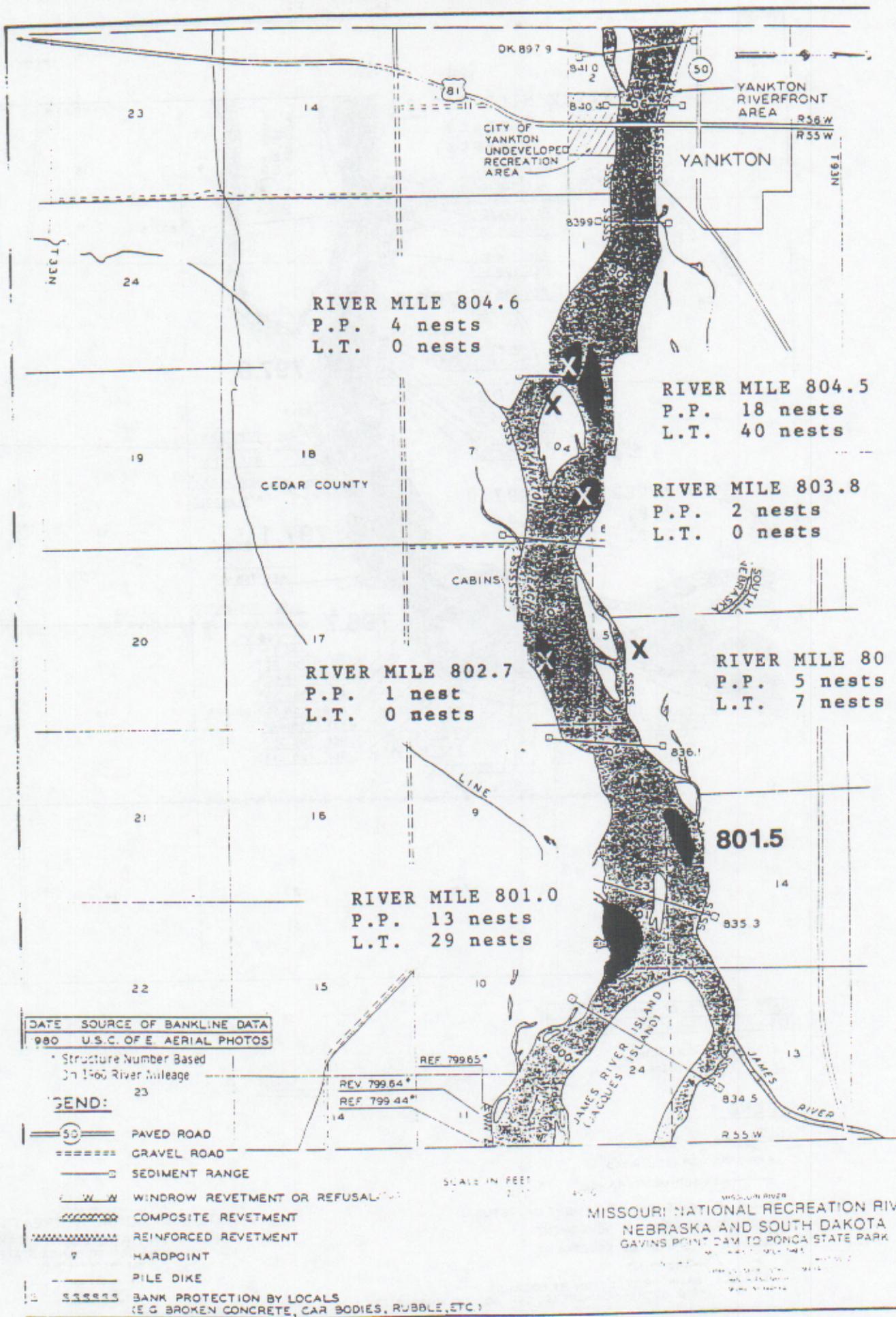
* Structure Number Based
 On 1960 River Mileage



LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- PILE DIKE
- BANK PROTECTION BY LOCALS
 (E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

MISSOURI RIVER
 MISSOURI NATIONAL RECREATION RIV
 NEBRASKA AND SOUTH DAKOTA
 GAVINS POINT DAM TO PONCA STATE PARK
 MILE 811.0 TO MILE 803.5
 MISSOURI RIVER DISTRICT ENGINEERS
 PLOTTED BY ENGINEERS
 DENVER, NEBRASKA



