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I. INTRODUCTION

One of the primary objectives of the U.S. Fish and Wildlife Service (Service) in managing natural areas is the maintenance of ecosystems and their dynamic processes to ensure as nearly as possible a functional natural environment. As one of these natural processes, fire constitutes one of the greatest influences on the ecosystem.

U.S. Fish and Wildlife Service policy requires that an approved Fire Management Plan must be in place for all of Service lands with burnable vegetation. Service Fire Management Plans must be consistent with firefighter and public safety, protection values, and land, natural, and cultural resource management plans, and must address public health issues. Fire Management Plans must also address all potential wildland fire occurrences and may include the full range of appropriate management responses. The responsible agency administrator must coordinate, review, and approve Fire Management Plans to ensure consistency with approved land management plans.

Service policy allows for a wildland fire management program that offers a full range of activities and functions necessary for planning, preparedness, emergency suppression operations, emergency rehabilitation, and prescribed fire operations, including non-activity fuels management to reduce risks to public safety and to restore and sustain ecosystem health.

This document is a detailed program of action that provides direction and implementation for the fire management program on the Lake Andes Complex (Complex). The plan will help achieve resource management objectives for the Complex as defined in Interim Goals for Lake Andes National Wildlife Refuge (NWR) Complex (4/97). See Appendix A.

A. Administrative Units

The Lake Andes Complex consists of three administrative units including Lake Andes NWR, Lake Andes Wetland Management District (WMD), and Karl E. Mundt NWR. The table below indicates the size of each of these administrative units.

Table 1: Size of Administrative Units

Unit	State or Service Easement	Service Fee Title	Total Acres
Lake Andes National Wildlife Refuge	4,700	937	5,637
Lake Andes Wetland Management District*	0	18,888	18,888
Karl E. Mundt National Wildlife Refuge	305	780	1,085
TOTAL	5,005	20,605	25,610

* Total does not include wetland, grassland, nor conservation easements totaling over 52,000 acres.

1. Lake Andes National Wildlife Refuge

Lake Andes NWR was established by Executive Order #7292 on February 14, 1936. The Executive Order designated 365 acres as a refuge and breeding ground for migratory birds. In 1939, the State of South Dakota granted an easement to cover the 4,700 acre meandered lakebed. The easement granted the Service the right to manage the water levels of Lake Andes for conservation purposes and the ability to maintain a refuge for migratory birds and wildlife.

2. Lake Andes Wetland Management District

Lake Andes WMD was established administratively as a district of land acquired through authorization and funding from the Migratory Bird Conservation Stamp Act. These lands were established with the primary purposes: waterfowl production, migratory birds, and for conservation purposes.

3. Karl E. Mundt National Wildlife Refuge

Karl E. Mundt NWR was established as a refuge in 1974. The Southland Corporation and the National Wildlife Federation purchased Karl E. Mundt NWR which was given to the Service to administer. The refuge was established to conserve fish, wildlife, and plants listed as endangered or threatened under the Endangered Species act. The refuge provides wintering and nesting habitat for the bald eagle.

4. Adjacent Lands

Land adjacent to the Karl E. Mundt NWR consists mainly of pasture with scattered row crops. Land adjacent to Lake Andes NWR consist mainly of cropland, pasture, and developments. The Waterfowl Production Areas (WPAs) within the Lake Andes WMD vary and can be surround by cropland, pasture, hayland, and/or developments.

B. Description of Complex

1. General Description of Lake Andes Complex

The Complex is located in southeastern South Dakota encompassing thirteen counties (Charles Mix, Brule, Douglas, Aurora, Davison, Hanson, Hutchinson, Bon Homme, Yankton, Turner, Clay, Lincoln, and Union). The Complex consists of a 6,000 acre Lake Andes NWR of which 4,700 acres is a conservation easement from the State of South Dakota; the 1,085 acre Karl E. Mundt NWR of which 305 is an easement from adjacent landowner; and the Lake Andes WMD which is composed of 84 WPAs protecting over 18,800 acres of wildlife habitat. The WMD stretches 175 miles from the Missouri River on the northwestern corner of the WMD to the Big Sioux River on the southeastern corner (Figure 1).

2. Topography and Soils

The Lake Andes Complex covers a region of South Dakota which overlaps two major physiographic provinces, the Central Lowlands and the Missouri Plateau. The major land features associated with this area of South Dakota are products of the Pleistocene glaciations which formed the Missouri River and the prairie potholes sometime between 12,000 and 40,000 years ago. The Complex is located within four distinct physiographic regions, Missouri Coteau, James River Lowland, Prairie Coteau, and the Missouri River Flood plain (Figure 2).

The topography can vary from the rolling hills of the Coteau to the level glacial drift and till plain of the Lowlands and Flood plains of the James and Missouri Rivers. Elevations can range from 2,112 feet in Brule County within the Missouri Coteau to 1,119 feet in Union County within the Missouri River Flood plain.

The soils within the thirteen counties comprising the Complex have been completely inventoried, and detailed soil mapping is available for each county through the Natural Resource Conservation Service (NRCS). The soil associations vary greatly according to the physiographic regions. Soils are derived from parent materials which include glaciolacustrine sediments, early Wisconsin glacial drift, and late Wisconsin glacial drift (loess). Generally, the soils present support typical prairie vegetation of

grasses and forbs.

3. Water Resources

As stated earlier, one of the more prominent wetland features throughout the Complex are the glaciated "prairie potholes." These prairie wetlands are more numerous within the Coteau regions, but are found within the entire Complex. It is the richness and diversity of the wetlands that are of primary interest to the Service. These prairie wetlands are extremely productive and very attractive to both migratory and resident wildlife. They serve as breeding and nesting areas for many migratory birds and as wintering habitat for many species of resident wildlife. Most of these wetlands are burnable at one time or another. Many of the prescribed burns conducted on the Complex are adjacent to water resources. Burn size is generally small and grass fuels do not produce heavy volumes of ash as compared to forest fuels. Burning wetlands can decrease encroaching stands of cattails and can improve vegetative cover if burned in the spring.

The western and southern edge of the Complex is bordered by two large Missouri River impoundments, Lake Francis Case and Lewis and Clark Lake. The Missouri River is one of the major river systems in the United States, and the entire Complex is within its vast watershed.

Another prominent water feature is the James River which enters the Complex near Hanson County and joins the Missouri River near Yankton, South Dakota. The James flows through three of the thirteen counties within the WMD. The James has the flattest gradient of any river its length in North America. As it flows through the Dakota Lake Plain physiographic region, the overall gradient is about 1 ½ inches per river mile. The water takes about 1 month to travel through South Dakota.

4. Climate

The Lake Andes Complex is located in the extreme southwestern portion of the Prairie Pothole Region. The southern location results in the area having milder winters than the remainder of the eastern Dakotas and Minnesota as well as longer and warmer summers. Annual temperatures can vary from an average low of 13.8°F in the winter to average 74.3°F in the summer. The record high recorded for the area was 110°F and record low -42.0°F. Although winds can come from any direction, the prevailing winds for the Complex are from the NW and SE during the year.

Annual evaporation can amount to 36 inches while the rainfall averages 25.68 inches and snowfall averages 34.9 inches. These conditions result in more years of marginal and poor wetland conditions in comparison to areas found farther north and east.

Precipitation and soil moisture effect vegetation growth. In drought years, little green-up is produced and fire danger increases. Year to year variations in climate and vegetation growth affect fire danger levels throughout the growing season.

5. Wildlife

Many wildlife species could potentially occur within the Complex. The information that follows is not intended to represent or describe all species that might occur there:

a. Invertebrate Populations

Wetlands within the Complex normally carry high invertebrate populations. Nesting waterfowl, waterfowl broods, water birds, and shorebirds are highly dependent on these protein food sources for healthy, vigorous growth. Invertebrates associated with wetlands include worms, crustaceans, snails, and insects. All of these species play an important role in the food chain and add to a diverse and stable ecosystem. No Federal endangered invertebrate species have been documented as occurring within the Lake Andes Complex.

b. Fish Populations

There are 100 species of freshwater fish that inhabit the waters and waterways of South Dakota. The fishery associated with the Complex would be classified as a warm-water fishery with low numbers of game fish and high numbers of minnows, carp, and suckers. Due to the shallow nature of the lakes and wetlands within the Complex, they have a high probability of fish winterkill. The Topeka shiner (*Notropis topeka*) is a federally listed species that does occur within the Complex area in the Big Sioux and James River watersheds.

c. Reptiles and Amphibians

Thirty-three species of reptiles occur in South Dakota of which nineteen occur within the Complex. These consist of turtles, skinks, and snakes (Appendix B). State threatened species (Appendix F) which exist within our complex include eastern hognose snake (*Heterodon platyrhinos*), spiny softshell (*Trionyx spiniferus hartwegi*), and false map turtle (*Graptemys pseudogeographica*).

There are seventeen species of amphibians that occur in South Dakota and nine of them within the Complex (Appendix B). These species consist of various salamanders, toads, and frogs.

d. Birds

Since South Dakota is in the Northern Great Plains, grassland birds are the predominant bird life in the State. Approximately 239 bird species are recorded as regularly occurring within the Complex. About 113 of these species nest within the Complex. Twenty-four other species have been sighted once or twice within the Complex. Appendix C contains a species lists of birds which have been recorded as utilizing Complex lands. The osprey which occurs within the Complex is the only State species that is not listed as a federally protected species (Appendix F & Section B.6).

e. Mammals

There are an estimated 54 mammal species found within the thirteen-county Lake Andes Complex (Appendix D). They range in size from the tiny least shrew weighing only a fraction of an ounce to the large mule deer weighing over 200 pounds. Abundance varies with species, but prairie insectivores and new world species of mice common to prairie ecosystems are very abundant in the Complex.

The South Dakota Game, Fish and Parks Department has identified four species of mammals which are considered as "Threatened" within South Dakota. These are the mountain lion, river otter, black bear, and swift fox. The black-footed ferret is listed as State and Federal "Endangered." None of these species have been documented to occur within the Complex in recent times.

6. Threatened and Endangered Species

The Lake Andes Complex contains a few federally listed threatened, endangered, and candidate species. The Complex will implement its fire management program within the constraints of the Endangered Species Act of 1973, as amended, and will take appropriate action to identify and protect from adverse effects any rare, threatened, or endangered species located within the Complex. U. S. Fish and Wildlife Service policy requires that State threatened and endangered species and Federal candidate species will be incorporated into planning activities. Appendix E contains a list of federal endangered, threatened, and candidate species occurring in South Dakota by county. Appendix F contains a list of State listed species.

