

WPF 165

1. Title of Project: Watershed Improvement to Restore Riparian and Aquatic Habitat on the Muleshoe Ranch CMA

2. Type of Project: Water Acquisition 3. Stream type:  Perennial 4. Date submitted 7-30-97

5. Date received by ADWR \_\_\_\_\_

6. Applicant Name The Nature Conservancy

Capital Project or other Intermittent

Water Conservation Ephemeral

Research

7. Applicant address (city, county, zip code)

300 East University #230  
Tucson, Az 85705

8. Inside AMA

Phoenix  
 Tucson  
 Prescott  
 Pinal  
 Santa Cruz



9. Contact person/title: Ed Brunson, Preserve Manager or Dave Gori, Stewardship Ecologist

Phone number: 520-622-3861

Fax number: 520-620-1799

10. Type of application:  
New  Continuation ( )

11. Project start date: 2-1-97  
End date: 12-31-2000

12. Other monies obtained and secured:	Grant type	Amount
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
<b>Total</b>	_____	_____

13. Estimated funding:  
a. AWPF 126,315  
b. Applicant 92,048  
c. Other \_\_\_\_\_  
d. Total 218,363

14. Tax ID number: PII

15. The undersigned hereby offers and agrees to perform in compliance with all terms, conditions, specifications and scope in the application. Signature certifies understanding and compliance with the attached application. Signature certifies that all information provided by the applicant within this application is true and accurate. The Arizona Water Protection Fund Commission may approve grant award agreements with modifications to scope items, methodology, schedule, final products, and/or budget.

Ed Brunson for TNC  
Typed Name of Authorized Representative

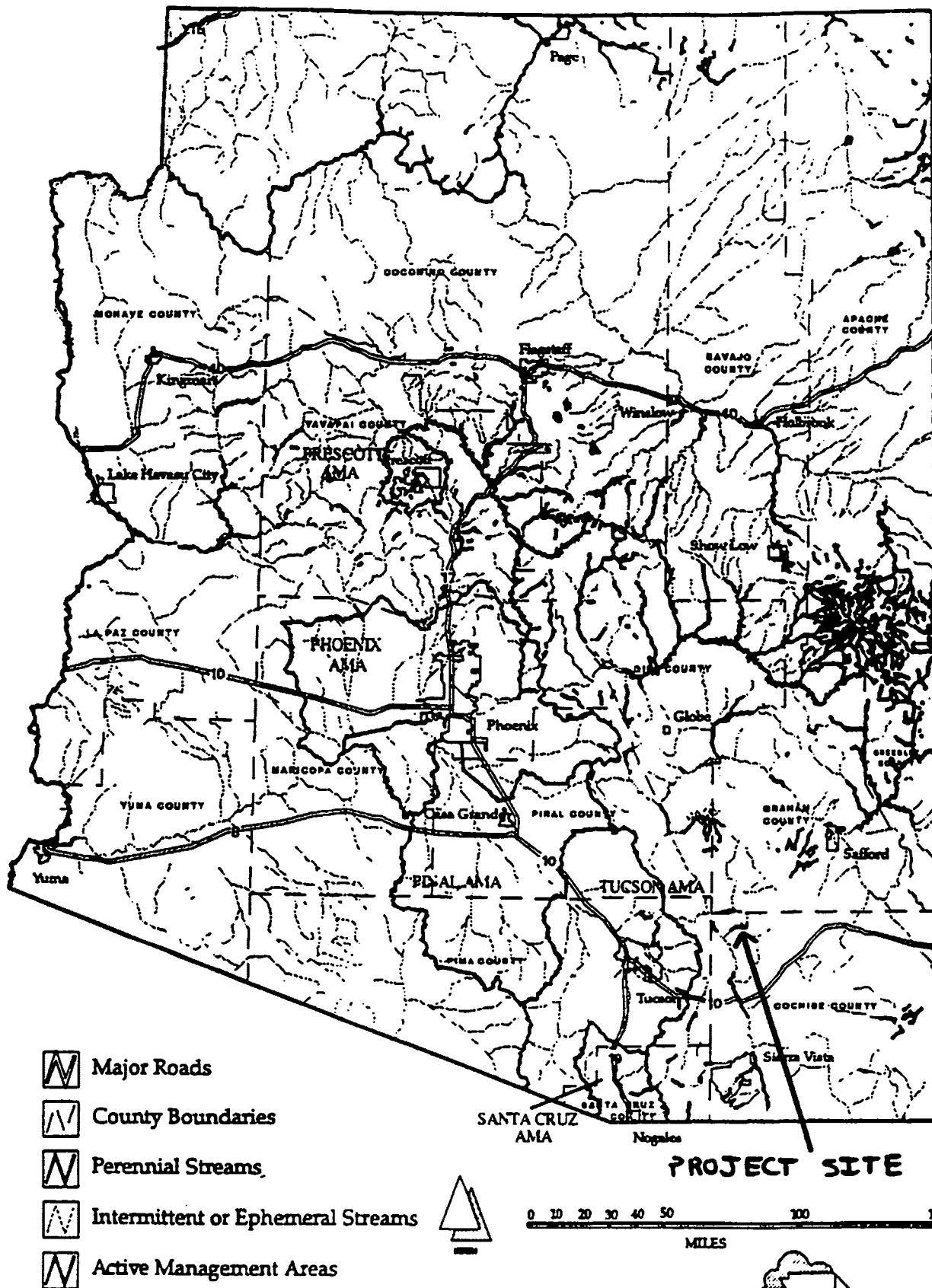
[Signature]  
Signature

Preserve Manager 520-622-3861  
Title and Telephone No.

7/30/97  
Date Signed

# Arizona Map Instructions

Indicate on the map the approximate location of your project. Ensure that your markings are clearly visible on all five copies submitted.



PROJECT NAME:

Watershed Improvement to Restore Riparian  
And Aquatic Habitat on the Muleshoe Ranch CM



## **Summary:**

The goal of this project is to restore riparian and aquatic habitat in 4 perennial streams on the Muleshoe Ranch Cooperative Management Area (CMA) by restoring watershed vegetation and function. These 4 streams occur in the Hot Springs watershed and include Hot Springs, Bass, Double R and Wildcat creeks. All support mixed broadleaf riparian forest and assemblages of 2-5 native fish species, which are State threatened. Gila chub, a fish that is now quite rare, occurs in Bass and Hot Springs. All or most of the watersheds for these 4 perennial streams are contained within the CMA boundary. The CMA is owned and managed by The Nature Conservancy, U.S. Bureau of Land Management and U.S. Forest Service.

Despite their high ecological value, these 4 perennial streams persist in a degraded condition. Frequent, intense floods continually remove mature trees and streambank vegetation and limit the recruitment of tree seedlings. This has resulted in a reduced density of riparian trees and understory vegetation, streambank erosion, and a reduced age-class diversity of riparian trees. In addition, these floods have eroded mature floodplain terraces, without replacing them with new ones, which has decreased floodplain aquifer storage and stream baseflows. Finally, aquatic habitat has been reduced in extent and in complexity, reducing the size of native fish populations, especially those that rely on pool habitats like Gila chub.