RIVER MILE 804.6
 P.P. 4 nests
 L.T. 0 nests

RIVER MILE 804.5
 P.P. 18 nests
 L.T. 40 nests

RIVER MILE 803.8
 P.P. 2 nests
 L.T. 0 nests

RIVER MILE 802.7
 P.P. 1 nest
 L.T. 0 nests

RIVER MILE 80
 P.P. 5 nests
 L.T. 7 nests

RIVER MILE 801.0
 P.P. 13 nests
 L.T. 29 nests

801.5

DATE	SOURCE OF BANKLINE DATA
980	U.S.C. OF E. AERIAL PHOTOS

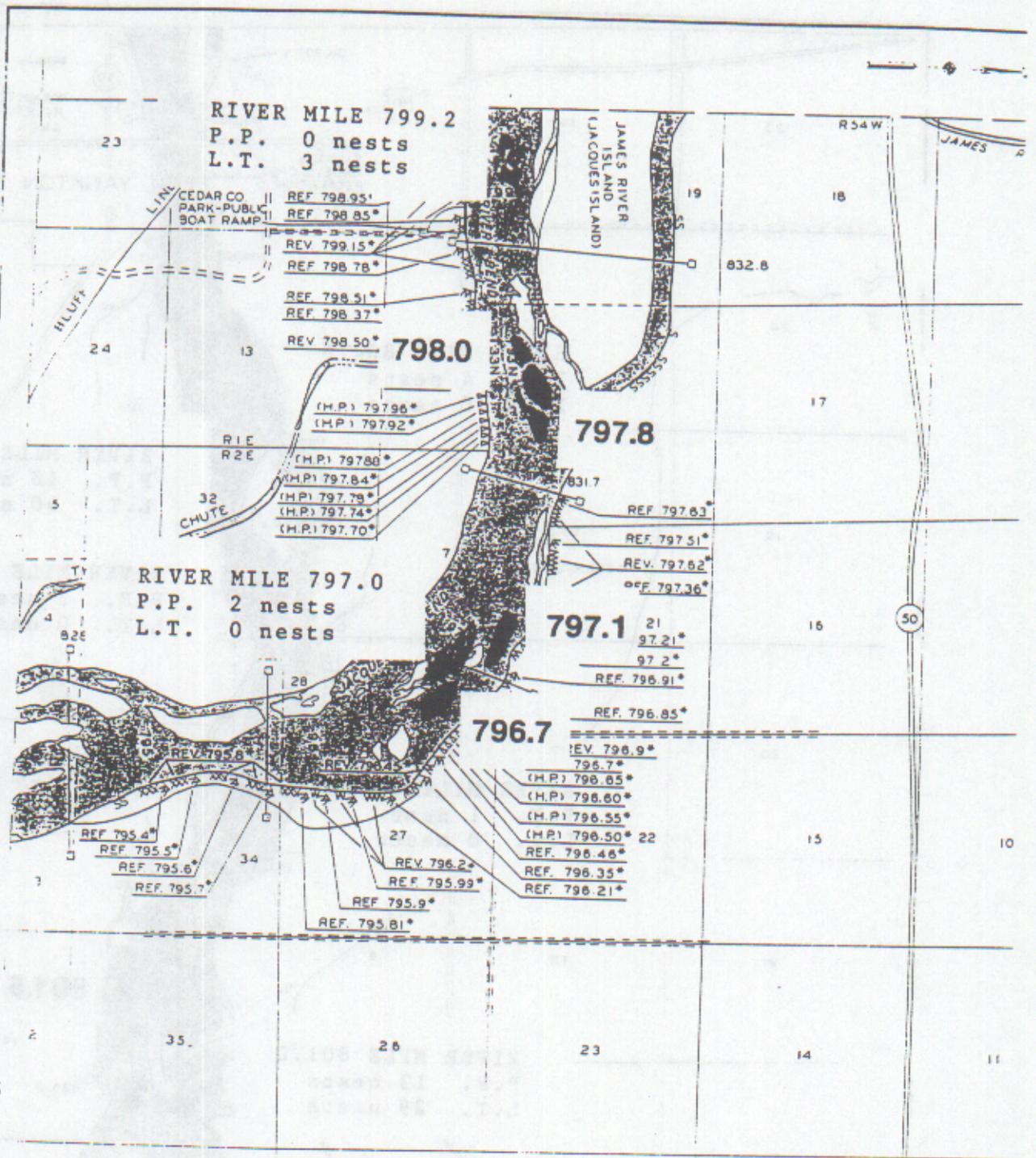
* Structure Number Based
 On 1960 River Mileage

LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- PILE DIKE
- BANK PROTECTION BY LOCALS
 (E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