Table 2. Threatened, Endangered, Candidate Species Found in LANWR Complex

SPECIES	STATUS
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Threatened
Piping Plover (<i>Charadrius melodus</i>)	Threatened
Western Prairie Fringed Orchid	Threatened
Whooping Crane (<i>Grus americana</i>)	Endangered
Least Tern (<i>Sterna antillarum</i>)	Endangered
Eskimo Curlew (<i>Numenius borealis</i>)	Endangered
American Burying Beetle (<i>Nicrophorus americana</i>)	Endangered
Pallid Sturgeon (<i>Scaphirhynchus albus</i>)	Endangered
Topeka Shiner (<i>Notropis topeka</i>)	Endangered
Lynx (<i>Lynx canadensis</i>)	Candidate
Sturgeon Chub (<i>Hybopsis gelida</i>)	Candidate
Sicklefin Chub (<i>Macrhybopsis meeki</i>)	Candidate

The western prairie fringed orchid is the only known endangered plant species that may be present on 14 WPAs within the Complex. These WPAs are located in the extreme eastern portion of the WMD. However, to date, there are no confirmed specimens in the Complex. Other areas where the western prairie fringed orchid has been found, fire has been used to enhance the plant. Fire will reduce litter depth and decrease competition of nonnative plant species.

7.

Improvements

Wildfire damage to improvements on and off the Complex is a primary concern. While developments can generally be protected from fire damage, dispersed improvements particularly fences are likely to be damaged by fires. A total of 216 miles of fence exist on Complex property, the replacement cost for the fence would be approximately \$8 million dollars.

The Complex has office/maintenance/visitor service facilities at the headquarters by Lake Andes which could cost the Service approximately \$1.6 million to replace. In addition to the headquarters facilities, three residences totaling \$379,000 are of special concern.

8. Cultural Resources

No historic or prehistoric resources have been identified on lands within the Complex. The Complex lies within the James and Missouri Coteau Archeological Regions. Documented occupation of the area spans a 10,000-year period. The probability that significant cultural resources are present on some acres of native prairie is good. The Regional Archeologist will be consulted during the planning phase of any proposed project and will determine the need for a cultural resource inventory in consultation with the South Dakota Historic Preservation Office. Fire management activities within the complex will be implemented in accordance with the regulations and directions governing the protection of cultural resources as outlined in the Departmental Manual Part 519 (519M), Code of Federal Regulations (36 CFR 800), Archeological Resource Protection Act of 1979, and Archeology and Historic Preservation Act of 1974. All fire management activities will be in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. Guidance will be followed in the event that a historic site is located.

9. Socio-Political-Economic Concerns

The dispersed nature of the Complex WPAs create many situations where escaped prescribed fires or wildfires could damage adjacent private structures, equipment, and grazing/hay/cropland. Wildfire damage to non Service public property can occur to wooden utility poles and utility junction boxes which are located on or adjacent to Service land.

Adjacent land ownership to the WMD is almost exclusively private. Private landowners generally have a low tolerance for wildfire. The use of prescribed fire is generally well accepted as a habitat management tool in most areas of the Complex. The Complex relies heavily on volunteer fire

protection districts for suppression on WPAs.

C. Habitat

The vegetation of the Complex is directly affected by the management of the upland habitats. The general purpose of upland management on the Complex is to impact the vegetation to obtain a diverse prairie grassland habitat for waterfowl production and other wildlife.

1. Grassland

The Complex is made up of three major vegetative zones the tall grass prairie, tall grass prairie transition, and the mixed grass prairie. The tall grass prairie consists of the four most eastern counties of the Complex. The only areas of the Complex considered mixed grass prairie is located on the western edge of Brule County and portions of Charles Mix County. The remaining areas fall within the tall grass prairie transition (Figure 3).

The following is a breakdown of vegetation classes and types.

a. Tall Grass Prairie

The dominant native grasses of the tall grass zone consist of big bluestem, Indian grass, switch grass, and other warm season grasses. Very little native prairie remains in this area since it contains highly fertile soils and adequate rainfall conducive to maximized agri-business. Land use is extremely heavy and most private wetlands have been drained.

b. Tall Grass Prairie Transition

The tall grass prairie transition zone covers the majority of the Complex. The dominant native grasses in this area are western wheatgrass, big bluestem, and porcupine grass. Land use is more diversified among small grains, row crops, hayland, and pasture due to low annual precipitation. Wetlands and associated vegetative cover on private land supports abundant populations of wildlife.

c. Mixed Grass Prairie

The western most vegetative zone, mixed grass prairie, has dominant native grass species of little bluestem, western wheatgrass, needle-and-thread grass, and blue grama. Annual rainfall averages 17 inches, therefore, dryland farming of small grain crops is the predominant agricultural use. Native prairie, pastures, and hayland comprise a larger percentage of the land use than in the two zones to the east.

2. Riparian woodlands/shelter belts

Native woodland vegetation in the Complex is primarily located within the James River Flood plain, its tributaries along the Missouri River, and the border of a few scattered wetlands in the Missouri Coteau. These woodlands are primarily deciduous trees and shrubs located where moisture conditions allow for their growth. There are also shelter belts and farmstead groves scattered throughout the Complex planted by man. Many trees and shrubs have invaded grasslands throughout the Complex due to shelter belts and the suppression of fire. Prescribed fire can be used to decrease undesirable trees and shrubs on grasslands. The Lake Andes Complex has had some success in decreasing tree growth with prescribed fire.

3. Wetland Vegetation

Wetland or aquatic vegetation refers to those plants which grow in water or in soils which are saturated for most of the growing season. Wetland vegetation is broken down into four major categories of plants, based on their growth form and the wetland zone they inhabit. These categories are free-floating, submergent, emergent, and amphibious.

Wetland vegetation covers approximately 35 percent of the acres managed by the Service within the Complex. All four categories of wetland plants exist within the Complex on both private and public lands. Aquatic plants grow in four classes of wetlands: temporary, seasonal, semipermanent, and permanent wetlands. It is not uncommon for a single wetland to have all four categories of aquatic vegetation.

D. Noxious Plants

There are many State listed noxious plant species that exist within the Complex (Appendix G). The primary species are Canada thistle, perennial sow thistle, leafy spurge, musk thistle, field-bindweed, and wormwood sage. These species often compete with and have negative effects on native plant species. The control of noxious plants is important to benefit native plant communities and is required by cooperative agreement with the State. The Complex participates in an integrated pest management control program which includes the use of prescribed

fire. Prescribed summer burns on the Complex may result in a decrease of Canada thistle, however, spring burns can increase the spread and density of some noxious weeds.

E. Historical/ Ecological Role of Fire

Prior to the 20th century the role of fire in the northern plains had been one of continued perpetuation of the prairie ecosystem. Fire restored vigor to plant growth, increased seed production, released nutrients, and reduced accumulations of litter (Higgins 1986). This included the area now designated as the Lake Andes National Wildlife Refuge Complex.

Since the early 20th century and the establishment of the Complex in 1936, nearly all fires within the boundaries have been suppressed and adjacent habitat has been fragmented from agricultural practices. These activities have significantly reduced the role fire plays as a vital element of the prairie ecosystem in the Lake Andes Complex. In more recent years there has been an accumulation of knowledge, now being translated into management practices, which recognizes fire as an essential process of the mixed grass prairie.

Wildfire is one of the primary natural forces which created native prairie. Historic records describe huge prairie fires started by lightning or humans. Fires burned millions of acres as there were few natural fuel breaks and no suppression. Wright (1980) and others believe that fire frequency in the prairie grasslands is on the order of 5 -10 years. Other studies indicate that longer frequency of 10-20 years may be more accurate.

The fire frequency has diminished since Lake Andes was established. Increased agriculture activity and fragmented prairie greatly suppressed the occurrence of wildfires. Remaining areas within Lake Andes Complex were generally hayed or grazed, denying the essential process fire provides the prairie. Managers now accept the fact that fire plays a unique ecological role which has no substitute in the management of grasslands. Fire is recognized as an essential natural process, an inert part of the prairie ecosystem.

F. Refuge Fire History

Fire records of the Complex exist from 1977. Wildfires are not frequent on the Complex and only thirteen wildfires have occurred since 1977. Six of the thirteen were caused by a human factor, four were caused by lightning strikes, and the remaining three the cause was not determined. Equipment and agriculture field burning account for the majority of human-caused wildfires. The agricultural field burning season occurs during the spring and fall, and is widespread throughout the Complex. Private landowners are not subject to the same burning regulations as government agencies. Farm fields are often ignited and left unattended, sometimes resulting in wildfires.

The Complex has been using prescribed fire as a management tool since 1977. Since that time, 917 acres have been prescribed burned during 23 burns. Average burn size is 45 acres. For a list of prescribed burns conducted on Complex lands see Appendix I.

The most significant wildfire to date occurred in 1978, was of unknown cause, and burned 92 acres of public land. All fires on record were controlled during the first burning period. Many of the wildfires were suppressed with the help of volunteer fire departments or solely by volunteer fire departments. (For more information, see Table 3 and Appendix I).

Table 3. Lake Andes National Wildlife Refuge Complex Wildfire History

Year	Number of Wildfires	Federal Acres	Private Acres	Cause
1998	1	1	N/A	Lightning
1997	1	1	0	Lightning
1996	0	N/A	N/A	N/A
1995	0	N/A	N/A	N/A
1994	0	N/A	N/A	N/A
1993	0	N/A	N/A	N/A
1992	1	37	0	Human
1991	1	15	0	Human
1990	0	N/A	N/A	N/A
1989	0	N/A	N/A	N/A
1988	0	N/A	N/A	N/A
1987	0	N/A	N/A	N/A
1986	0	N/A	N/A	N/A
1985	1	30	5	Human
1984	1	55	0	Unknown
1983	0	N/A	N/A	N/A
1982	0	N/A	N/A	N/A
1981	2	57	10	Unknown, Human
1980	4	133	310	Human, Lightning
1979	0	N/A	N/A	N/A
1978	1	92	0	Unknown
TOTAL	13	421	325	

II. POLICY COMPLIANCE

A. Compliance With Service Policy

The U.S. Fish and Wildlife Service policy requires that an approved Fire Management Plan must be in place for all Service lands with burnable vegetation. This plan provides fire management guidelines for the Lake Andes Complex.

B. NEPA Compliance

This plan meets the requirements of the National Environmental Protection Act (NEPA). The original fire management plan and environmental assessment for the use of prescribed fire was submitted in 1987. It is necessary to revise the current fire management plan to meet new policy requirements. An environmental assessment for Upland Management on Lake Andes National Wildlife Refuge Complex including the use of prescribed fire was approved on September 8, 1994 (Appendix S). A new EA will not be completed for prescribed fire due to new regulations published in the Federal Register (62 FR 2375) January 16, 1997. The new regulation categorically excludes prescribed fire when used for habitat improvement purposes and conducted in accordance with local and State ordinances and laws. Wildfire suppression and prescribed fire are both categorically excluded, as outlined in 516 DM 2 Appendix 1. The Complex will circulate drafts of this plan to its cooperators and other interested parties for review and comment.

C. Authorities Citations

The following statutes authorize and provide the means for prevention, presuppression, control and suppression of wildfire on lands under the jurisdiction of the Department of the Interior, or lands adjacent thereto.