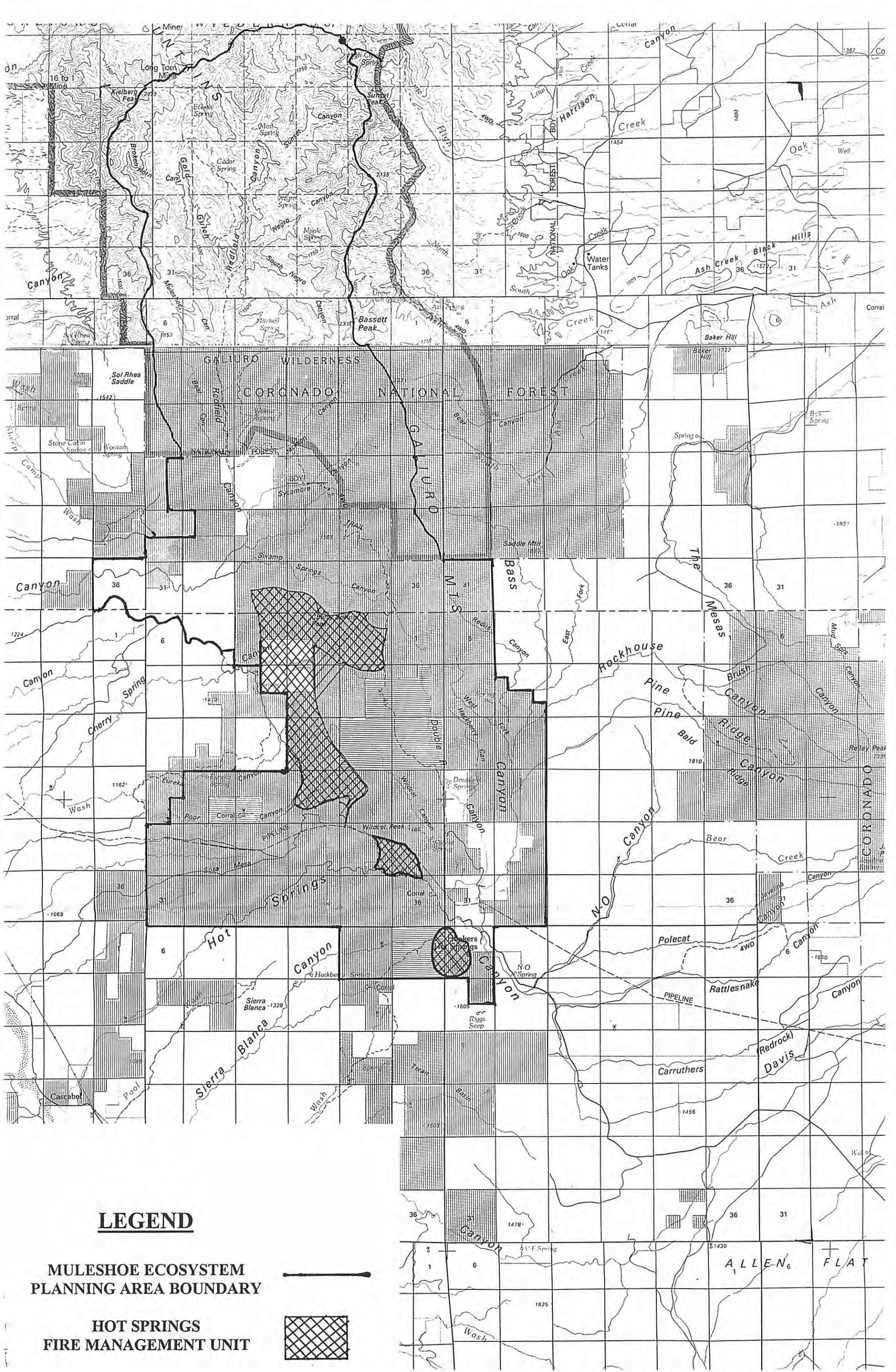
A primary goal of the Ecosystem Management Plan (EMP) for the Muleshoe is to restore and enhance riparian and aquatic habitat in Hot Springs, Bass, Double R and Wildcat creeks. The EMP's strategy for doing this is to improve watershed condition by increasing the abundance and cover of perennial grasses and reducing shrubs. This will be accomplished by (1) restoring fire as a natural process to the Hot Spring's watershed using prescribed burns; and (2) continued grazing rest until vegetation recovery occurs. In addition, the EMP recommend that signs be posted to discourage off-road vehicle (ORV) access into lower Hot Springs Creek. We are requesting funds in this proposal to implement these management actions. We will conduct the prescribed burns in a significant portion of the watersheds with the goal of burning approximately 2,200 acres each year during the funded project period. We are also requesting funds to construct 3 miles of perimeter fencing at the SE corner of the CMA. This fence will prevent livestock from a neighboring ranch from accessing Bass Creek and its watershed on the CMA, thereby facilitating watershed and riparian recovery. Finally we are requesting funds to purchase signs that would discourage ORV access in lower Hot Springs Creek.

Several lines of evidence indicate that wildfires were frequent in semi-desert grasslands prior to 1870's. However, over the last century, overgrazing by livestock which reduce the fine fuels needed to carry fire, have greatly reduced the frequency and extent of these wildfires with the result that semi-desert grassland watersheds have been invaded by shrubs like mesquite, acacia, burroweed and snakeweed. Overgrazing by cattle has caused additional changes since grasses differ in their palatability, susceptibility, and tolerance to grazing. These vegetation changes have had profound effects on watershed hydrological processes and stream hydrology. In particular, runoff and soil erosion following rainfall events have increased, increasing the frequency and intensity of floods while soil infiltration has decreased, decreasing aquifer recharge and stream baseflows. These alterations in stream hydrology, in turn, have had significant (and negative) impacts on riparian and aquatic habitat as described above.

When the Conservancy purchased the Muleshoe Ranch in 1982, upland vegetation (i.e. semi-desert grassland) was in extremely poor condition due to overgrazing by livestock and the lack of wildfires: shrubs dominated, perennial grasses were rare, litter and live vegetation cover was low and soil loss through erosion was extensive. Since then, temporary grazing rest has increased perennial grass cover to some extent but there has been no decline in the density of shrubs. Several studies have shown that wildfires or prescribed burns reduce shrub density and encourage their replacement by perennial grasses.

We have already observed these results in some of our burn units on the Muleshoe. Since 1990, we have conducted 1 or more prescribed burns each year with the exception of 1994 and have been monitoring their effects; these burns range from 20 to 300 acres in size. In 1995, we conducted our first large scale burn of 2,300 acres in the Wildcat watershed in cooperation with BLM. Thus, we have experience planning for, safely implementing, and monitoring the effects of large-scale burns.

We expect that the improvement in watershed condition and function resulting from the proposed prescribed burns and completion of the perimeter fence, will (1) decrease the frequency and intensity of scouring floods; (2) reduce soil loss from the uplands; (3) increase the extent and amount of baseflow; (4) increase the quality and diversity of aquatic habitats, especially the frequency of pools which will benefit native fish; and (5) increase the density of riparian trees and recruitment of younger age classes. The benefits from this project will be long-term, but can be documented because the monitoring program will be continued for at least 10 years after the funded project period.