SCALE IN FEET

MISSOURI NATIONAL RECREATION RIVER
 NEBRASKA AND SOUTH DAKOTA
 GAVINS POINT DAM TO PONCA STATE DAM



DATE SOURCE OF BANKLINE DATA
 1980 U.S.G. OF E. AERIAL PHOTOS

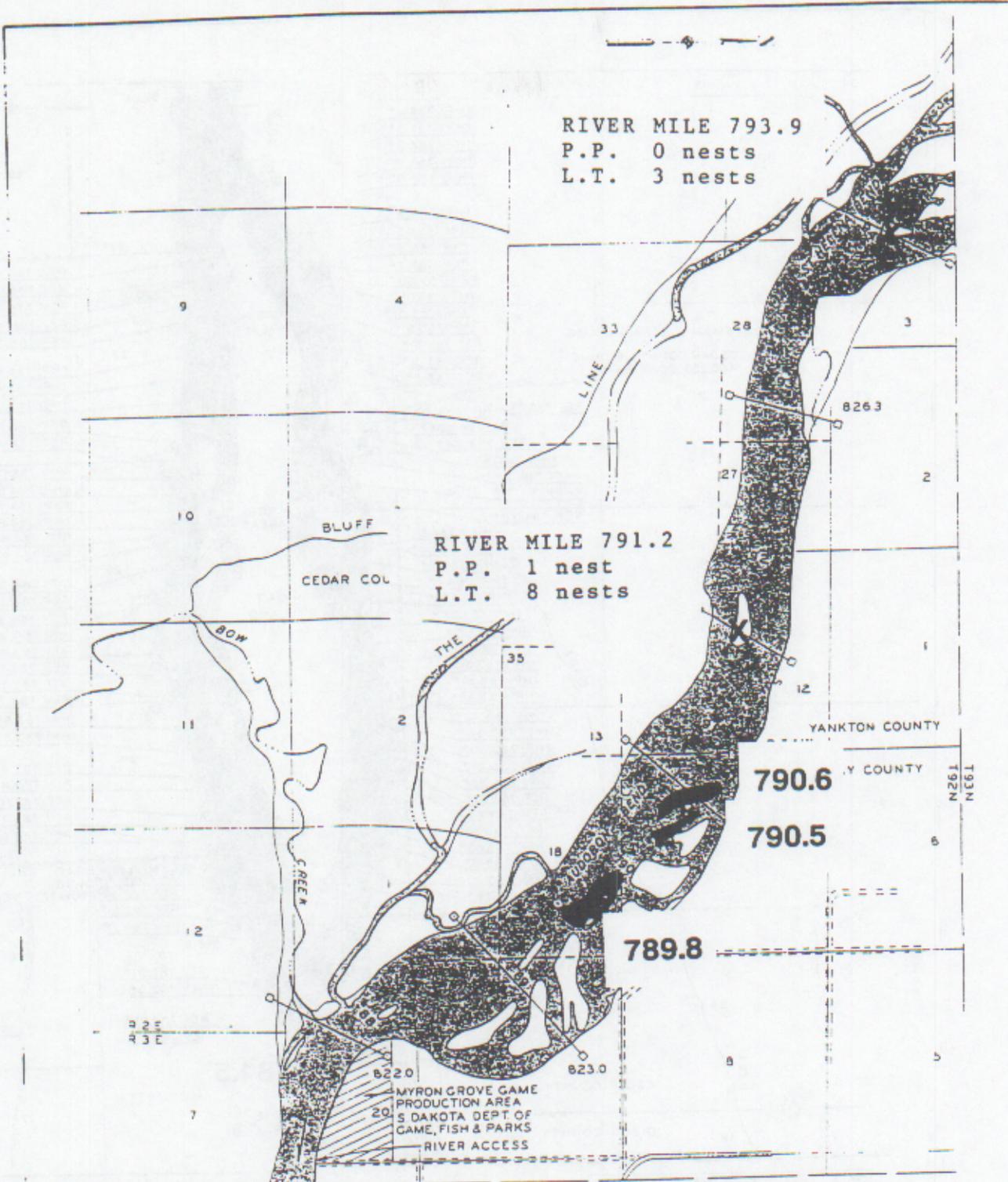
Structure Number Based
 on 1963 River Mileage

LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- BANK PROTECTION BY LOCALS
 (E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

MISSOURI RIVER
 MISSOURI NATIONAL RECREATION RIVER
 NEBRASKA AND SOUTH DAKOTA
 GAVINS POINT DAM TO PONCA STATE PARK
 MILE 795 TO MILE 794.5

NO. 1 SHEET
 U.S. ARMY ENGINEER DISTRICT HEADQUARTERS
 ST. LOUIS, MISSOURI
 DRAWN BY: [unreadable]
 CHECKED BY: [unreadable]