1. Protection Act of September 20, 1922 (42 Stat. 857; 16 U. S. C. 594).
2. Economy Act of June 30, 1932, (47 Stat. 417; 31 U. S. C. 315).
3. Federal Property and Administrative Services Act of 1949 (40 U. S. C. 471 et seq.).
4. Reciprocal Fire Protection Act of May 27, 1955 (69 Stat. 66, 67; 42 U. S. C. 1856, 1856a and b). Authorizes reciprocal fire protection agreements with any fire organization for mutual aid with or without reimbursement and allows for emergency assistance in the vicinity of agency facilities in extinguishing fires when no agreement exists.

5. National Wildlife Refuge System Administrative Act of 1966 as amended (80 Stat. 927; 16 U. S. C. 668dd-668ee).
6. Disaster Relief Act of May 22, 1974 (88 Stat. 143; 42 U.S.C. 5121).
7. Federal Fire Prevention and Control Act of October 29, 1974 (88 Stat. 1535; 15 U.S.C. 2201).
8. Federal Grants and Cooperative Act of 1977 (Pub. L. 95-244, as amended by Pub. L. 97-258, September 13, 1982. 96 Stat. 1003 31 U. S. C. 6301-6308).
9. Supplemental Appropriation Act of September 10, 1982 (96 Stat. 837).
10. Wildfire Suppression Assistance Act of 1989, (Pub. L. 100-428, as amended by Pub. L. 101-11, April, 1989).
11. Departmental Manual, Part 621, Chapter 1, Wildfire Suppression and Management (April 10, 1998).
12. United States Fish and Wildlife Service Wildland Fire Management Handbook (December 28, 2000).
13. United States Fish and Wildlife Service Manual, 621 FW 1-3 (February 7, 2000).

D. Other Regulatory Concerns

Fire management activities within the Complex will be implemented in accordance with the regulations and directions governing the protection of cultural

resources as outlined in Departmental Manual Part 519 (519M), Code of Federal Regulations (36 CFR 800), the Archaeological Resources Protection Act of 1979, and the Archaeology and Historical Preservation Act of 1974. National Historic Preservation Act of 1966 Section 106 clearance will be followed for any fire management activity that may affect historic structures or archaeological resources. The Endangered Species Act of 1973, as amended, dictates that managers will take appropriate action to identify and protect from adverse effects any rare, threatened, or endangered species. Service policy requires that State threatened and endangered species and Federal candidate species will be incorporated into any planning activities.

E. Enabling Legislation and Purpose of Refuge

1. Lake Andes NWR

In February, 1936, Lake Andes NWR was established by Presidential Executive Order #7292. The Executive Order designated 365 acres as a refuge and breeding ground for migratory birds. The Service manages the refuge for conservation purposes and to maintain a refuge for migratory birds and other wildlife.

2. Karl E. Mundt NWR

Karl E. Mundt NWR was established as a refuge in 1974. The refuge was established to conserve fish, wildlife, and plants listed as endangered or threatened under the Endangered Species Act.

3. Waterfowl Production Areas

WPA acquisition started in the 1960's and continues under three authorities: 16 U.S. C. 715d (Migratory Bird Conservation Act); by transfer under the Consolidated Farm and Rural Development Act (7 U. S.C. 2002, c); and by acquisition under the Migratory Bird Hunting and Conservation Stamp, as amended (16 U.S.C. 718 [c]) for one or more of the following purposes:

- (1) Incidental fish and wildlife oriented recreational development.
- (2) The protection of natural resources.
- (3) The conservation of endangered species or threatened species.
- (4) As Waterfowl Project Areas subject to all provisions of the Migratory Bird Conservation Act except the inviolate sanctuary provisions, as mandated.

4. Other

The goal of fire management on Service lands is to protect or enhance habitat and ecosystems for the benefit of fish and wildlife. Service fire policy is based on the Departmental Manual, (910 DM 1-2). It is the policy of the Service that "Every wildland fire is either a wildfire or a prescribed fire. The Service will employ prescribed fire whenever it is an appropriate tool for managing Service resources; and to protect against wildfire whenever it threatens human health, private property, or Service resources." (U.S. Fish and Wildlife Service Manual, Part 621, Fire

Management).

F. Complex Planning Documents

1. EA- Upland Management Plan - Lake Andes 1994

The purpose of the document is to evaluate the alternative actions for managing upland habitat to achieve long term management objectives. Researchers have found that in order to provide quality habitat the upland vegetation must be in a healthy state. Grasses and grassland-allocated forbs require periodic disturbance and partial or total defoliation events in order to maintain a healthy and vigorous condition. The use of prescribed fire can provide a disturbance which can help create a healthy stand of vegetation. Prescribed burning done in cycles of every 3-5 years can increase decomposition in dead vegetation allowing nutrients to enrich the soils and new vegetative growth to occur. If prescribed burning is done at the right times, it may also encourage native species to grow while suppressing invasive plants. The use of prescribed fire as a management tool can help to create suitable wildlife habitat. Refer to Appendix S.

2. Complex Safety Plan:

The Complex Safety Plan objectives are:

- # Provide safe working conditions for employees
- # Provide a safe environment for the visiting public
- # Protect and ensure safety of government equipment
- # Define safety related responsibilities of station personnel
- # Promote a safety attitude
- # Identify sources of emergency assistance
- # Provide documentation

G. Lake Andes Complex Goals and Objectives

Goal 1: Endangered Species/ Essential Habitat: Preserve, restore, and enhance upland, wetland, and riparian habitats on which federally threatened and endangered species depend.

Objective: Provide nesting habitat for two pair of bald eagles at the Karl E. Mundt NWR that is secure from human disturbance.

Objective: Assure recruitment of tree species suitable as nest sites and roost sites for bald eagles based upon a fifty year growing cycle at the Karl

E. Mundt NWR.

Objective: Assure adequate survey data exists or is completed for all listed species prior to any land management activity i.e. prescribed burns, water control structure placement, etc.

Objective: Cooperate with other land management agencies with regard to surveys, management activities, and/or monitoring.

Goal 2: Migratory Bird Habitat: Provide habitat for the life requirements of waterfowl and other migratory birds.

Objective: Assure existing nesting habitat meets nest structural requirements for waterfowl and passerine species.

Objective: Assure that managed wetlands provide nutritional and structural requirements for nesting waterfowl, wading birds, and wetland dependent passerine species.

Objective: Assure that managed wetlands provide nutritional and structural requirements for migrating wetland dependent species.

Objective: Provide protection for additional at-risk wetlands and grasslands important to migratory birds.

Goal 3: Habitat Restoration/Protection: Preserve, restore, and maintain a native prairie ecosystem for indigenous species.

Objective: Assure wetland and grassland protection through the Small Wetlands Acquisition Program.

Objective: Control all exotic and invasive species while encouraging or establishing native species representative of the vegetative zone characteristic of the site.

Goal 4: Private Lands Initiative: Emphasize habitat protection on private land and work with landowners on soil, water, and wildlife conservation projects.

Objective: Involve private landowners in maintaining the ecosystem to increase conservation efforts.

Objective: Restore habitat through voluntary partnerships with private landowners.

Objective: Implement habitat restoration projects in partnerships with South Dakota Game, Fish and Parks and other conservation groups.

Goal 5: Resource Management: Maintain the complex through active management programs to include fire protection, law enforcement, water management, noxious weed control, cooperative agreements, and cooperative wildlife surveys.

Objective: Employ prescribed fire whenever it is an appropriate tool for managing Complex resources and protect against wildfire whenever it threatens human health, private property, or Service resources.

Objective: Enforce Service policy and regulations on Complex lands while ensuring the safety of employees and the visiting public.

Objective: Manipulate water levels on wetlands that have the capability to increase the diversity of invertebrates by providing vegetative structure.

Objective: Assure open water on the artesian well-fed wetlands does not artificially maintain high numbers of migrating waterfowl causing undue disease problems.

Objective: Conduct an aggressive noxious weed control program to maintain the integrity of the Complex's grassland habitats.

Objective: Cooperate with other resource management agencies to protect and enhance the Missouri River Ecosystem.

Objective: Complete mandated wildlife surveys and cooperate with other resource management agencies in completing migratory bird surveys.

Goal 6: Environmental Education: Promote an understanding and appreciation of the ecology of prairie ecosystems which leads to the appreciation of the National Wildlife Refuge System.

Objective: Develop working environmental education relationships with local school teachers and students.

Objective: Develop local demonstration sites as outdoor classrooms throughout the Complex.

Objective: Represent and/or support the Service during local, regional, or

national education training programs.

Goal 7: Wildlife-Dependent Recreation & Interpretation: Provide a range of opportunities for compatible wildlife/wildlands-oriented recreation and interpretation.

Objective: Provide wildlife viewing opportunities throughout the Complex.

Objective: Assure compliance with compatibility issues.

Objective: Provide hunting and fishing opportunities for youth and challenged individuals.

Objective: Support and cooperate with SD Game, Fish and Parks in compatible recreational use.

Goal 8: Partnerships: Create, maintain, and enhance new partnerships that are mutually beneficial and further the goals of the Complex.

Objective: Develop partnerships for funding resource management and recreational projects.

Objective: Develop working relationships with local and regional conservation groups.

III. REFUGE FIRE MANAGEMENT OBJECTIVES

The goal of wildland fire management is to plan and make decisions that help accomplish the mission of the National Wildlife Refuge System. That mission is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. Fire management objectives (standards) are used in the planning process to guide management to determine what fire management responses and activities are necessary to achieve land management goals and objectives.

The primary goal is to provide for firefighter and public safety, property, and natural resource values. Service policy and the Wildland Fire Policy and Program Review direct an agency administrator to use the appropriate management response concept when selecting specific actions to implement protection and fire use objectives. The resulting Appropriate Management Response are specific actions taken in response to a wildland fire to implement protection and fire use objectives. With an approved Fire Management Plan, the Refuge staff may use wildland fire in accordance with local and State

ordinances and laws to achieve resource management objectives (habitat improvement).

At present, the Complex does not have a Master or Comprehensive Conservation Plan. Various operational plans for the Complex include objectives which pertain to fire management. A thorough discussion of the Complex's goals and objectives, hazard fuel management concerns, and how fire will be used to achieve desired results can be found in the previous section. Fire specific goals and objectives are indicated below.

A. Complex Fire Management Goals

1. Protect and enhance the Complex's habitats for the benefit of fish and wildlife.
2. Protect against wildfire whenever it threatens human health, private property, or the Complex's resources.
3. Restore fire into the ecological process.
4. Maintain safety of personnel involved in fire management.

B. Complex Fire Management Objectives

1. Achieve responsible and definable land use benefits through the integration of the fire protection program and the use of fire as a management tool.
2. Manipulate or remove fuels to reduce the likelihood of ignition and/or lessen potential damage and resistance to control in the event of ignition.
3. Implement an aggressive fire prevention/trespass program.
4. Suppress all wildfires using strategies and tactics appropriate to the situation.
5. Employ prescribed fire whenever it is an appropriate tool for managing the Complex's resources.
6. Educate the public regarding the role of prescribed fire within the Complex.
7. Train qualified personnel assigned to fire management duties.