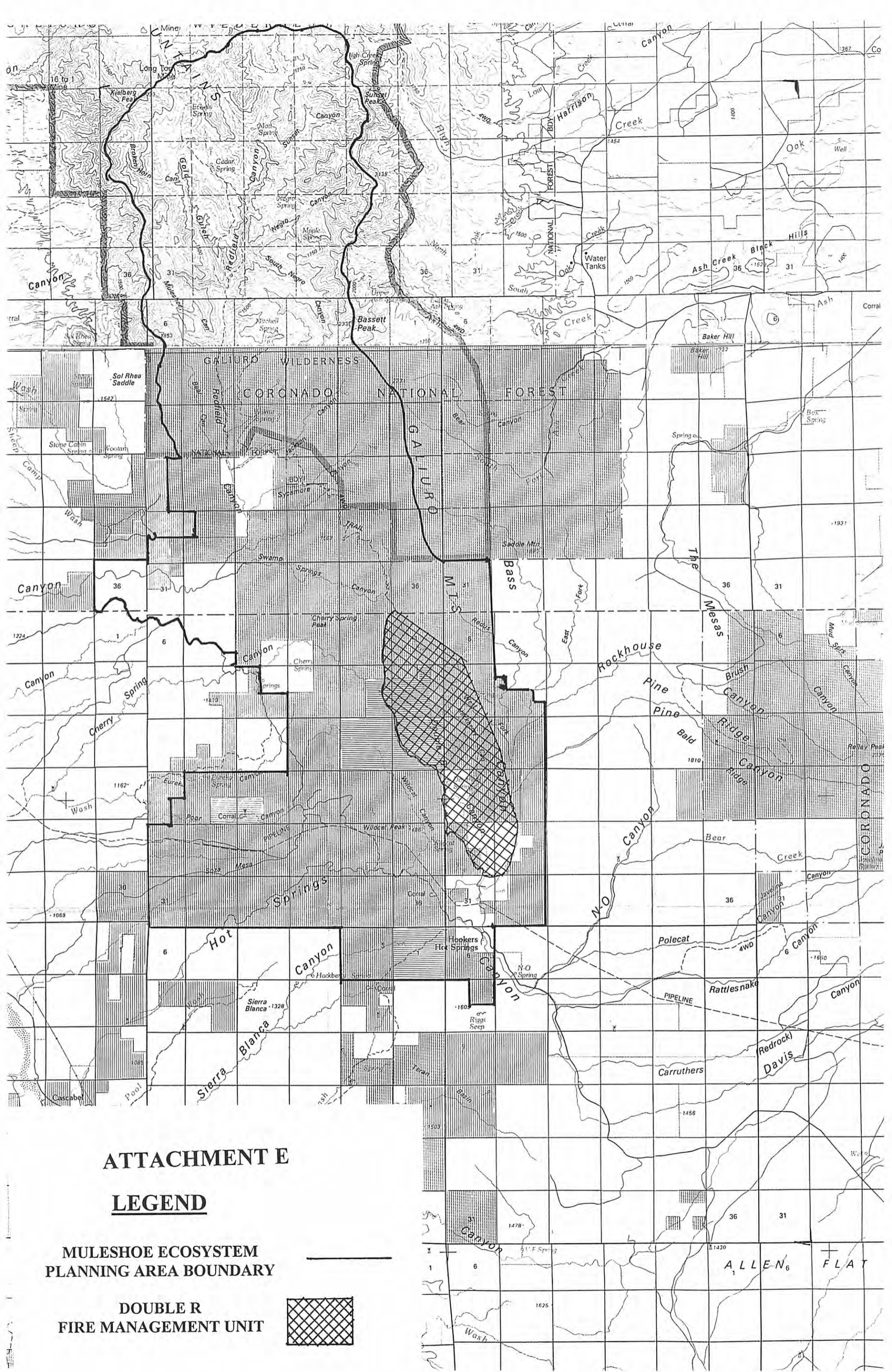


**LEGEND**

MULESHOE ECOSYSTEM  
PLANNING AREA BOUNDARY

HOT SPRINGS  
FIRE MANAGEMENT UNIT



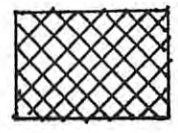


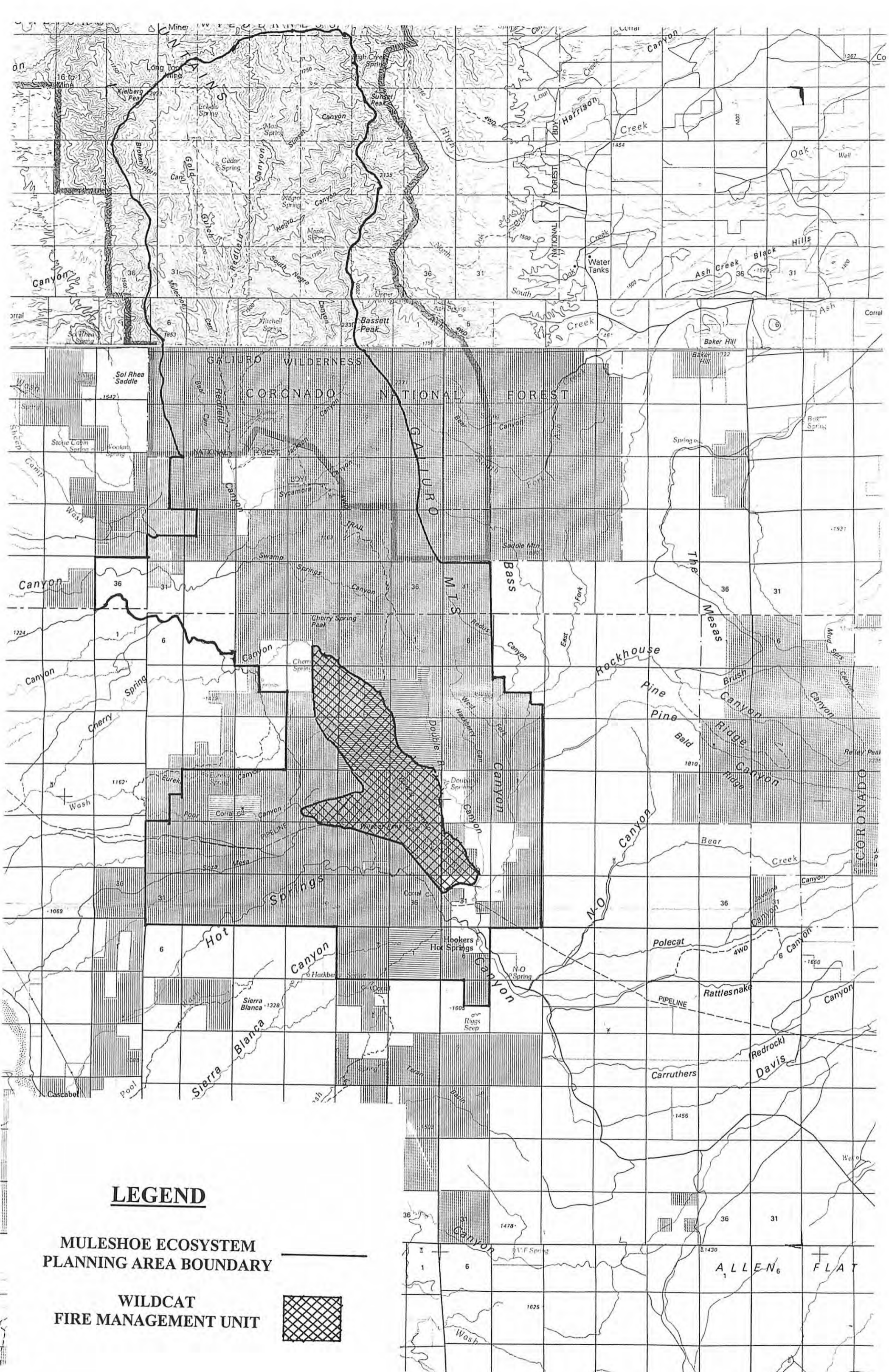
# ATTACHMENT E

## LEGEND

MULESHOE ECOSYSTEM  
PLANNING AREA BOUNDARY

DOUBLE R  
FIRE MANAGEMENT UNIT

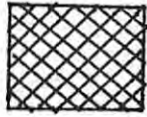




**LEGEND**

MULESHOE ECOSYSTEM  
PLANNING AREA BOUNDARY

WILDCAT  
FIRE MANAGEMENT UNIT



**LOCATION INFORMATION SHEET/LAND OWNERSHIP FORM**

1. County: Cochise 2. Section: multiple 3. Township: 12S

4. Range: 20 & 21E 5. Stream Name: Hot Springs

6. Landownership of project area: U.S. Dept. of Interior, (BLM) & The Nature Conservancy

7. Current land use of project area: Cooperatively managed federal and private land which includes riparian areas that are important fish and wildlife habitat and associated semi desert grasslands that have historically been grazed by livestock and are currently being rested

8. Length of stream through project area: six miles

9. Size of project area (in acres): 22,000

10. Is the project area fully defined at this time: Y/N? yes

11. Provide directions to the project site from the nearest town. List any special access requirements. Twenty eight miles northwest of Willcox, Arizona. Exit Willcox on Airport Road and after 15 miles, take the right fork at junction. Go to the end of the road, which terminates at the CMA headquarters.

12. If you own the land on which the project is located, attach a copy of the appropriate legal document showing title in the name of the applicant, and including a legal description of the property.  
See attachment A.

If you manage the land on which the project is located, attach a copy of the lease, special use permit, intergovernmental agreement or other appropriate official instrument.

There is a Cooperate Management Agreement between BLM, TNC and the USFS for the Muleshoe CMA. This project will take place on the portion of the CMA owned by TNC or managed by BLM.  
See attachment B.

### **Statement of problem/s:**

Overgrazing by livestock and a reduced frequency of wildfires have led to a general decline in watershed condition and changes in the structure and composition of watershed (semi-desert grassland) vegetation on the Muleshoe Ranch Cooperative Management Area (CMA). These changes have had profound effects on watershed hydrological processes and stream hydrology, decreasing baseflows, increasing the frequency and intensity of floods, and reducing water quality. These alterations in stream hydrology, in turn, have negatively impacted riparian and aquatic habitats in 4 perennial streams on the Muleshoe CMA. These streams are Hot Springs, Bass, Double R and Wildcat creeks. In particular, (1) frequent, intense floods continually remove mature trees and streambank vegetation and limit recruitment of woody seedlings; this has resulted in a reduced density of riparian trees and understory vegetation, unprotected streambanks, and a reduced age-class diversity of riparian trees; (2) these floods have eroded mature floodplain terraces without replacing them with new ones which has decreased floodplain aquifer storage and baseflows; and (3) aquatic habitat has been reduced in extent and in complexity, reducing the size of native fish populations, especially those species that rely on pool habitats. Despite their degraded condition, these 4 perennial streams still support significant ecological values, including mixed broadleaf deciduous riparian forest, several rare and sensitive plant species, and assemblages of 2-5 native fish species, all of which are State threatened. Gila chub, a fish that is declining throughout its range and is now quite rare, occurs in 3 of the 4 streams. A primary goal of the draft Ecosystem Management Plan (EMP) for the Muleshoe is to enhance and restore riparian and aquatic habitat in these 4 perennial streams for native fish and other wildlife. The EMP articulates a number of measurable resource objectives and management actions for achieving this goal.