DATE	SOURCE OF BANKLINE DATA
780	U.S.C. OF E. AERIAL PHOTOS

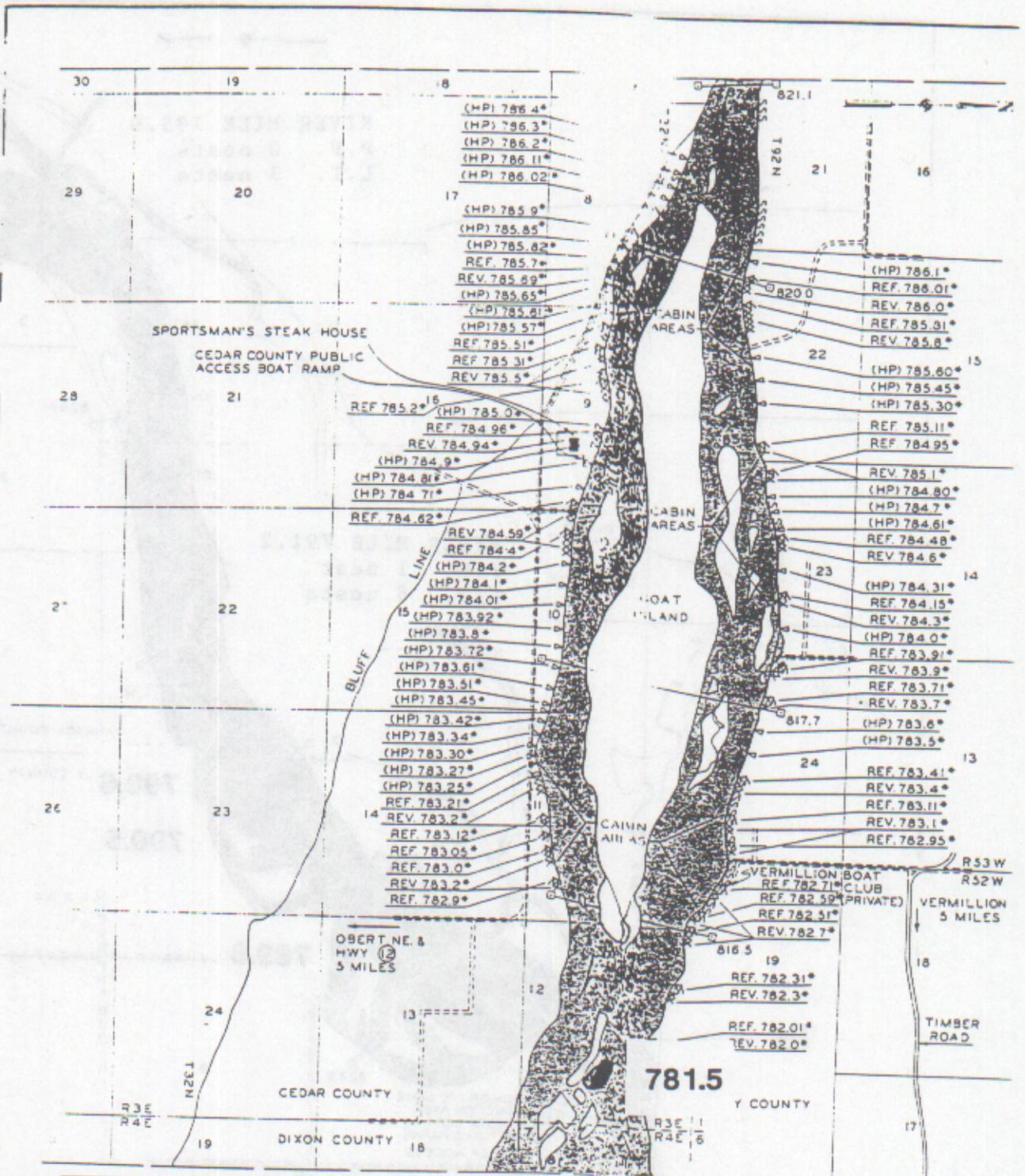
* Structure Number Based
On 1960 River Mileage

SCALE IN FEET
0 2000 4000

LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- BANK PROTECTION BY LOCALS
(E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

MISSOURI NATIONAL RECREATION RIVER
NEBRASKA AND SOUTH DAKOTA
GAVINS POINT DAM TO PONCA STATE PARK
SCALE 1965 TO MILE 787.7
DATE OF SURVEY 1965
DATE OF PHOTO 1965