8. Do not allow employees to be purposely exposed to life-threatening conditions or situations, except where the life of another is threatened.

IV. FIRE MANAGEMENT STRATEGIES

Every wildland fire is either a wildfire or a prescribed fire. Prevention of unwanted fires is a high priority. The Complex's prevention program will be designed to minimize losses from wildfire giving consideration to resource objectives. It will portray a balanced philosophy of the prevention of unwanted wildfire and the use of prescribed fire to achieve resource management objectives. Prescribed fire is a management tool that will be used to manage wildland fuels and manipulate vegetation to meet refuge objectives at the Lake Andes Complex.

A. Strategies to Meet Fire Management Objectives

1. Using the Appropriate Management Response concept, suppress all wildfires commensurate with values at risk. Strategies employing a range of suppression options will be considered, and minimum impact suppression techniques (MIST) will be utilized, where appropriate (Table 4).

Table 4: Appropriate Management Response

SITUATION	STRATEGY	TACTIC
1. Wildland fire on Refuge lands which does not threaten life, natural or cultural resources or property values.	Restrict the fire within defined boundaries established either prior to the fire or during the fire.	1. Holding at natural and man-made barriers. 2. Burning out. 3. Observe and patrol.
1. Wildland fire on Service property with low values to be protected. 2. Wildfire burning on to Service lands. 3. Escaped prescribed fire entering another unit to be burned.	Take suppression action, as needed, which can reasonably be expected to check the spread of the fire under prevailing conditions.	1. Direct and indirect line construction. 2. Use of natural and man-made barriers. 3. Burning out 4. Patrol and mop-up of fire perimeter.
1. Wildland fire that threaten life, property or sensitive resources. 2. Wildland fire on Service property with high values to be protected. 3. Observed and/or forecasted extreme fire behavior.	Aggressively suppress the fire using direct or indirect attack methods, holding the fire to the fewest acres burned as possible.	1. Direct and indirect line construction 2. Engine and water use. 3. Aerial retardant 4. Burn out and back fire. 5. Mop-up all or part of the fire area.

2. Suppress all wildfires in a safe and cost effective manner consistent with resources and values at risk.
3. Suppression strategies and tactics will be unique to each incident dependent on safety considerations, weather conditions, costs of suppression, fuel conditions, availability of resources and location of the fire
4. Prescribed fire will be utilized as a management tool for achieving hazard fuel reduction and resource management objectives. Hazard fuel prescribed fires will only be used when they compliment resource management objectives.
5. Prescribed fire will be used as a tool to restore and perpetuate native wildlife species by maintaining a diversity of plant communities, enhancing ecosystem functions, reducing noxious weeds, and retarding invasion of wood species.

6. Cost effective fire monitoring will be initiated to insure objectives are being met. Long term monitoring transects or plots will detect changes in cover and species composition. Monitoring information will also be used to refine burn prescriptions to better achieve objectives.
7. Prescribed fire operations and wildfire suppression will be conducted only by trained and qualified personnel. Such personnel will be issued and required to wear and use protective clothing and equipment.
8. Heavy equipment (dozers, discs, plows and graders) will not be used for fire suppression except in life threatening situations without the express approval of the Project Leader and/or the assigned Burn Boss/Incident Commander of that fire.
9. All fire management programs will be conducted in a manner consistent with applicable laws, policies, and regulations.

B. Fire Use Strategies

1. Use prescribed fire to manipulate vegetation and enhance the biological productivity and diversity of specific organisms or to accomplish specific objectives, e.g. prairie restoration and maintenance, manage for a species of special concern. Reduce vegetative litter, control noxious weeds, and improve height and density of plant cover.
2. Aggressively suppress wildfires occurring in sensitive areas.
3. Establish long-term monitoring transects or plots in all major upland habitat types to detect changes in cover and major species composition.
4. Prescribed fire may be used to reduce hazardous fuel accumulations, provided resource management objectives are also being met and the use of fire for this purpose is cost-effective.

C. Limits to Strategies

1. Wildfire use for resource benefit will not be utilized.
2. Limit disturbance to the soil by minimizing mechanical fire breaks to control wildfires and in preparations of prescribed burns.
3. To the greatest extent possible, hazard fuel prescribed fires will be used

only when they can compliment resource management objectives.

4. Prescribed burning in areas where threatened, endangered, and candidate species exist will not be conducted if the prescribed fire is detrimental to the species or any adverse impacts cannot be mitigated. Section 7 clearance will be secured, as appropriate.
5. Small to medium size prescribed burns (10-300 acres) where threatened, endangered, and candidate species exist will be conducted in an effort to increase local habitat diversity by creating a mosaic of habitats and increased habitat interspersions and edges.
6. Heavy equipment (dozers, discs, plows, and graders) will not be used for fire suppression except in life threatening situations without the express approval of the Complex Project Leader.
7. Use techniques that minimize prescribed fire emissions and the adverse impacts of smoke on public health and environment to meet quality standards set by EPA.
8. Minimize smoke impacts by burning during weather conditions that provide optimal humidity levels and wind conditions for the types of materials being burned.
9. The use of prescribed fire to achieve management objectives must be conducted in a cost effective manner.
10. Aerial Retardants and foams will not be used within 300 feet of any waterway as described in the Guidelines for Aerial Delivery of Retardant or Foam near Waterways.

D. Impacts of Fire Management Activities

The fuels surrounding Service lands can be categorized into four general categories: wildland fuels, urban interface, rural interface and agricultural row crops. The wildland fuels are composed of three NFFL fuel models:

- G Fuel Model 1 is characterized by cured continuous short grassland and savanna fuels with an average fuel depth approximately 1 foot.
- G Fuel Model 3 is characterized by cured continuous tall grass prairie, wild grains and marshlands with an average fuel depth of approximately 3 feet.
- G Fuel Model 9 is characterized by surface loose hardwood litter under stands of deciduous trees with an average fuel depth of 2-3 inches. This fuel type

typically is found in scattered pockets and is best represented in the river bottoms and shelterbelts of eastern South Dakota.

The agricultural private lands surrounding Service lands are subject to changing land use practices due to crop rotation, summer fallowing, enrollment in Conservation Reserve Programs (CRP), variable livestock grazing practices and on agricultural crop prices. This continuous change in land use results in the seasonal fuel changes. The surrounding agricultural fuels are typically characterized as cultivated crop land or planted crop land. Planted crop land is characterized by one on the following NFFL fuel models:

- G Fuel Model 1 is characterized by cured short herbaceous grain crops with an average fuel depth of approximately 1-2 foot (i.e. Alfalfa, oats, millet, mustard, flax, soybeans and etc.).
- G Fuel Model 3 is characterized by cured cultivated tall grains that have not been harvested with an average fuel depth of approximately 3 feet. (i.e. wheat, corn, sunflowers, sudan grass).

Several WPA's are located adjacent to urban and rural interface areas. This intermixture of wildland fuels, combined with urban and rural community sprawl has the greatest risk to threaten or destroy life and personal property. These fuel complexes generally consist of a combination of wildland fuels, agricultural fuels, structures, public utilities, hazardous fuels, commercial and residential facilities, out buildings, fences, and etc.

Suppression of wildland fires on remote WPA's and in urban interface areas is challenging. The scattered WPA's are spread over eight different counties. The District relies heavily on volunteer fire protection districts for suppression and notification of wild fires at remote WPA's.

V. FIRE MANAGEMENT RESPONSIBILITIES

A. Staff Responsibilities

Fire Management Team - Wildfire assignments are made on the basis of individual qualifications and position requirements. Principal members of the Complex fire management team are the Complex's permanent staff consisting of the Project Leader, Refuge Operations Specialists (ROS), Area Biologist, Maintenance and Equipment operators, and Huron WMD based prescribed fire crew.

1. Project Leader

- # Responsible for the overall management of the Complex including the fire program.

Insures that Department, Service, and Complex policies are maintained and followed.

Insures sufficient collateral duty firefighters meeting Service standards are available for initial attack.

Approves and tracks use of Firebase accounts.

Serves on the fire management team, as available and qualified.

Approves prescribed fire plans.

2. Refuge Operations Specialists

Supervise the resource management activities on land management units within the Complex including the selection of tools to be used in achieving objectives (including prescribed fire).

Insure that Department, Service, and Complex policies are followed and maintained.

During the absence of the Project leader, are delegated the responsibility for managing the wildland and prescribed fire programs.

Prepare annual FireBase budget requests.

Responsible for planning, coordinating, and directing preparedness activities including:

- a. Fire Training
- b. Physical testing and Interagency Fire Qualification System (IFQS) data entry.
- a. Fire cache and equipment inventory accountability, maintenance, and operation.
- b. Cooperation with cooperative agencies. Revises cooperative agreements as necessary.
- c. Insures Step-Up Plan is followed.

Updates the Fire Management Plan, maintains fire records, reviews fire reports (DI-1202) for accuracy.

Serves on the fire management team, as available and qualified.

Writes prescribed burn plans for the Complex.

3. Area Biologist

Provides biological support for fire monitoring program to determine if prescribed fires accomplish resource management objectives.

Provides technical/biological support to managers in selecting appropriate resource objectives and the best tool to use in accomplishing selected objectives, to include prescribed fire.

4. Collateral Duty Firefighters:

Responsible for their personal protective equipment and physical conditioning.

Qualify annually on the pack test before fire seasons begins.

Maintain assigned fire equipment in ready state and use required safety gear.

Assist supervisors in maintaining accurate records.

5. Maintenance and Equipment Operators

Responsible for insuring the maintenance and readiness of engines and fire equipment cache at Lake Andes NWR.

Serve on the fire management team, as available and qualified.

6. Wildfire Incident Commander (as assigned)

The incident commander (IC) will be responsible for the safe and efficient suppression of the assigned wildfire.

Fulfill the duties described for the IC in the Fireline Handbook (PMS 410-1).

- # Ensure that personnel are qualified for the job they are performing.
- # Notify dispatch of all resource needs and situation updates, including the need for extended attack.
- # Utilize minimum impact strategies whenever possible.
- # Ensure that fire behavior is monitored, data collected and recorded.
- # Identify and protect sensitive areas.
- # Submit completed DI-1202, crew time sheets, and a listing of any other fire related expenditures or losses to the Project Leader within 10 days of the fire being declared out.

7. Prescribed Burn Boss (as assigned)

- # Implement approved prescribed burn plans within prescriptions.
- # Assist with the administration, monitoring, and evaluation of prescribed burns.
- # Ensure that fire behavior is monitored, data collected, and recorded.
- # Submit completed DI-1202, crew time sheets, and a listing of any other fire related expenditures or losses to the Project Leader within 10 days of the fire being declared out.

B. Cooperator Involvement and Fire Related Agreements

Along with other land management agencies, the Service has adopted the National Interagency Incident Management System (NIIMS) Wildland and Prescribed Fire Qualification Subsystem Guide, PMS 310-1 to identify minimum qualification standards for interagency wildland and prescribed fire operations. PMS 310-1 recognizes the ability of cooperating agencies at the local level to jointly define certification and qualification standards for wildland fire suppression. Under that authority, local wildland fire suppression forces will meet the standards established for their agency or department. All personnel participating in prescribed fire management activities must meet Service fitness and training standards.