### **Statement of cause/s of the problem/s:**

A number of studies indicate that prior to 1870, semi-desert grasslands in southeastern Arizona were maintained as shrub-free grasslands by frequent and extensive wildfires. However, over the last century, intense livestock grazing, which reduces the fine fuels needed to carry fire, and active fire suppression have greatly reduced the frequency and extent of these wildfires. As a result, semi-desert grassland watersheds have been invaded and are now dominated by a number of shrubs species which compete with native grasses for water and nutrients; these shrubs include mesquite, burroweed, snakeweed, creosote, juniper and acacia. Overgrazing by livestock has caused additional compositional changes since grass and forb species differ in their palatability, susceptibility, and tolerance to grazing. The combined effect of the lack of wildfires and overgrazing on watershed vegetation and condition has been: (1) soil loss through erosion; (2) a reduction in total vegetative cover; (3) a decrease in the density and cover of perennial grasses, especially mid- to tall-stature bunchgrasses; and (4) an increase in the density and cover of annual grasses and shrubs. These structural and compositional changes are evident in watersheds on the Muleshoe CMA, as they are in most semi-desert grasslands/shrub steppes in the Southwest. These vegetation changes have had profound effects on watershed hydrological processes, increasing runoff and soil erosion following rainfall events and decreasing soil infiltration. These altered watershed processes, in turn, have had significant (and negative) impacts on stream hydrology, water quality, riparian vegetation and native fish, as described above. Off-road vehicle (ORV) use has also contributed to these problems by disrupting vegetation establishment on low terraces near the channel, eroding streambanks, and disrupting aquatic habitat.

### **Statement of remedies or solutions:**

Improving watershed condition is a critical step to restoring and enhancing riparian vegetation and aquatic habitat in Bass, Hot Springs, Double R and Wildcat creeks. To achieve these goals, the draft Ecosystem Management Plan calls for the restoration of fire as a natural process to the watershed through the use of prescribed burns and continued grazing rest to enhance vegetation recovery. The plan also identifies a need to construct a short segment of perimeter fence that would prevent trespass livestock from entering Bass Creek and its watershed, thereby facilitating watershed and riparian recovery. Finally, the EMP recommends that signs be posted to discourage ORV access into lower Hot Springs Creek. In this proposal, we are requesting funds to implement all of these management actions. Numerous studies and our own monitoring data indicate that prescribed burns, coupled with grazing rest, decrease the cover and density of shrubs and increase the abundance and cover of perennial grasses. As described above, these vegetative changes have been shown to (1) decrease runoff and soil erosion from the watershed (i.e., reducing the frequency and intensity of floods, improving aquatic habitat for native fish, and improving water quality); and (2) increase soil infiltration (i.e., potentially increasing baseflows). Thus, by restoring watershed vegetation through prescribed burning and continued grazing rest (which is facilitated by additional fence construction), we will restore watershed hydrological processes and stream hydrology which, in turn, will enhance and restore aquatic and riparian habitat for native fish and other wildlife.

A similar approach to vegetation management is being employed by the Malpai Borderlands Group, a group of ranchers that live and work in the Arizona-New Mexico border region. Since 1995, the Group has been cooperating with U.S. Forest Service and The Nature Conservancy to conduct large-scale burns in semidesert grassland watersheds in the Peloncillos Mountains with the goal of improving range condition. Preliminary monitoring results suggest that the prescribed burns are reducing shrubs and increasing perennial grasses.