DATE	SOURCE OF BANKLINE DATA
1980	U.S.C. OF E. AERIAL PHOTOS

* Structure Number Based
On 1960 River Mileage

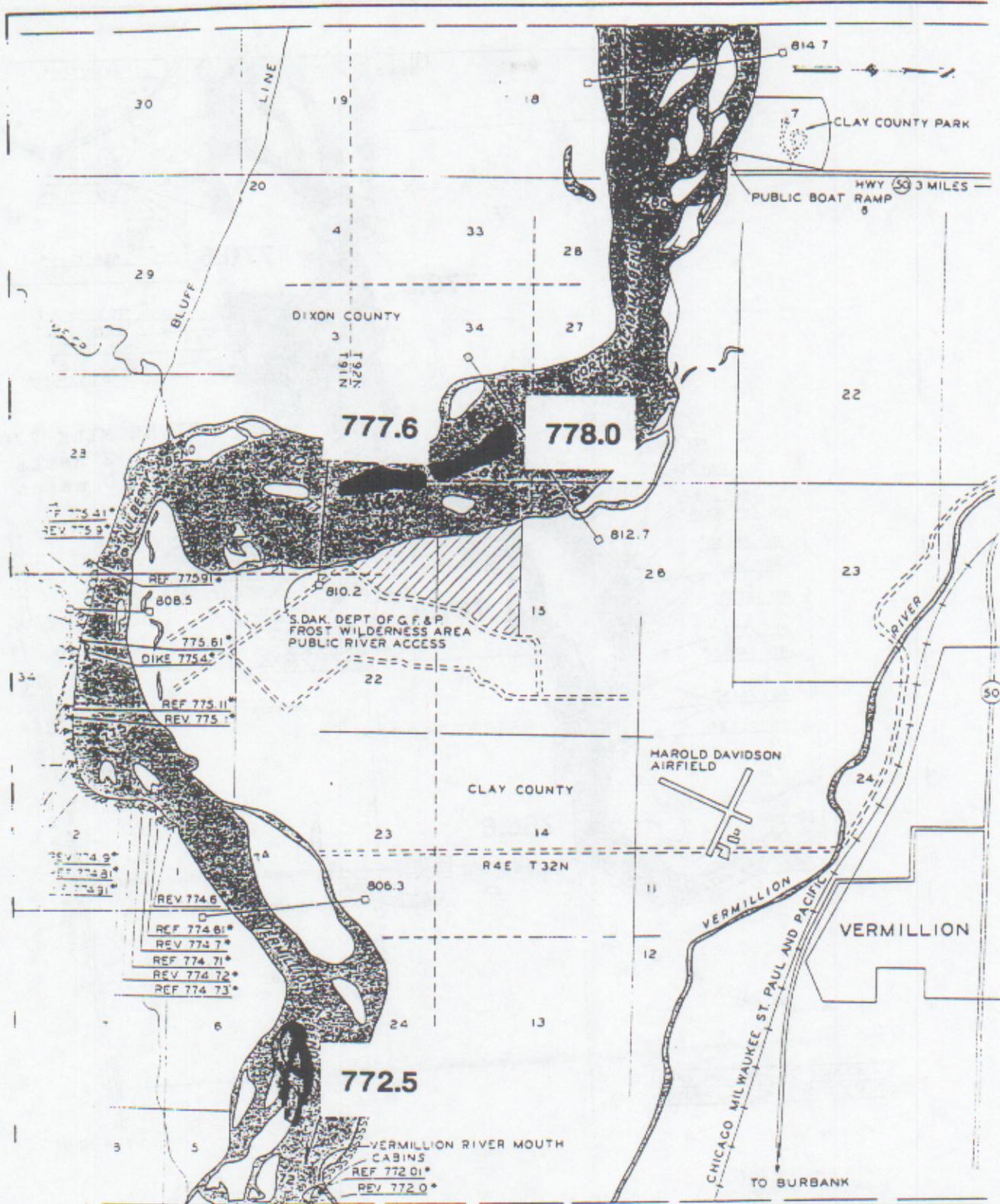
SCALE IN FEET
0 2000

END:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVELTMENT OR REFUSAL
- COMPOSITE REVELTMENT
- REINFORCED REVELTMENT
- HARDPOINT
- STONE FILL DIKE, REVELTMENT OR REFUSAL
- BANK PROTECTION BY LOCALS
(E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

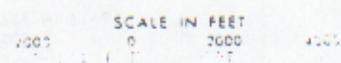
MISSOURI RIVER
MISSOURI NATIONAL RECREATION RIVER
NEBRASKA AND SOUTH DAKOTA
GAVINS POINT DAM TO PONCA STATE PARK
MILE 787.2 TO MILE 789.9

DESIGNED BY
DRAWN BY
CHECKED BY
DATE



LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- BANK PROTECTION BY LOCALS
(E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)