Mutual aid resources will report to the IC (in person or by radio) and receive their

duty assignment. Mutual aid forces will be first priority for release from the fire. If additional firefighters are needed, appropriate procedures will be used to acquire them. For a updated list of cooperative agreements, fire related agreements and Memorandum of Understanding see Appendix H.

VI. FIRE SEASON

Thirteen wildfires burning a total of 746 acres have been recorded from 1977 - 1998 for the Complex. Records of wildfire activity prior to 1977 could not be located in the Complex files. Human caused fires through agricultural practices and other sources make up the majority of the wildfires that have occurred on the Complex.

The fire season is split into two periods: March 22nd - May 1st and September 8th - November 7th. Fluctuation in precipitation and effects of drought can shorten or lengthen the season accordingly. The fire season does not limit the use of prescribed fire outside of this time frame. For management purposes a prescribed fire can be planned anytime outside of and during the fire season. For a breakdown of past fires see Appendix I.

Risk of wildfires or prescribed fires escaping from Lake Andes NWR Complex lands is moderate. Farming, grazing, wetlands, and lakes create barriers to fire spread in most areas. Access for light and medium engines is fair considering slope, wetlands, rocks, and limited access roads or trails. The nature of the topography requires specific knowledge of access routes for fire suppression actions.

Table 5. Fire Season and Fire Frequency at Lake Andes Complex

Average number of fires 1977-1998	0.6/year
Ten Year Average 1988-1998	0.3 /year
Fire Season	Mar. 22-May 1 and Sept. 8-Nov.7

VII. EQUIPMENT AND STAFFING NEEDS

A. Normal Unit Strength

1. Engines, tools, and other equipment

Engines are the primary initial attack resource on the Complex because of the predominance of fine fuels and access roads. Earth moving equipment is available, however, it will only be used after approval of the Project Leader.

The light engine will be fully prepared year round and stored in the heated fire bay. The water tender will be filled when the possibility for hard freeze is past, usually in April. All other equipment will be stored at the Complex headquarters and may be kept in the equipment storage building during the winter months.

Lists of tools and other equipment can be found in Appendix J.

Table. 6 _____ Normal Unit Strength - Equipment

Item	Year Purchased	Percent of Fire Funding	Have	GVW	Need	GVW
Engine Module(s) medium (200-400 gal)			0		1	18K
Slip-on unit(s)	1987 1986	50% 50%	1 1			
Water Tender(s)	Unknown	None	1			
Portable Pump(s) Standard float-a-pump			0		1	
Power Saw(s)	1982 & 61	None	2			
Mower(s)	1994	None	3		1	
Tractor(s)	1998,92,85,82	None	4			
Grader(s)	1988	None	1			
Plow Unit/Disk	1986	None	1			
ATV(s)	1998	100%	2		2	
Other List						

Other Equipment Available for Fire Suppression or Prescribed Fire Operations Not Fire Funded
Wheel Loader
4 additional ATV's
Rake

2. Personnel

Position **needs** of the Fire Management program for both preparedness and prescribed fire for the Complex are found in Table 6. A list of current staff available to meet position needs and employee contact list is

contained in Appendix K.

Table 7: Fire Management Needs for Lake Andes Complex

Position	Minimum Number required
Incident Commander (ICT5)	1
Prescribed Burn Boss (RXB3)	2
Engine Boss (ENGB)	2
Firefighter (FFT2)	4
Engine Operators (ENOP)	2

VIII. PREPAREDNESS

A. Current Staff Available and Employee Contact List

A current list of staff qualified for prescribed burning and wildfire suppression can be found in Appendix K. For a listing of employees and where they can be reached or contacted in case of a fire emergency see Appendix L.

B. Pre-Season Readiness Activities

1. Training and Qualifications

The safety of firefighters and the public is the first priority. Persons engaged in fire suppression activities are exposed to a high element of risk. The Refuge Manager and fireline supervisors must make every effort to reduce the exposure to risk and enhance performance. One way is through formal and on-the-job training and improved physical fitness. The Service has adopted the training and fitness standards established in 310-1, and all firefighters must meet these and other standards established by the Service to participate in fire management activities. Interagency training opportunities will be utilized whenever possible.

Fish and Wildlife Service policy sets training, qualification, and fitness requirements for all wildland firefighters and prescribed fire positions. All personnel involved in fire management functions will be provided with the training required to meet Service qualification standards for the position they are expected to perform. Interagency training opportunities will be utilized whenever possible.

a. Training

The Regional Office will pay for all approved fire training if the

following criteria are met:

1. Participant completes and submits to the Zone FMO a National Wildfire Coordinating Group Interagency Training Nomination form (NFES 2131), complete with supervisory approval and an estimated cost of training, travel, and per diem prior to the commencement of training.
2. Except for certain training courses which are approved by the Regional Fire Management Coordinator, training requests are approved by the Zone FMO.
3. Upon completion of the training, a copy of the Certificate of Completion and a copy of the travel voucher are sent to the Budget Assistant for Refuges and Wildlife in the Regional Office.

b. Annual Refresher Training

All personnel involved in Fire Management activities are required to complete fire management refresher training annually in order to be qualified for fire management activities in that calendar year. Refresher training will concentrate on local conditions and factors, the Standard Fire Orders, LCEs, 18 Situations, and Common Dominators. NWCG courses Standards for Survival, Lessons Learned, Look Up, Look Down, Look Around, and others meet the firefighter safety requirement; but, efforts will be made to vary the training and use all or portions of other NWCG courses to cover the required topics. Fire **shelter use and deployment** under adverse conditions, if possible, **must** be included as part of the annual refresher.

c. Physical Fitness

All personnel involved in fire management activities will meet the fitness standards established by the Service and Region. At this point in time, firefighters participating in wildfire suppression must achieve and maintain an **Arduous** rating. Firefighters participating in prescribed burns must achieve and maintain a **Moderate** rating. Information found in Appendix M provides specific instructions to administer the tests, a health screening questionnaire to aid in assessing personal health and fitness of employees prior to taking the test, an informed consent form, and safety considerations. A trained and qualified American Red Cross Responder (or equivalent) who can recognize symptoms of physical distress and appropriate first aid procedures must be on site during the test.

Wildland fire fitness tests shall not be administered to anyone who has obvious physical conditions or known heart problems that would place them at risk. All individuals are required to complete a pre-test physical activity readiness questionnaire prior to taking a physical fitness test. They must read and sign the Par-Q health screening questionnaire, an informed consent form (Appendix M). If an employee cannot answer NO to all the questions in the PAR-Q health screening questionnaire, or is over 40 years of age, unaccustomed to vigorous exercise, and testing to achieve a Moderate or Light rating, the test administrator will recommend a physical examination. As noted below, all individuals over 40 years of age **must** receive an annual physical **prior** to physical testing.

d.

Physical Examinations

In keeping with Service Policy, a physical examination is required for all new permanent employees and all seasonal employees assigned to arduous duty as fire fighters prior to reporting for duty. A physical examination may be requested for a permanent employee by the supervisor if there is a question about the ability of an employee to safely complete one of the work capacity tests. All permanent employees over 40 years of age who take the Pack or Field Work Capacity Test to qualify for a wildland or prescribed fire position are required to have an annual physical examination before taking the test.

Prescribed Fire Plan Preparation			x																
Review and Update Fire Management Plan				x															
Prepare Pre-season Risk Analysis			x																

Activities should be completed prior to the end of the month that is indicated.

Weather monitoring will be done daily during the burning season.

C. Impacts of Drought and Other Activities

As indicated previously, periods of drought can greatly impact fire behavior and resistance to suppression. For that reason the Rangeland Fire Danger Index, Palmer Drought Index, and the Keech-Byram Drought Index will be monitored at a minimum on a weekly bases throughout the year. All are available on the Internet at <http://ndc.fws.gov>. The Refuge fire staff can also contact the Custer Interagency Dispatch Center (605-673-4434) during periods of high fire danger to track indices and anticipate possible fire activity. Preparedness actions have been identified in the Step-Up Plan to respond to unusual conditions associated with drought and other factors (Appendix N).

Large scale fire suppression activities occurring in various parts of the country can have an impact on local fire management activities. For example, resources may be limited to implement prescribed fire activities because the closest available resources may be assigned to fire suppression duties or Refuge personnel may be involved as well. Regional drought conditions may also tie-up local resources

that would normally be able to assist with Refuge fire management activities. It may be necessary to go out of Region to get the resources needed to staff the Refuge engine during periods of extreme drought or high fire danger. _____

Prescribed fire activities will not be conducted when the National Preparedness is at Levels IV or V, without approval of the Rocky Mountain Area Coordination Group. All other preparedness activities will be in accordance with the **Complex Step-up Plan** (Appendix N).

D. Emergency Presuppression and Severity Funding

Severity funding is different from Emergency Presuppression funding. Emergency Presuppression funds are used to fund activities during short-term weather events and increased human activity that increase the fire danger beyond what is normal. Severity funding is requested to prepare for abnormally extreme fire potential caused by unusual climate or weather events such as extended drought. Severity funds and emergency presuppression funds may be used to rent or preposition additional initial attack equipment, augment existing fire suppression personnel, and meet other requirements of the Step-up Plan.

Emergency Presuppression and Severity funds will be requested in accordance with the guidance provided in the Service's Fire Management Planning Handbook. As a general guide, Severity funding will be requested if a severe drought is indicated by a Palmer Drought Index reading of -4.0 or less or a Keech-Byram Drought Index of 600 or greater and a long-range forecast calling for below average precipitation and/or above average temperatures. Drought Indices can be located at:
<http://www.boi.noaa.gov/fwweb/fwoutlook.htm>.

IX. WILDFIRE PROGRAM

A. Special Safety Concerns and Firefighter Safety

Heavy fuel loading and adverse weather conditions can work together to produce conditions that are detrimental to firefighter safety. It is common practice to attack the fire at the head using mechanized equipment. Firefighters must be alert to their surroundings and the weather to insure there is adequate time to access escape routes and safety zones. Intermittent streams and wetlands can pose safety problems of getting stuck among fuel concentrations.

Smoke from wildfires and prescribed fires is a recognized health concern for firefighters. Smoke from wildfires is a recognized health concern for firefighters. Incident commanders must plan to minimize exposure to heavy smoke by incorporating the recommendations outlined in the publication Health Hazards of Smoke (Sharkey 1997). The use of respirators is not recommended.

B. Fire Prevention

Human caused fires through agricultural practices and other sources make up the majority of wildfires that have occurred on the Complex. In general, the public and visitors to the Complex are aware of fire prevention. As a reminder, the Complex may do the following:

- # Signing
- # Contacts with Complex cooperators and neighbors
- # Public contacts through press releases and verbal contacts
- # Employee training and awareness
- # Closures when necessary
- # Implementation of State regulations and restrictions
- # Enforcement of regulations and prosecution of violators

C. Detection

The Complex relies on neighbors, visitors, cooperators, and staff to detect and report fires. In addition, the Step-Up Plan provides for increased patrols by Complex personnel during periods of very high and extreme fire danger.