## Introductory Information:

The Muleshoe Ranch Cooperative Management Area (CMA) is owned and managed by The Nature Conservancy, U.S. Bureau of Land Management (BLM), and U.S. Forest Service. There are 7 perennial streams on the CMA, 4 of these streams are in the Hot Springs watershed; they include Hot Springs, Bass, Double R and Wildcat creeks. These streams support mixed broadleaf deciduous riparian forest and assemblages of 2-5 native fish species, which is noteworthy in the Southwest. Gila chub, a fish that is declining throughout its range and is now quite rare, occurs in Bass and Hot Springs. All or most of the watersheds for these 4 perennial streams are contained within the CMA boundary; the dominant watershed vegetation type is semidesert grassland.

Despite their high ecological value, these 4 perennial streams persist in a degraded condition. Frequent, intense floods continually remove mature trees and streambank vegetation and limit recruitment of woody seedlings; this has resulted in a reduced density of riparian trees and understory vegetation, unprotected streambanks, and a reduced age-class diversity of riparian trees compared to better condition reference sites. In addition, these floods have eroded mature floodplain terraces without replacing them with new ones, which has decreased floodplain aquifer storage and baseflows. Finally, aquatic habitat has been reduced in extent and in complexity, reducing the size of native fish populations, especially those that rely on pool habitats like Gila chub.

The Bureau of Land Management has recently completed an Ecosystem Management Plan (EMP) for the Muleshoe Ranch CMA. One of the primary goals of this plan is to restore and enhance riparian and aquatic habitat in Hot Springs, Bass, Double R and Wildcat creeks. The plan articulates measurable resource objectives for these habitats, proposes management actions for achieving them, and outlines a monitoring program for determining when these resource objectives have been met.

Because of the relationships between watershed vegetation, watershed hydrological processes, stream hydrology and riparian and aquatic habitats, the EMP's approach to restoring riparian and aquatic habitat is to improve watershed condition, i.e., restore the structure and composition of watershed vegetation. This will be accomplished primarily by two management actions: (1) reintroducing fire as a natural process to the Hot Springs watershed using prescribed burns; and (2) continued grazing rest until vegetation recovery occurs. The plan also identifies a need to construct a short segment of boundary fence that would prevent trespass livestock from entering Bass Creek and its watershed. Finally, the EMP recommends that signs be posted to discourage off-road vehicle (ORV) access into lower Hot Springs Creek.

The project area includes most of the greater Hot Springs watershed. Approximately 22,000 acres of land and over six miles of perennial stream are included in this area.

In this proposal, we are requesting funds to implement these management actions. We will conduct prescribed burns in significant portions of Hot Springs, Bass, Double R and Wildcat watersheds with the goal of burning approximately 2,200 acres each year during the funded project period. These prescribed burns will be conducted in 3 units: the Double R, Hot Springs, and Wildcat burn units. Prior to conducting these burns, we will develop site fire plans for each of these units.

We recognize that the use of fire as a management tool is a highly weather dependent proposition. While the goal is to burn relatively equal acreage each year, the units have been planned so that maximum flexibility is retained. If necessary, adjustments will be made to the burn schedule to burn during the optimum period. Safety first is and will be the rule, and the burn schedule will be modified if burns cannot be conducted in a safe manner.

We are also requesting funds to construct 3 miles of perimeter fencing at the SE corner of the Muleshoe Ranch CMA. This fence will prevent livestock from a neighboring ranch from obtaining access to Bass Creek and its watershed on the CMA, thereby facilitating watershed and riparian recovery. Currently, the number of trespass livestock is low due to the vigilance and cooperation of our neighbor. However, construction of this segment of fence will complete perimeter fencing of the entire CMA and will ensure that grazing rest is maintained until watershed and riparian areas have recovered. Finally, we are requesting funds to purchase signs that would discourage (better yet, prohibit) ORV access in lower Hot Springs Creek; these signs will be posted adjacent to historic access points along the CMA boundary. Currently, ORV use in this lower segment of Hot Springs is low, nevertheless, it is disrupting vegetation establishment on low terraces near the channel, eroding streambanks, and disrupting aquatic habitat.

Since the 1870's, semidesert grassland watersheds have undergone significant changes in vegetation composition and structure throughout the Southwest. These changes are also evident on the Muleshoe and include (1) a decrease in perennial grasses and total vegetative cover; and (2) an increase in annual grasses and woody shrubs including mesquite, burroweed, turpentine bush, acacia, and snakeweed (Humphrey and Mehrhoff 1958, Humphrey 1963, Buffington and Herbel 1964, Bahre and Bradbury 1978). Most scientists agree that these changes are due primarily to overgrazing by livestock and a decreased frequency of wildfires (see Bahre 1991 for review). Overgrazing by cattle reduces the vigor of perennial grasses, increasing their susceptibility to mortality during drought periods (Blydenstein 1966); reduces soil fertility (Archer et al. 1988); and reduces the capacity of grasses to outcompete woody shrubs (Archer and Smeins 1991). All of these factors favor the establishment and growth of woody shrubs over perennial grasses. In addition, fire was a frequent occurrence in semidesert grasslands prior to 1870 (Humphrey 1958, Bahre 1985, Davis 1994). A decrease in fine-fuels caused

by livestock grazing and fire suppression efforts have combined to limit the frequency of fires, permitting shrubs to invade grasslands by reducing mortality on seedlings and young plants (e.g., Cable 1967, Wright 1974, Wright and Bailey 1982, Archer and Smeins 1991).

More subtle changes in plant composition have also occurred due to overgrazing. Perennial grasses are not uniformly palatable or susceptible to livestock which alters competitive interactions between individual grass species. The result has been a shift in species composition away from the most palatable or susceptible species (Hazel 1967; Heitschmidt 1990; Briske 1991; Stuth 1991); in general, low growing, rhizomatous species have increased while medium- to tall-stature bunch grasses have decreased.

The vegetation change in semidesert grasslands in general, and on the Muleshoe Ranch in particular, has had profound influences on watershed processes and stream hydrology. In general, decreases in herbaceous vegetation are associated with increased surface runoff, decreased soil infiltration, decreased soil moisture capacity and increased evapotranspiration (Horton 1937, USDA 1940, Thurow 1991). Studies have linked heavy grazing, which results in reduced vegetation cover, with increased runoff and sediment yields (Lusby 1970) and reduced infiltration rates (Ponce 1989, Thurow 1991). In a semidesert grassland in Arizona, Woolhiser et al. (1990) compared two micro-watersheds, with and without woody vegetation, and found that the shrub to grass conversion decreased runoff and increased infiltration. Similar results were obtained by Simanton et al. (1977) in a similar habitat.

Positive impacts on stream baseflow and riparian vegetation resulting from conversion of shrubland to grassland have also been documented (Lewis 1968; Bosch and Hewlett 1982; Johnson and Carothers 1982; Davis 1984; Debanco et al. 1984; Stabler 1985; Debanco and Schmidt 1990). Bosch and Hewlett (1982) reviewed 94 catchment experiments in a wide range of plant communities and concluded that there is overwhelming evidence that reduction of woody vegetation increases annual streamflow. While these studies were conducted on chaparral, woodland and forested plant communities, similar, but less direct results have been observed in semidesert grasslands (Woolhiser et al. 1990). In a study conducted in a semidesert grassland in New Mexico, a strong positive relationship was shown between vegetation cover and infiltration; grass cover was the dominant factor in increasing infiltration while shrubs and litter were non-significant (Willcox et al. 1988).