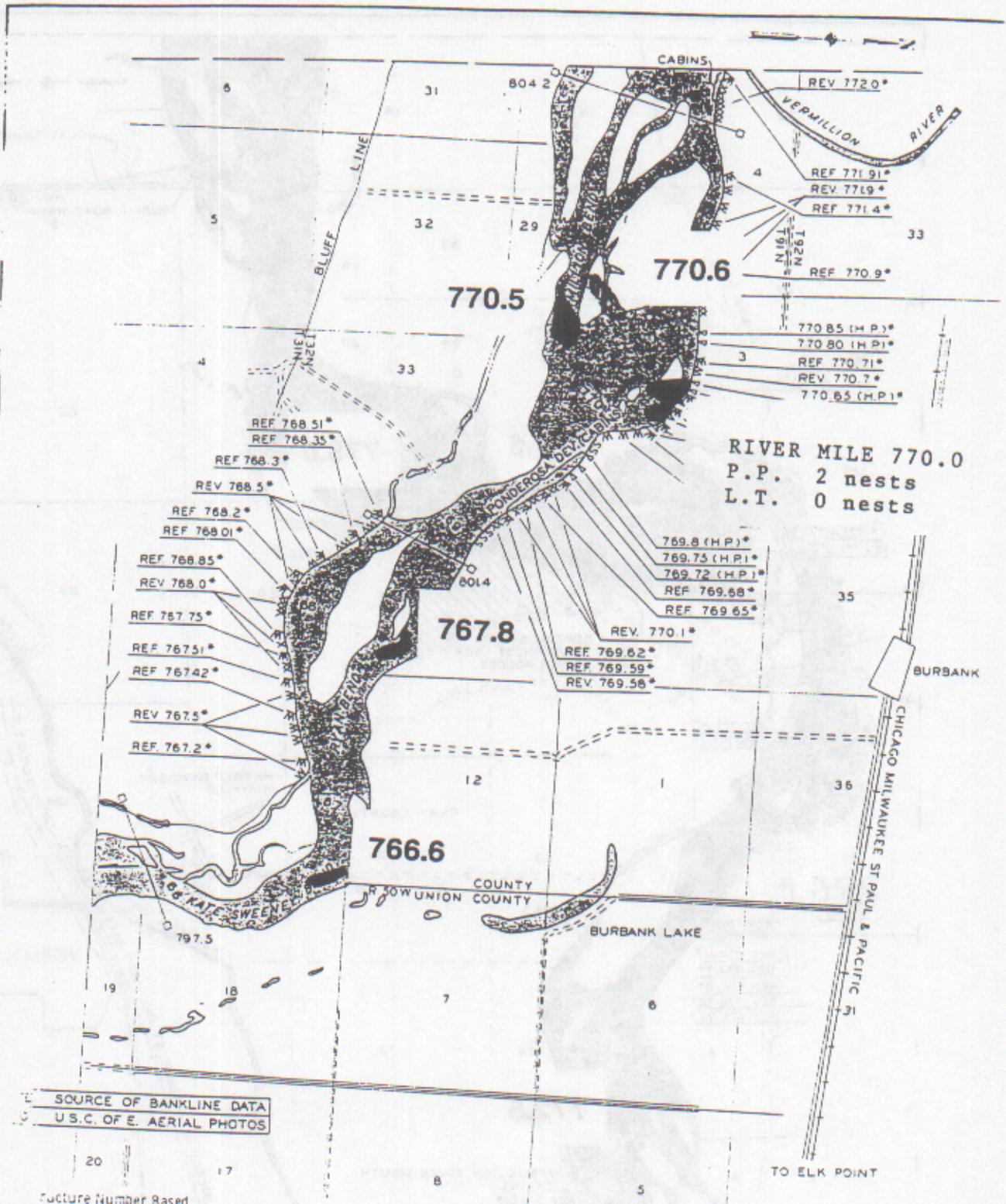


DATE	SOURCE OF BANKLINE DATA
1980	U.S.C. OF E. AERIAL PHOTOS

* Structure Number Based
On 1960 River Mileage

MISSOURI RIVER
MISSOURI NATIONAL RECREATION RIVER
NEBRASKA AND SOUTH DAKOTA
GAVINS POINT DAM TO PONCA STATE PARK
MILE 760.9 TO MILE 771.9