There may be occasions when unqualified personnel discover a wildland fire. When this occurs the employee should report the fire and request assistance before taking action to suppress or slow the spread of the fire. If the fire poses an imminent threat to human life, the employee may take appropriate action to protect that life before requesting assistance. The unqualified personnel will be relieved from direct on-line suppression duty or reassigned to non-fireline duty when qualified initial attack forces arrive.

D. Initial Reporting and Dispatching

All fires occurring within or adjacent to the Lake Andes NWR, Karl E. Mundt NWR, and Lake Andes WMD will be reported to the Complex headquarters. **The person receiving the report will be responsible for implementing the Fire Dispatch Plan (Appendix O) and assume duties of Fire Dispatcher until relieved or released.**

For local fires, the **Fire Dispatcher** will stay on duty until: (1) all Complex resources return; (2) relieved by another dispatcher; or (3) advised by IC that he/she can leave. The Fire Dispatcher will not be required to stay on duty if the fire occurs outside Complex radio coverage, but the Dispatcher must notify the Custer Dispatch Center (1-605-673-4434/4435/4436) that a dispatcher is not on duty at the Complex before leaving.

The **Fire Dispatcher** will be responsible for coordinating the filling and delivery of any resource orders made by the IC for all operational and logistical needs, including engines, aircraft, tools, supplies, and meals. The IC will place all resource orders through the Dispatcher, and specify what is needed, when it is needed, and where it is needed. The Dispatcher will promptly determine if the resource orders can be filled or procured locally and notify the IC. **If a resource order can not be filled locally, the Dispatcher will place the order with the Custer Dispatch Center (1-605-673-4434).** The Zone FMO at J. Clark Salyer NWR or the Center Coordinator will generally be able to assist with ordering resources from outside the area.

Requests for assistance by cooperators on fires not threatening the Complex must be made to the Project Leader or designee. Only qualified and properly equipped resources meeting NWCG standards will be dispatched off of the Complex.

E. **Fire Suppression**

1. **Initial Attack**

Often Initial Attack action is initiated by local volunteer fire departments. Cooperative agreements with the State will be maintained to provide for cooperative suppression actions. Assistance from local or Federal cooperators will follow the "closest resources" and "total mobility" principles in accordance with Service policy.

All fires occurring on the Complex and staffed with Service employees will be supervised by a qualified Incident Commander (IC), whenever possible. The Incident Commander or lead firefighter (also referred to as the IC) will be responsible for all management aspects of the fire until the fire is declared out or he/she is relieved. If a qualified IC is not available, the highest qualified firefighter will assume command until relieved or the fire is declared out. All resources will report to the IC (either in person or by radio) prior to deploying to the fire and upon arrival to the fire. The IC will be responsible for aspects of the management of the fire, including:

- G Providing a size-up of the fire to dispatch as soon as possible.
- G Using guidance found in the fire Management Plan or in the Delegation of Authority, determine the strategy and tactics to be used
- G Determine the resources needed for the fire.

- G Brief assigned resources on the strategy and tactics to be used, expected fire behavior, historic weather and fire behavior patterns, impacts of drought, live fuel moisture, escape routes and safety zones, and radio frequencies to be used
- G Advising dispatch of resource needs on the fire.
- G Managing all aspects of the incident until relieved or the fire is suppressed.

The IC will receive general suppression strategy from the Fire Management Plan, but appropriate tactics used to suppress the fire will be up to the IC to implement. **Minimum impact suppression tactics (MIST)** will be used whenever possible.

2. Limits

- a. The use of earth moving equipment for suppression activities (dozers, graders, plows) on the Complex will not be permitted without the approval of the Project Leader.
- b. Fires will be suppressed in a cost effective manner.

3. Escaped Fires/Extended Attack

Whenever it appears a fire will escape initial attack efforts, leave Service lands, or when fire complexity exceeds the capabilities of command or operations, the IC will take appropriate, proactive actions to ensure additional resources are ordered. The IC, through dispatch or other means, will notify the Zone FMO of the situation. The Zone FMO will assist the Project Leader in completing a Wildland Fire Situation Analysis (WFSA) and Delegation of Authority (Appendix P).

F. Mop up Standards and Emergency Stabilization and Rehabilitation

The IC will be responsible for mop-up and mitigation of suppression actions taken on Refuge fires. The mop-up standards established in the Fireline Handbook will be followed. Refuge fires will be patrolled or monitored until declared out.

Prior to releasing all firefighters from a wildland fire the following actions will be taken:

- G All trash will be removed.
- G Firelines will be refilled and waterbars added if needed.
- G Hazardous trees and snags cut and the stumps cut flush.

G Disked firelines should be compacted as soon as possible to preserve the living root stock of natives grasses.

G Overturned sod resulting from plowing must be rolled back with a grader or by hand and compacted to preserve native grass root stock.

Other emergency stabilization and emergency rehabilitation measures may be taken in accordance with Chapter 5 of the Fire Management Handbook. Briefly:

G **Emergency stabilization** is the use of appropriate emergency stabilization techniques in order to protect public safety and stabilize and prevent further degradation of cultural and natural resources in the perimeter of the burned area and downstream impact areas from erosion and invasion of undesirable species. The Incident Commander may initiate Emergency Stabilization actions before the fire is demobilized, as delegated by the Agency Administrator, but completing emergency stabilization activities may be completed after the fire is declared out.

G **Rehabilitation** is the use of appropriate rehabilitation techniques to improve natural resources as stipulated in approved refuge management plans and the repair or replacement of minor facilities damaged by the fire. Total "rehabilitation" of a burned area is not within the scope of the Emergency Rehabilitation funding. Emergency Rehabilitation funding can be use to begin the rehabilitation process if other funding is committed to continue the rehabilitation throughout the life of the project (beyond the initial 3 years of Emergency Rehabilitation funding). Major facilities are repaired or replaced through supplemental appropriations of other funding.

G Because of the emergency nature of the fire event, the emergency stabilization section of the Emergency Stabilization and Rehabilitation Plan (ESR Plan) must be developed expeditiously and is frequently developed by a local unit or designated burned area ESR team. The rehabilitation section of the ESR Plan is not considered an emergency, and is developed as other refuge land use plans. The refuge manager is responsible for preparing all ESR Plans. In order to be funded, ESR Plans must meet resource management objectives and be approved by the Project Leader and the Regional Director.

X. PRESCRIBED FIRE PROGRAM

A. Introduction

The Complex has been using prescribed fire as a management tool since 1977. Since that time, 917 acres have been prescribed burned during 23 burns. Average burn size is 45 acres. The Complex uses prescribed fire as a tool in two management areas: resource management and hazard fuels reduction.

1. Resource Management Objectives

The goals of resource management for the Complex are to maintain the Complex through active management programs to include fire protection, law enforcement, water management, noxious weed control, cooperative agreements, and cooperative wildlife surveys. Resource management prescribed fire is used to restore/create/maintain a diversity of plant communities in order to restore and perpetuate native wildlife species.

Objectives of meeting resource management goals through fire include:

1. Restoration/perpetuation of native grass and forb species.
2. Reduction/control of non native grasses, such as Kentucky bluegrass and smooth brome.
3. Maintain/rejuvenate quality nesting cover for waterfowl.
4. Control of woody species invasion of grasslands, such as cedar trees.
5. Aid in control of noxious weeds.
6. Control of dense cattail growth in shallow wetlands.
7. Site preparation for seeding projects.

2. Hazardous Fuel Reduction

The Complex hazard fuel reduction program uses prescribed fire within or near Complex development zones, wildfire sensitive resources, and specific WPA and refuge boundary zones. Prescribed burn units are selected based on values at risk on adjacent land, probability for escape from Service land, and fuels. Fuels in hazard fuel sites have 6-10 inches of accumulated litter. The large volume of litter causes control problems during suppression actions. High litter loadings allow wildfires to carry even during full green-up conditions. To the greatest extent possible, hazard fuel burns will only be used when they can compliment resource management objectives.

The goal of hazard fuel burns is to reduce hazard fuel loading thereby reducing the possibility of catastrophic fire or severity of burns. Objectives include:

1. Reduce dead fuel loadings (litter) of 2-3 tons per acre over at least 75% of the prescribed burn unit.
2. Reduce woody plants and trees such as cedar by 50%.
3. Treat approximately 500 acres per year.
4. Initiate burning on prescribed burn units once every 3-5 years depending on fuel accumulations and resource management.

3. Use of Prescribed Fire to Achieve Resource Objectives

Achieving many of the above objectives requires repeated prescribed burns over a 12-15 year period with a 3-5 year burn frequency.

Primary Objective: Treat approximately 1,000 acres per year in order to accomplish resource management goals and objectives on 10 prescribed burn units (assuming current level of funding). As part of the prescribed fire program, a monitoring program funded by non Fire funds will be instituted to verify that objectives are being achieved.

4. Limits

Multiple units may be burned at the same time within the Complex. The maximum number of simultaneous burns will depend on the cumulative impacts of smoke on sensitive targets. The Zone FMO or other qualified Prescribed Fire Manager will be assigned to coordinate the management of simultaneous burns. It is not required that the Prescribed Fire Manager or Zone FMO be on-site during the burns. Sufficient suppression forces must be available for each burn in the event of an escape.

Lake Andes Complex is within the Rocky Mountain Coordination Area. Prescribed fires cannot be ignited when the Rocky Mountain Area is in fire danger Preparedness Level V and/or the National Preparedness Level is IV or V. When the South Dakota Rangeland Fire Danger Index is in the Very High or Extreme category, verbal permission must be obtained from the local rural fire protection district chief.

Drought can have an effect on fire severity and control. One or more drought indicators (PDI - KBI) will be used to determine the degree of drought. These indicators can be access on the web at <http://www.boi.noaa.gov/fwweb/fwoutlook.htm> .

5. Burning Season

The fire season is split into two periods: March 22nd - May 1st and September 8th - November 7th. Fluctuation in precipitation and effects of drought can shorten or lengthen the season accordingly. The fire season does not limit the use of prescribed fire outside of this time frame. For management purposes a prescribed fire can be planned anytime outside of and during the fire season. For a breakdown of past fires see Appendix I.

The normal prescribed burn season begins approximately April 1, depending on snowmelt. The season continues until December 31. Most prescribed burn units are not burned between May 1 and July 15 in order to avoid damaging nests. The time frame in which a particular unit is burned depends on burn objectives. Some burning will occur during the winter depending on snow conditions. Winter burns are generally for cattail control in wetlands and for burning blacklines to be used as control lines for future burn units.

B. **Complexity**

Most burns in the Complex fall within the low complexity category as determined by the Region 6 Complexity Analysis Process. The average number of personnel required to conduct a burn of low complexity on the Complex is 5-6. Most burns are structured with a burn boss, 4-5 prescribed fire crew members (FFT2), and two light engines.