Thus, the evidence is clear that vegetation change in semidesert grassland watersheds has increased runoff and sediment yields resulting in more frequent, intense floods in riparian areas and declining water quality. These, in turn, have altered the recruitment and survivorship of riparian plants (Stromberg et al. 1991, Stromberg 1993b); the dynamics of macroinvertebrate populations (Meecham and Platts 1979, Fisher et al. 1982, Armour et al. 1991); and the availability and quality of aquatic habitats for native fish (Heede and Rinne 1990).

The evidence is less clear, however, that vegetation changes in semidesert grassland watersheds have reduced stream baseflows. The relationship between soil infiltration and aquifer recharge is not well documented in semidesert habitats and there is little evidence that diffuse recharge (i.e., infiltration over extensive areas that eventually reaches the water table) commonly occurs. There are a number of potential reasons for this including the common occurrence of near-surface caliche layers and high evapotranspiration rates which limit the downward penetration of soil moisture (Stephens and Knowlton 1986, Cable 1980). However, in a semidesert grassland with sandy soils and sparse woody vegetation, diffuse recharge of the water table has been measured (Stephens and Knowlton 1986). Additional studies in semidesert habitats are needed to document vegetation effects on stream baseflows. If shrub to grass conversion can enhance baseflows, native fish would benefit since the abundances of all but one species, longfin dace, are positively related to the amount of baseflow (Hardy 1990). Riparian vegetation would also benefit since canopy height, leaf area index, riparian width, and plant species diversity are all positively correlated with median annual streamflow (Stromberg 1993a). Although the relationship between increased soil infiltration in the watershed and stream baseflows is unclear, frequent floods that erode terraces without replacing them reduce the water storage capacity of the floodplain aquifer which, in turn, reduces baseflows (Jackson et al. 1987).

When The Conservancy purchased the Muleshoe Ranch in 1982, upland vegetation (i.e., range condition) was in extremely poor condition due to overgrazing by livestock and the lack of wildfires: shrubs dominated, perennial grasses were rare, and litter and live basal cover was low. At this time, the BLM temporarily retired livestock grazing to allow the watershed to recover. Since then, perennial grass cover has increased to some extent but there has been no apparent decline in the density of shrubs. This observation is consistent with a number of studies that show increases in perennial grasses and woody shrubs following exclusion of cattle (Brown 1950, Glendening 1952, Hennessey et al. 1983). In contrast, natural fire or prescribed burns have been shown to reduce shrub densities and encourage their replacement by perennial and/or annual grasses (e.g., Bock et al. 1976, Wagle 1981).

We have already observed these results in some of our burn units on the Muleshoe (D. Gori, unpubl. data). In 1990, we initiated a prescribed burn program on the CMA and established permanent plots in units that were subsequently burned vs. not burned to monitor vegetation response. Since then, one or more prescribed burns, ranging from 20 to 300 acres in size, have been conducted each year with the exception of 1994. In 1995, we conducted our first large-scale burn of 2,300 acres in the Wildcat watershed in cooperation with the BLM; the burn resulted in a mosaic of burned and unburned areas which is characteristic of natural wildfires in semi-desert grassland. Thus, we (TNC and BLM) have experience planning for, safely implementing, and monitoring the effects of large-scale burns.

The draft Muleshoe EMP articulates quantitative objectives for watershed vegetation but, in general terms, the objective is to increase the abundance and cover of perennial grasses, especially mid- to tall-stature species, and reduce shrubs. As described above, this will be accomplished by restoring fire as a natural process to the Bass, Double R, Wildcat and Hot Springs watershed using prescribed burns and

continuing to rest the watershed from livestock grazing. We expect that the improvement in watershed condition and function from these 2 management actions, including completion of the perimeter fence, will (1) decrease the frequency and intensity of scouring floods; (2) reduce soil loss (sediment yields) from the uplands; (3) increase the extent and amount of baseflow; (4) increase the quality and diversity of aquatic habitats, especially the frequency of pools, undercut banks and woody debris cover which will benefit fish like the Gila chub; and (5) increase the density of riparian trees and recruitment of younger size classes (i.e., saplings).

The benefits from this project will be long-term. These benefits, however, can be documented because the monitoring program and associated equipment maintenance will be continued for at least 10 years. After this period, we will evaluate our results and continue monitoring as needed. Baseline (pre-burn) monitoring of watershed vegetation, riparian vegetation, streamflows, native fish populations, and aquatic habitat is already in place; post-burn monitoring will be initiated following the prescribed burns.

We are proposing to expand our monitoring program to evaluate the short-term effect of prescribed burning on native fish and aquatic habitat. Burning can affect the physical and biological aspects of fish habitat and the abundance and composition of fishes in drainage burned (Meehan 1991). Over the long-term, prescribed burning should have beneficial effects on aquatic habitat and fish populations. However, in the short term, potential adverse effects could result from off-site effluent emanating from the prescribed burned area including: (1) increased nutrient discharge (nitrates, nitrites, phosphorus, etc.) which could result in stress or mortality of fish; and (2) increased sediment deposition and scouring of the main channel resulting from increased flows. Most of the information on adverse effects of burning is anecdotal and involves wildfires instead of prescribed burns. The potential negative impacts of burning, however, have created a conflict for resource managers concerned with watershed restoration and protection of listed or sensitive fish species. Monitoring results from this project will provide information on the short-term response of fish populations to burns and may be useful in resolving this conflict.

#### REFERENCES (For above and elsewhere)

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## **SCOPE OF WORK AND OBJECTIVES**

### **Objective #1:**

Conduct prescribed burns to improve watershed condition; change the composition and structure of watershed vegetation by increasing the frequency and cover of perennial grasses, especially mid- to tall-statured species and by decreasing the cover of shrubs.

**Benefits:** Improved watershed conditions should result in decreased frequency and intensity of floods, increased baseflows, improved water quality through reduced sediment yields, improved aquatic habitat for native fish particularly an increase in pool habitat, improved riparian vegetation development.

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### **Objective #2:**

Construct additional perimeter fencing to exclude trespass livestock from Bass Creek and its watershed.

### **Benefits:**

Better control and management of livestock will improve watershed conditions, enhance recruitment of riparian trees, increase the density and cover of riparian vegetation, reduce erosion and increase aquifer recharge during floods.

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### **Objective #3:**

Continue and expand ongoing monitoring program for watershed vegetation, riparian vegetation, streamflow, floodplain geomorphology, native fish and aquatic habitat.

### **Benefits:**

The monitoring program will provide pre- and post-burn information on the composition and structure of watershed vegetation, quality of aquatic habitat and size of native fish populations, streamflows, and condition of riparian forest vegetation. The monitoring program will be critical in determining how quickly watershed and riparian vegetation, native fish, aquatic habitat and stream hydrology are responding to prescribed burns and improved livestock management and when the resource objectives articulated in the draft Ecosystem Management Plan have been achieved.

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### **Objective #4:**

Post signs at the downstream boundary of Muleshoe CMA in Hot Springs wash to discourage off-road vehicle (ORV) access into lower Hot Springs riparian area.

### **Benefits:**

Signage will help reduce ORV traffic into Hot Springs which will improve recruitment success of tree seedlings, increase the density of near channel vegetation, stabilize streambanks and reduce impacts on native fish.