U.S. ARMY ENGINEER DISTRICT OFFICE
CORPS OF ENGINEERS
OMAHA, NEBRASKA



RIVER MILE 770.0
 P.P. 2 nests
 L.T. 0 nests

SOURCE OF BANKLINE DATA
 U.S.C. OF E. AERIAL PHOTOS

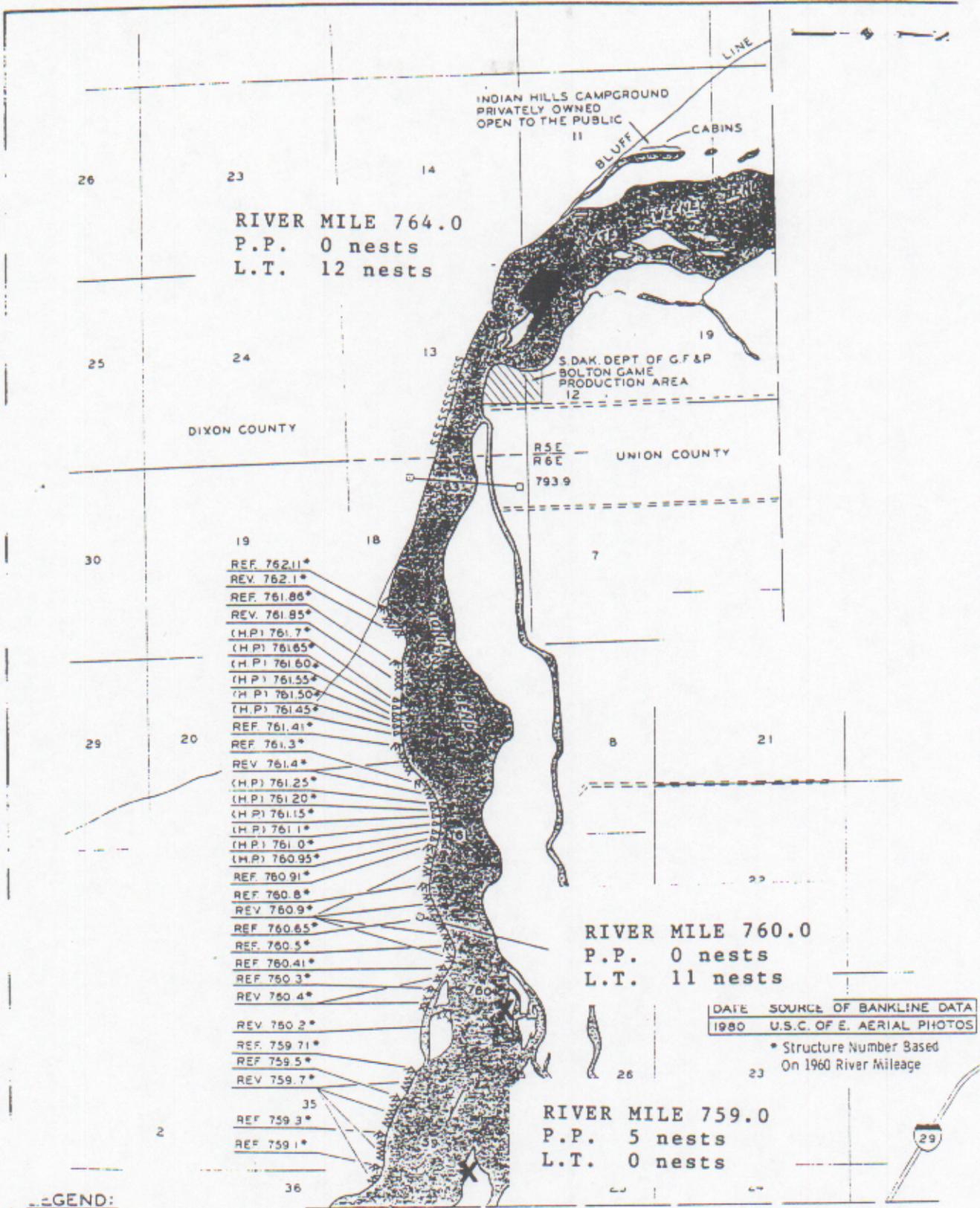
Figure Number Based
 1960 River Mileage

LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVETMENT OR REFUSAL
- COMPOSITE REVETMENT
- REINFORCED REVETMENT
- HARDPOINT
- BANK PROTECTION BY LOCALS
 (E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC)