C. **Planning, Preparation and Implementation**

Managers are responsible for supervising the development of resource management objectives for prescribed burn units in their areas of responsibility. Prescribed fire is just one of a combination of tools available. If needed, the Zone FMO or Regional Prescribed Fire Specialist will be consulted for assistance in determining how to achieve the desired objectives. The burn plan will document objectives and the plan of action for achieving them. Burn plans can be written by any qualified person, but must be reviewed by a burn boss.

Contingency planning can range from the a simple injury to a key person on the burn, to the complete loss of control of a situation due to unanticipated weather events and control problems. Contingency planning shall be an essential part of the Sand Lake fire management program because of the potential risk involved with prescribed burning. The essential components of all contingency plans included in prescribed burn plans will identify “Who, What, When, Where as well as how” an unanticipated problem will be managed .

All prescribed burn plans shall identify the following essential elements for contingency planning:

- G Who has the authority to activate the contingency plan.
- G Clearly defined trigger points.
- G Special instructions for reporting and escaped fire or slopover.
- G Who will be notified when the contingency actions are being implemented
- G The location of values or resources requiring protection and a established a priority for providing protection.
- G Identify the initial action used to suppress the wildland fire. Including the organizational structure, strategies, tactics, additional resources, health and safety concerns.
- G Containment opportunities outside of the burn unit (i.e. fuel breaks, roads, and other areas).
- G Contingency elements required to be on-site during a prescribed burn operation.

There is no “one size fits all” standard for determining when a prescribed fire should be declared a wildland fire. Therefore, determining when to implement the contingency plan or declare a prescribed fire a wildfire will vary with every situation. Because of this, the following “trigger points” have been identified to serve as a guide to determine when and if the contingency plan will be implemented:

- G When five or more slopovers occur.
- G When private property, cultural resources, structures and other resource values are threatened.
- G When the fire behavior predictions exceeds the prescription parameters.
- G When local burning restrictions and fire use policies have been implemented.

The actual trigger points will be identified in each burn plan.

Potential prescribed burn units will be selected and a draft list will be reviewed for sound biological practices by the Project Leader. A review of the previous years prescribed fire accomplishments, failures, and any monitoring results will also take place at this time. Burn plans will be submitted for review to the Zone FMO at least 60 days prior to the planned burn day. The Project Leader has final approval of the burn plan upon review. He/She will prioritize the burn units to be burned on a Complex wide basis.

The maintenance staff and managers will be responsible for preparing all fire equipment used for prescribed burning prior to April 1. Prescribed burn units may require preparation including: mowlines, blackline, and public relations. Preparation for burns will be handled on an individual basis and will be identified in the prescribed burn plan for that unit.

C. Monitoring and Evaluation

1. **Introduction**

Past monitoring and evaluation of prescribed fires has been limited due to funding and staffing limitations. Burn prescriptions and timing are based on past research (Higgins, Smith, Kruse, Kirsch, and others). Preburn evaluation was limited to general photographs and/or qualitative evaluation of fuel conditions and green up conditions. Burn day evaluations documented weather (many times not on site) and limited documentation of fire behavior. Subjective measurements (visual) such as the percent of fuel consumed were also made. Post burn evaluation was limited to subjective qualitative estimates of species response in achieving objectives.

Although little site specific data on the effects of fire for the Complex exists, general conclusions can be made from the Fire Effects Information System (Appendix Q).

Fire monitoring protocols for the Region or Service will be used at the Complex (Appendix R). When the fire management program proposed by this plan is fully funded, a more quantitative monitoring program may be implemented. Protocols will be established to determine if burn objectives are being met and long term monitoring will be conducted to determine vegetation responses.

2. **First Order Fire Effects Monitoring Program**

- a. **Environmental Conditions** will be recorded at the site periodically prior to ignition and hourly during the burn. Conditions evaluated include Air Temperature, RH, and Wind speed and direction.
- b. **Fuel moisture(s)** will be measured or estimated using tables, charts, or other prediction system (BEHAVE).
- c. **Fire Behavior** such as flame length and rates of spread will be recorded.
- d. **Post fire effects** will be measured or estimated. These effects include scorch height, percent of area burned, percent of fuel consumed - based on fuel (time-lag) classification, amount of duff removed, etc.

XI. **FIRE MANAGEMENT UNITS**

The Complex is broken into three Fire Management Units for both prescribed fire and wildfire suppression (Figure 5). The three units are the Lake Andes NWR, Karl E. Mundt NWR, and Lake Andes WMD. The Complex was divided into three management units for the following reasons:

- # There is adequate staffing and resources at Lake Andes NWR to take initial action on wildland fires occurring on the Refuge and can handle most wildland fires relying on the resources at hand.
- # There is limited staffing and equipment at Karl E. Mundt NWR which is separated from the headquarters at Lake Andes NWR. As a result, staffing at Lake Andes cannot be relied on to take action on wildfires occurring on the Mundt NWR. It may be necessary to rely on local volunteer fire departments for assistance.
- # The WMD is composed of several small blocks of land which in many cases are miles from the Complex headquarters and are intermingled with private lands. For these reasons it is expected that most of all the reported wildfires will be suppressed by local volunteer fire departments.

Table 9: Size of Units

Unit	State or Service Easement	Service Fee Title	Total Acres
Lake Andes National Wildlife Refuge	4,700	937	5,637
Lake Andes Wetland Management District	0	18,888	18,888
Karl E. Mundt National Wildlife Refuge	305	780	1,085

TOTAL	5,005	20,605	25,610
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A. Fuels and Expected Fire Behavior

1. Fuels

Fuel and vegetation types and characteristics of the Complex and surrounding area are:

Fuel Model 1 (Short grass): Approximately half of the Complex area fits fuel model 1. Annual and perennial grasses are included in this fuel model. Very little shrub or timber is present in this area. Fire is spread by fine, porous, and continuous fuels that have cured or are nearly cured. Total fuel load equals 0.74 tons per acre of dead fuels. Spread rates with 5 mph wind speed and 8% moisture content fire can spread at 78 chains per hour and can have a 4 ft. flame length.

Fuel Model 3 (Tall grass): Fires in this model are the most intense for grasses and spreads quickly when influenced by the wind. Over one-third of the grass stand is considered dead or cured. This would include cured stands of cattails and patches of tall grass species. Fuel loading consists of fine and course dead fuels, averaging 3 tons per acre. Spread rates with 5 mph winds can reach 104 chains per hour and can have a flame length of 12 feet.

Fuel Model 9 (Hardwood litter): This fuel model describes areas where loosely compacted leaf litter is the primary carrier of the fire. Fires run through the surface litter faster than model 8 and have longer flame height. Fall fires in hardwoods are predictable, but high winds will actually cause hire rates of spread than predicted because of spotting caused by rolling and blowing leaves. Rates of spread are slow, 7.5 chains/hour with flame lengths of 3 feet or less, under normal conditions.

2. Expected Fire Behavior

Fire behavior is dependent on many factors. Some of the most important influences are relative humidity, air temperatures, fuel type, fuel moisture, windspeed, slope, aspect, time of day, and season. On site predictions of estimated fire behavior can be made with the above inputs through the use of nomograms and other prediction models developed for the purpose. The various prediction systems provide outputs of Rate of Spread, Fireline Intensity, Heat Per Unit Area, and Flame Length. Other indicators such as

the Keech-Byram Index or Palmer Drought Index can help determine if extra personnel and funding are required for a potential hazardous fire season. At the present time the Complex does not have a weather station, therefore, the necessary data has not been collected to accurately determine a fire weather history. Until such time as the Refuge purchases and installs a weather station and catalogues site specific data in WIMS, the National Weather Service in Sioux Falls at www.crh.noaa.gov/fsd/forprod.htm will be used to determine potential fire behavior and trends necessary to properly manage the fire suppression program.

3. **Fuel Status**

Fuel loadings in stands of cattails, DNC, and on reseeded tall grass lands (Model 3) are much heavier than normal. Less robust tame grass plots can have heavier than normal loadings as well. Loading depends on the frequency of fire or the effects of other management actions on an area. See Section X A-2 for further information.

4. **Unexpected Fire Behavior**

Weather changes can happen rapidly and can play a major role in fire suppression activities. Weather patterns such as cold fronts, inversions, and thunderstorms can effect suppression efforts of an escaped fire and need to be monitored during the fire season. Also yearly and season weather patterns can change and can have a major effect on fuel loadings and moisture. Severe weather such as tornados and hail storms can change the amount of fuel in a given area making it difficult to control suppression. In addition, severe weather may also provide a source for fire in the event of lightning and live electrical lines. Although these cases are not common staff will be alert and will monitor weather conditions which may cause havoc for fire suppression.

B. Fire Effects

Effects of Topography on Fire: Boundaries within the Complex were established along jurisdictional lines rather than geographic features. Many of the boundary lines for Complex fire management and prescribed burn units are conducive to fire spreading onto private land due to topography.

Effects of Fire on Soils: Soil erosion resulting from suppression or prescribed fire is generally not a problem on the Complex. Occasionally, local cooperators use disc lines as a fire suppression tactic. The use of a disc line is not permitted on Complex lands without the permission of the Project Leader or his/her designee due to noxious weed invasion and soil erosion. Mowing and wet lines will be used whenever possible.

Effects of Fire on Insects:

Fire can cause an immediate decrease in insect populations (except ants, other underground species, and flying insects), followed by a gradual increase in numbers as the vegetation recovers. The insects eventually reach a population level higher than adjacent areas, then decline to near present levels as vegetation and soil litter stabilize (Higgins et al. 1989).

Effects of Fire on Amphibians and Reptiles:

No federally listed reptiles or amphibians have been observed in the Complex, but management of a diverse prairie ecosystem which includes using prescribed fire, should provide habitat for any that might be found and help maintain current non-listed populations.

Effects of Fire on Birds:

Bird species evolving with fire may show fire adapted behavior and response, whereas other species exposed infrequently to fire in their evolutionary history may be severely inhibited by it (Best 1979, Kruse and Higgins 1990). Research conducted in North Dakota concluded diversity of nesting birds was higher, nesting success increased, and vegetation diversity increased after burning (Kirsch 1972 and Kruse 1988). Kruse and Piehl (1986) found that burning during the nesting season did not eliminate production for the year and many active nests can survive the fire.

Effects of Fire on Mammals:

The direct impacts of fire on mammals include disturbance or infrequent mortality of individuals, particularly slow moving and/or sedentary species. Fire in the mixed grass prairie can favor mammals. Information concerning the effects of fire on wildlife can be reviewed in *The Effects of Fire in the Northern Great Plains*, prepared by Higgins, Kruse, and Piehl 1989.

Effects of Fire on Endangered Species:

Fire is a natural and essential part of the Complex's ecosystems. Native wildlife evolved with fire and have developed means of tolerating and/or benefiting from fires. However, the sensitive nature of some of the endangered species require that their habitats be protected from large wildfires especially where adjacent habitat is lacking. Prescribed burning in areas where threatened, endangered, and candidate species exist will be conducted if the prescribed fire is not detrimental to the species or when any adverse impacts can be mitigated. When any management activity is suspected to have any impact on these species a Section 7 consultation will be undertaken.