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### **Objective #5:**

Demonstrate how watershed management techniques can improve both riparian habitats and associated rangeland.

### **Benefits:**

Results from this project can be shared with other land owners and resource managers. By disseminating this information, similar watershed improvement projects may be implement at other locations in Arizona.

## **SCOPE OF WORK: TASK DESCRIPTIONS**

### **Task #1 Description:** Obtain Required Permits and Authorizations.

The following will be obtained: SHPO clearance for all areas where cultural or historic resources may be impacted, BLM clearances, ADEQ Smoke Management Permit and NEPA approval. The grantee will also obtain any other required permits.

**AWPF task cost:** \$ 2,400

**Deliverable description:** Signed copies of required permits and clearances

**Deliverable due date:** January, 1999

### **Task #2 Description:** Development of Site Fire Plans

Site fire plans will be prepared before any prescribed burns are conducted. An ADEQ smoke management review will be included in this planning process.

**Subtask 2a:** Develop Site Fire Plan for Double R Fire Unit. Preparation includes development of the burn prescription, a resource review by appropriate staff and details of the logistics of conducting the prescribed burn. This plan is prepared by BLM Fire Management staff (public land) and TNC staff (TNC land).

**Subtask 2b:** Develop Site Fire plan for Hot Springs Fire Unit. Preparation includes development of the burn prescription, a resource review by appropriate staff and details of the logistics of conducting the prescribed burn. This plan is prepared by BLM Fire Management staff (public land) and TNC staff (TNC land).

**Subtask 2c:** Develop Site Fire Plan for Wildcat Fire Unit. Preparation includes development of the burn prescription, a resource review by appropriate staff and details of the logistics of conducting the prescribed burn. This plan is prepared by BLM Fire Management staff (public land) and TNC staff (TNC land).

**AWPF task cost:** \$ 0

### **Deliverable description:**

**Subtask 2a:** Approved Site Fire Plan for Double R Fire Unit, including required reviews in annual fire summary report.

**Subtask 2b:** Approved Site Fire Plan for Hot Springs Fire Unit, including required reviews in annual fire summary report.

**Subtask 2c:** Approved Site Fire Plan for Wildcat Fire Unit, including required reviews in annual fire summary report.

### **Deliverable due date:**

**Subtask 2a:** July, 1998

**Subtask 2b:** July, 1999

**Subtask 2c:** July, 2000

### **Task #3 Description:** Conduct Prescribed Burns in Project Area.

**Subtask 3a:** Conduct a management ignited prescribed burn or burns in the Double R Fire Unit. Within the unit 2200 acres will be burned. BLM and TNC staff will work with trained and qualified contractors to conduct these burns during late spring.

**Subtask 3b:** Conduct a management ignited prescribed burn or burns in the Hot Springs Fire Unit. Within the unit 2200 acres will be burned. BLM and TNC staff will work with trained and qualified contractors to conduct these burns during late spring.

**Subtask 3c:** Conduct a management ignited prescribed burn or burns in the Wildcat Fire Unit. Within the unit 2200 acres will be burned. BLM and TNC staff will work with trained and qualified contractors to conduct these burns during late spring.

**AWPF task cost:** \$ 59,610

### **Deliverable description:**

**Subtask 3a:** Burn results including costs and acreage burned in annual fire summary report.

**Subtask 3b:** Burn results including costs and acreage burned in annual fire summary report.

**Subtask 3c:** Burn results including costs and acreage burned in annual fire summary report.

**Deliverable due date:**

**Subtask 3a:** August, 1998

**Subtask 3b:** August, 1999

**Subtask 3c:** August, 2000

**Task #4 Description:** Fence Construction

Construct 3.0 miles of fence at the SE corner of the Muleshoe Ranch CMA. Fence will be constructed by a licensed contractor working under the direction of the TNC operations manager. This fence will be located in sections 20, 29 & 30, Township 12S Range 21E. The fence will be a four strand barbed wire construction with smooth bottom wire. This is a remote location so fenceline will be prepared and fence built using handtools only; mules will be used to transport fence materials to the construction site.

**AWPF task cost:** \$ 17,100

**Deliverable description:** Summary of construction activities, receipts and documentation of contract completion in semi-annual progress report.

**Deliverable due date:** December, 1998.

**Task #5 Description:** Fence Maintenance

TNC will check (2 times/year) and repair, if needed, the newly constructed fence; maintenance will continue for at least 10 years after the funded project period.

**AWPF task cost:** \$ 0

**Deliverable description:** Summary of maintenance activities will be included in the semi-annual progress and final report.

**Deliverable due date:** December, 1999 and December, 2000.

**Task # 6 Description:** Baseline-Monitoring and Data Summary.

**Subtask 6a:** Monitoring Upland Watershed Vegetation

We have already established 20 permanent vegetation monitoring plots (50 m x 45 m) in the 3 burn units: 10 plots in the Double R Fire Unit, 2 plots in the Hot Springs Fire Unit, and 8 plots in the Wildcat Fire Unit. A subset of these plots (n = 12) were sampled annually in September from 1991 to 1993, while the rest were sampled once in September, 1994. Our goal is to have 8-10 monitoring plots in each of the 3 burn units which means that we will establish 6-8 additional plots in the Hot Springs Fire Unit and 0-2 additional plots in the Wildcat Fire Unit. Plots were selected in representative vegetation for that portion of the unit. We will sample all plots in the burn unit once in the growing season prior to burning, except plots in the Double R Unit which were sampled 2 growing seasons before the scheduled burn. This means that plots in the Double R Unit were sampled (pre-burn) in September, 1996, before the funded project period; plots in the Hot Springs Unit will be sampled in September, 1998, and plots in the Wildcat Unit will be sampled in September, 1999. Five 40-m long transects will set up in each macroplot and shrub cover will be measured along each of these transects using a line-intercept method. The transects will be randomly located within the macroplot using a stratified random design. Quadrats (40 cm x 40 cm) will be placed along these transect lines at 2-m intervals for a total of 100 quadrats/plot. Presence or absence of perennial and annual grasses by species and perennial and annual forbs by category will be recorded in each quadrat (i.e., frequency sampling) as well as comparative yield, and dry weight rank. At the corners of each quadrat, substrate cover (i.e., rock, soil, gravel, litter, and live vegetation) will be recorded using a point-intercept method. Photopoints will be established at the 4 macroplot corners and 2 photographs will be taken at each photopoint showing vegetation within and adjacent to the plot. The same plots will be used to collect post-burn vegetation data. A rainfall gauge will be installed in each burn unit at the start of the project and cumulative precipitation will be recorded every 3 months thereafter before and after the burn. Vegetation sampling will be conducted by a contract botanist and TNC interns; training of the vegetation crew and data summary will be performed by a TNC technician under the direction of the project scientist.

**Subtask 6b:** Monitoring Streamflows

We will monitor streamflows (baseflows), using a Marsh-McBirney meter at established sites along Hot Springs (2 sites), Bass (1 site), Wildcat (1 site), and Double R; 1 streamflow measurement will be made each month in each stream. We have been collecting monthly streamflows in Hot Springs, Bass, and Wildcat since 1989. Streamflow measurements will be initiated in Double R in January, 1998.