SCALE IN FEET
 0 2000 4000

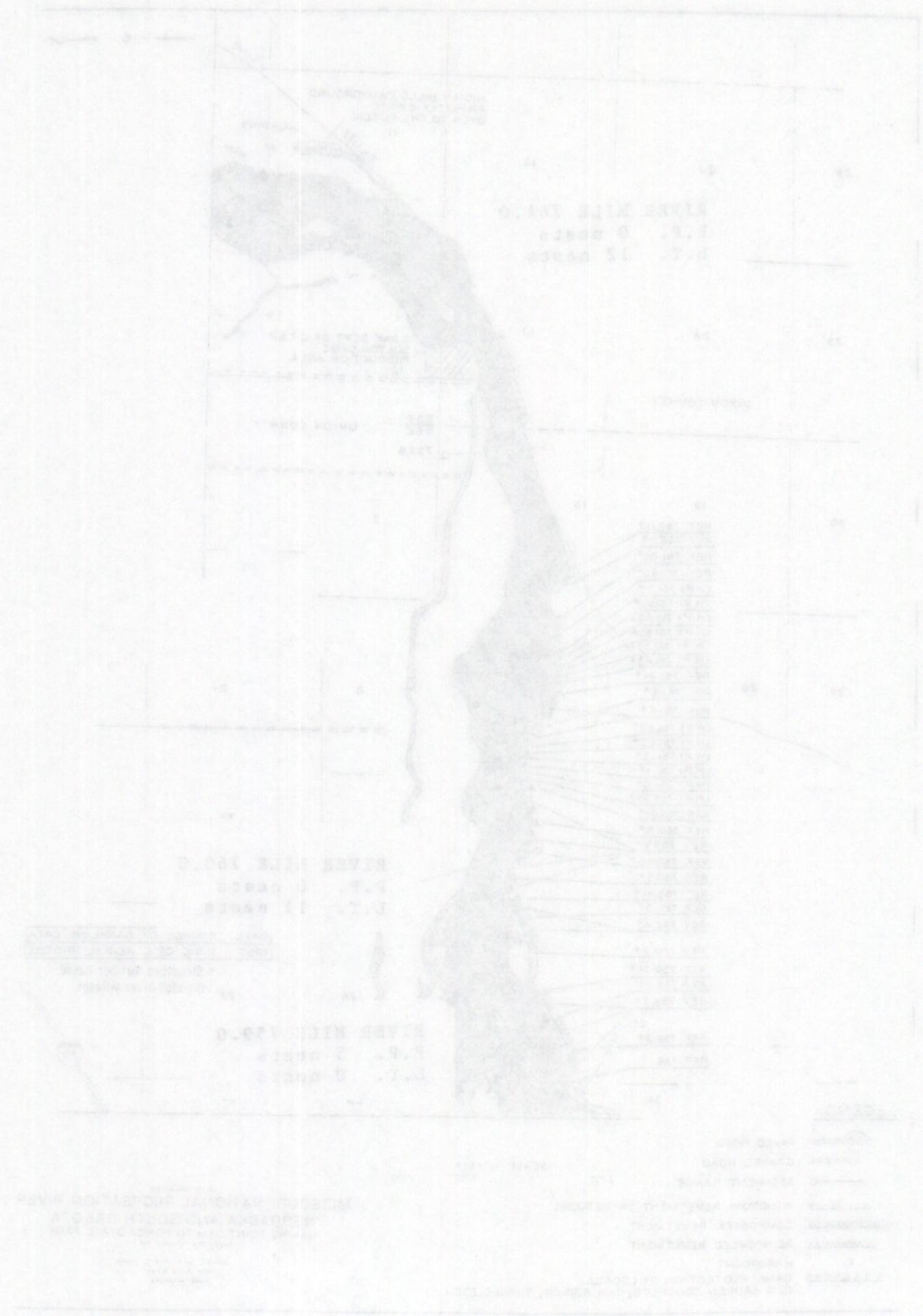
MISSOURI RIVER
 MISSOURI NATIONAL RECREATION RIVER
 NEBRASKA AND SOUTH DAKOTA
 GAVINS POINT DAM TO PONCA STATE PARK
 MILE 771.9 TO MILE 764.4
 SHEET NO. 771.9 TO MILE 764.4
 DISTRICT ENGINEER DISTRICT NO. 1
 CORPS OF ENGINEERS
 WASHINGTON, D.C.



LEGEND:

- PAVED ROAD
- GRAVEL ROAD
- SEDIMENT RANGE
- WINDROW REVELTMENT OR REFUSAL
- COMPOSITE REVELTMENT
- REINFORCED REVELTMENT
- HARDPOINT
- BANK PROTECTION BY LOCALS
(E.G. BROKEN CONCRETE, CAR BODIES, RUBBLE, ETC.)





RIVER MILE 100.0
 P.P. 0 marks
 L.T. 11 marks

RIVER MILE 100.0
 P.P. 0 marks
 L.T. 11 marks

Scale of 1 inch = 1 mile
 Date of Survey 1910
 Surveyed by J. H. ...

MISSOURI NATIONAL RECREATION RIVER
 VERBENA AND SOUTH BRANCH
 FROM FORT MONROE TO FORT SHERMAN

Legend:
 ROAD
 RAILROAD
 DRAINAGE CANAL
 WATERWAY
 WATERWAY WITH BRIDGE
 WATERWAY WITH DAM
 WATERWAY WITH WEIR
 WATERWAY WITH LOCK
 WATERWAY WITH SLUICE
 WATERWAY WITH GATE
 WATERWAY WITH VALVE
 WATERWAY WITH CHECK
 WATERWAY WITH BARRAGE
 WATERWAY WITH TOWER
 WATERWAY WITH PILE
 WATERWAY WITH PIER
 WATERWAY WITH ABUTMENT
 WATERWAY WITH PIERS
 WATERWAY WITH ARCH
 WATERWAY WITH BUTTRESS