Effects of Fire on Vegetation

One of the cheapest and most effective way of improving and restoring native vegetation is by using fire. Selective suppression or promotion of a particular species depends on the date of the fire in relation to the phenology of the particular species (Wilson and Stubbendieck 1997, Higgins et al. 1986). Large

wildfires could have negative effects on certain grass species depending on the time of year and drought conditions. Prescribed fires, appropriately timed, will be used to manage Complex grasslands. Additional information concerning effects on vegetation and other natural resources can be accessed on the Internet at <http://www.fire.org/per/tools.cgi>.

1. Expected Fire Effects

Expected fire effects on common species and species of special concern can be found in Appendix Q. Additional information can be found at <http://www.fire.org/perl/tools.cgi>.

C. Prescribed Fire Objectives For Each Management Unit

1. Lake Andes NWR

- # Restoration/perpetuation of native grass and forb species.
- # Maintain/rejuvenate nesting cover for waterfowl and other grassland dependent species.
- # Reduce and control non native grass species and noxious weeds.
- # Periodic reduction of dense cattail growth in wetland areas.
- # Reduce hazard fuel loading.

2. Karl E. Mundt NWR

- # Restoration/perpetuation of native grass and forb species.
- # Control of woody species invasion of grasslands.
- # Reduce hazard fuel loading.

3. Lake Andes WMD

- # Restoration/perpetuation of native grass and forb species.
- # Maintain/rejuvenate nesting cover for waterfowl and other grassland dependent species.
- # Reduce and control non native grass species and noxious weeds.
- # Control of woody species invasion of grasslands.
- # Periodic reduction of dense cattail growth in wetland areas.
- # Reduce hazard fuel loading.
- # Site preparation for farming and seeding projects.

D. Suppression Strategies and Techniques For Each Management Unit

1. Lake Andes NWR

- # Initial attack will be conducted by qualified staff persons. Equipment is on hand and located on site.
- # Equipment will be maintained and readily available to respond in a timely manner.
- # Existing roads and trails, bodies of water, and areas of sparse or non-continuous fuels will be utilized as primary control lines, anchor points, escape routes, and safety zones.
- # Backing fires will be conducted from existing roads and natural barriers to halt the spread of fire when appropriate.
- # Use burnouts to stabilize and strengthen the primary control lines.
- # The Incident Commander will choose the appropriate suppression strategy and technique to use.

2. Karl E. Mundt NWR

- # Initial attack will be conducted by staff person on site with assistance from the local volunteer fire department, if warranted.
- # Complex initial attack equipment and personnel will mobilize and direct/conduct suppression efforts on site.
- # Existing roads and trails, bodies of water, and areas of sparse or non-continuous fuels will be utilized as primary control lines, anchor points, escape routes, and safety zones.
- # Backing fires will be conducted from existing roads and natural barriers to halt the spread of fire when appropriate.
- # Use burnouts to stabilize and strengthen the primary control lines.
- # The Incident Commander will choose the appropriate suppression strategy and technique to use.

3. Lake Andes WMD

- # Initial attack will be conducted by local volunteer fire departments.
- # If warranted, Complex initial attack equipment and personnel will mobilize and direct/conduct suppression efforts on site.
- # Existing roads and trails, bodies of water, and areas of sparse or non-continuous fuels will be utilized as primary control lines, anchor points, escape routes, and safety zones.
- # Backing fires will be conducted from existing roads and natural barriers to halt the spread of fire when appropriate.
- # Use burnouts to stabilize and strengthen the primary control lines.

The Incident Commander will choose the appropriate suppression strategy and technique to use.

E. Limits and Special Concerns

1. Limits

The use of heavy equipment on any fire management unit must be approved by the Project Leader or his or her designee.

2. Special Concerns

a. Suppression

Rapid rates of spread, potentially long response times, and large number of individual prescribed burn units (WPAs), pose suppression problems and increase the likelihood of escape onto adjacent lands.

Isolation of many land blocks as well as the Karl E. Mundt unit from Service staffed equipment will reduce response times.

Karl E. Mundt NWR was established to provide habitat for wintering and nesting Bald Eagles which are currently listed as a threatened species under the Endangered Species Act. Suppression and the escape of a wildfire are concerns for protecting critical habitat for this species.

b. Prescribed burning

Environmental impacts of the prescribed fire program are discussed in previous sections of this Fire Management Plan. The Complex covers a thirteen county area that contains numerous small towns and communities. The main industry in the area is agriculture or agriculture related.

The overall social and economic environment can be affected by how uplands on the Complex are managed. The affect is usually local, however, when all Complex land units are combined, the affect is more widespread. Habitat management is often accomplished by authorizing local farmers to hay or graze on Complex lands. This is viewed as positive both socially and economically. Local farmers and ranchers prefer to hay or graze lands on the Complex rather than seeing them burn.

The majority of neighbors accept the fact that the federal government owns land for waterfowl production, and most have a general appreciation for the value of wildlife. However, these neighbors expect the land to be managed for wildlife and not left idle for more than 5 years. Land which is left idle generally has a lower habitat quality than managed land leading to negative responses by the public. Public responses are generally positive when the land is managed and objectives are met. Prescribed fire is one of the tools necessary to accomplish the goals of the Complex.

Escaped prescribed fires pose a threat to adjacent life and property, but, with proper planning and prescriptions, qualified personnel, and contingency planning this threat can be minimized. Temporary air quality impacts from smoke can also be minimized with proper planning.

XII. ADDITIONAL OPERATIONAL ELEMENTS

A. Public Safety

Firefighter and public safety will always take precedence over property and resource protection during any fire management activity. Firefighter safety is covered in section IX. A. This section will deal with public safety.

Fire fronts in grass fuels are fast moving and dangerous. However, due to the small size of most Complex units, entrapment is not a big threat to sportsman or visitors who may be in the area. Neighbors who initiate their own suppression actions lack proper training, equipment, and communications and may be at risk. The Complex staff will attempt to keep the fire scene (wildfire and prescribed fire) clear of people except for FWS firefighters and cooperating volunteer fire departments. Burn areas are usually closed to the public during prescribed fires.

Smoke from a wildfire or prescribed burns could impair visibility on roads and become a hazard. During wildfires, the IC is responsible for managing traffic hazards from smoke. Smoke from prescribed fires is part of the burn prescription and is the responsibility of the burn boss. Actions to manage smoke include: use of road guards and pilot car, signing, altering ignition techniques and sequence, halting ignition, requesting local law enforcement to manage traffic, and suppressing the fire.

Wildfires which might escape from FWS lands and spread to inhabited private property are also a concern. The IC is responsible for contacting the local law enforcement so that they may warn or evacuate the public from potentially dangerous wildfires. Additionally, the Complex will continue where practical to use prescribed fire to manage hazard fuels in high risk areas.

B. Public Information and Education

Informing the public is an important part of fire suppression, fire prevention, prescribed fire, and the FWS mission. During wildfires, the IC is responsible for providing fire information to the press and the public. The IC may delegate this task as needed.

Informing the public is a vital element of the prescribed fire program. The following actions will be used to promote the prescribed fire program to the public:

- # Press releases.
- # Attendance at local volunteer fire department meetings.
- # Including the prescribed fire message in Complex interpretive publications and materials.
- # Personal contact with bystanders during prescribed burns.
- # Following prescribed burn plans and preventing escaped fires.
- # Develop a quantitative fire effects monitoring program and sharing results with the public.

C. Fire Critiques and Plan Review

1. Fire Plan Review

The Fire Management Plan will be reviewed annually (no later than November 30) to ensure the fire program advances and evolves with the FWS and the Complex's mission.

2. Wildfire Critique and Review

Wildfires will be critiqued by the IC and documented on the DI-1202. The Zone FMO or Regional Fire Management Coordinator (FMC) or his designee will conduct formal fire critiques in the event of:

- # Significant injury/accident/fatality.
- # Significant property or resource damage occurs.
- # Significant safety concerns are raised.
- # If an extended attack is necessary.

3. Prescribed Fire

Prescribed fires will be critiqued by the burn boss and documented in the burn plan and on a DI-1202. The Zone FMO or Regional FMC will conduct a formal critique in the event of:

- # Significant injury/accident/fatality.
- # If an escape prescribed fire occurs.
- # Significant safety concerns are voiced.
- # Smoke management problems occur.

4. Records and Reports

The Incident Commander (IC) on a wildfire or the burn boss on a prescribed burn will be responsible for the completion of a DI-1202 fire report as well as crew time reports for all personnel assigned to an incident. The IC or burn boss should include a list of all expenses and/or items lost on the fire and a list of personnel assignments on the DI-1202. The timekeeper will be informed of all time and premium pay to be charged to the fire.

Individual prescribed burn plans will be the primary document used to record prescribed fire information. Burn plans document State air quality requirements, personnel, costs, fire behavior, weather, and burn critique information. All appropriate forms and information will be submitted to the Zone FMO within 10 days of the fire being declared out.

XIII. AIR QUALITY/ SMOKE MANAGEMENT

The management of smoke is incorporated into the planning of prescribed fires, and to the extent possible, in suppression of wildfires. Sensitive areas are identified and precautions are taken to safeguard visitors and local residents. Smoke dispersal is a consideration in determining whether or not a prescribed burn is within prescription. Generally the fine grass fuels and small burn size (80-600 acres) generate low volumes of smoke for short duration (4-5 hours).

The Lake Andes National Wildlife Refuge Complex fire management activities which result in the discharge of pollutants (smoke, carbon monoxide, particulate, and other pollutants from fires) are subject to and must comply with all applicable Federal, State, and local air pollution control requirements as specified by Section 118 of the Clean Air Act, as amended 1990.

Smoke from wildfires and prescribed fires is a recognized health concern for firefighters. Prescribed burn bosses and wildfire incident commanders must plan to minimize exposure to heavy smoke to 1 hour or less, at which time the employee should be rotated to a smoke free area (USDA Forest Service, Missoula Technology and Development Center). The use of respirators is not recommended.

XIV. FIRE RESEARCH AND MONITORING

The Complex will continue to encourage fire related research projects on FWS lands where research operations will not conflict with unit management objectives. At present red cedar trees are encroaching Complex land. Research on how fire can be used as a tool to impede the invasion of cedar growth on Complex units is needed. Fire monitoring is discussed in previous sections of this plan, see Section X. D.

XV. CONSULTATION AND COORDINATION

All fire management program activities will be implemented in cooperation and coordination with the State of South Dakota, South Dakota Department of Environmental Health, and rural fire protection districts. Other agencies and organizations will be consulted with as needed.

General program consultation and coordination will be sought from the South Dakota Refuges FMO, the Regional Fire Management Coordinator, Regional Prescribed Fire Specialist, and the National Interagency Fire Center (NIFC).

The following were consulted in the development of this plan: Carl Douhan, Prescribed Fire Specialist; Brian McManus, ND/SD Zone FMO; staff at the Lake Andes Complex.

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