Streamflow measurements will be taken and data summarized by TNC field technicians under the supervision of the project scientist. We also mapped the extent of surface flow in Wildcat in May, 1994, and we will do this in Bass, Double R, Hot Springs and Wildcat in May, 1998, prior to conducting any burns.

**Subtask 6c: Monitoring Native Fish and Aquatic Habitat**

In 1991, we established 5 permanent monitoring stations for native fish and aquatic habitat along the perennial portion of Hot Springs, 8 permanent stations along Bass, and 2 permanent stations along Double R; in 1995, 2 permanent stations were established along Wildcat Creek. At each station, we sample 100-200 m of aquatic habitat (i.e., a stream transect) for native fish using seines or a backpack electroshocker, depending on the stream; the length of habitat sampled at each station is constant between years. Prior to sampling, the stream transect is divided into macrohabitats using the classification of McCain et al. (1989) and each macrohabitat is sampled independently. The number of fish by species and by age-class (juveniles vs. adults) is recorded for each macrohabitat along with the distance of individual seine hauls or the number of shocking seconds in that macrohabitat. From these data, we can calculate relative abundance by species and age-class and estimate absolute abundance by normalizing fish numbers by the distance or time sampled. For each of the sequential macrohabitats along a stream transect, we record the length of that macrohabitat, width, 8-10 random depth measurements, maximum depth, areal cover of woody debris (in m<sup>2</sup>) and length of undercut bank (in meters). In addition, 2 photopoints were established at each monitoring station, 1 on the downstream end of the transect and 1 on the upstream end. Two photographs are taken at each photopoint, 1 looking upstream, the other looking downstream, to document riparian habitat along the transect and adjacent to it. All monitoring stations on all streams are sampled annually in October. Because a significant portion of the Wildcat watershed was burned in 1995, no additional pre-burn monitoring will be done in Wildcat Creek. Likewise, because the Double R Unit is located at the top of the Hot Springs watershed and is scheduled to be burned in spring 1998, the last pre-burn monitoring of Double R, Hot Springs, and the lowermost 2 stations in Bass will be conducted in October, 1997, prior to the funded project period. Bass Creek above its confluence with Double R will be unaffected by all 3 scheduled burns; thus, the 6 monitoring stations in this segment will continue to be sampled each October and will serve as controls for affected sites in lower Bass.

As described in the Introductory Information section, prescribed burning may have short-term negative impacts on native fish resulting from off-site effluent emanating from the prescribed burn area (i.e., runoff with elevated nutrient levels or sediment) which may cause stress or mortality of fish. To monitor for possible short-term impacts, we will delineate 2 50-m stream reaches in Bass, 1 located above the Double R confluence (unaffected, control reach), the other located below the confluence (affected reach). These 2 reaches will be monitored for 2 years. Sampling will be seasonal to account for the effects of runoff from the burned area to the adjacent stream reach and will occur in April and October (beginning in April 1998) to determine the effects of winter and summer runoff events on fish populations and aquatic habitat. Fish numbers will be estimated using depletion sampling with electrofishing equipment. Depletion sampling will provide reasonable approximations of true population size in the affected and control stream reaches. Aquatic habitat will be sampled as described above. Habitat parameters and fish population estimates will be compared in the affected reach before and after burning and with the upstream control reach. Fish monitoring will be conducted by project scientist, TNC field technicians, volunteers, and interns; data summary will be completed by TNC technician.

**Subtask 6d: Monitoring Riparian Vegetation and Floodplain Geomorphology.**

In 1994, two monitoring sites for riparian vegetation were established and sampled in Hot Springs and 1 in Bass Creek; 1 site will be established in Double R in 1998. Ten belt transects, 3 meters in width, and spanning the entire floodplain, perpendicular to the stream, were set up at each site; the distance between transects was approximately 75 meters. Within each belt transect, the number of seedlings, saplings, mature and old trees were counted by species. The length of each transect was also recorded so that densities of the different age-classes could be calculated for each site. Seedlings were operationally defined as plants < 1 cm in diameter at breast height (dbh) or < 2 m tall; saplings were defined as plants 1-4 cm dbh or > 2 m tall; mature trees were > 4 cm dbh but < 35 cm dbh; and old trees were > 35 cm dbh. Two photopoints were established at each site and 2 photographs were taken at each photopoint, 1 facing upstream and 1 downstream. Riparian vegetation at all monitoring sites will be (re)sampled in March-April, 1998, prior to the Double R Unit burn. The riparian vegetation monitoring will be conducted by the project scientist, a BLM resource specialist, and TNC technicians. Data summary (i.e., the density of different age-classes and ratio of saplings to mature trees at each site) will be completed by TNC technician.

To monitor changes in floodplain and channel morphology, we will establish permanent transects that span the width of the floodplain; the elevational profile (cross-section) of the floodplain along each transect will be surveyed using a TOPCON Auto-level transit. Five floodplain cross-sections will be established in both Bass and Hot Springs and 4 cross-sections will be established in Double R; one or more of the transects will be located in the riparian vegetation monitoring site(s) for that stream. All transect locations will be selected by project scientist and BLM resource specialists in representative stream reaches. The cross-sections will be surveyed in March-April, 1998, by contract surveyors before the Double R burn; cross-sections will be resurveyed every 6 years for at least 10 years after the funded project period. Data will be summarized by TNC technician.

**AWPF task cost:** \$ 19900

**Deliverable description:**

**Subtask 6a:** Discussion of upland vegetation monitoring activities and data summaries in applicable semi-annual progress report.

**Subtask 6b:** Summary of streamflow data and maps of extent of surface flow in applicable semi-annual progress report.

**Subtask 6c:** Discussion of fish and aquatic habitat monitoring activities and data summaries in applicable semi-annual progress reports.

**Subtask 6d:** Discussion of riparian vegetation monitoring and floodplain survey activities and data summaries in annual progress report.

**Deliverable due date:**

**Subtask 6a:** Semi-annual progress reports submitted in December, 1998; July, 1999; December, 1999; and July, 2000.

**Subtask 6b:** Semi-annual progress report submitted in July, 1998.

**Subtask 6c:** Semi-annual progress report submitted in December, 1998.

**Subtask 6d:** Semi-annual progress report submitted in July, 1998.

**Task #7 Description:** Post-Burn Monitoring and Data Analysis

**Subtask 7a:** Monitoring Upland Watershed Vegetation

Post-burn upland vegetation and photo monitoring will be conducted in September immediately following the spring burn using the methods and personnel described in Task #7a. Given the burn schedule, macroplots in the Double R Burn Unit will be sampled in September, 1997, macroplots in the Hot Springs Unit will be sampled in September, 1998, and those in the Wildcat Unit will be sampled in September, 1999. After the funded project period, vegetation in the macroplots and photopoints will be resampled 5- and 10- years after the unit was burned. At the end of this 10-yr period, the post-burn results will be evaluated and monitoring will be continued as needed. Vegetation data will be summarized by TNC technician and analyzed by project scientist to determine changes in the measured parameters over time. In addition, photographic data will be compared and a qualitative assessment developed for changes observed in species composition, shrub cover and substrate cover.

**Subtask 7b:** Streamflow Monitoring

Post-burn streamflow monitoring will be conducted once a month in Bass, Double R, Wildcat and Hot Springs from 1998 to 2000 following the Double R Unit burn; Streamflow monitoring will continue in all streams and at all sites for at least 10 years after the funded project period. Once collected, streamflow data within streams will be analyzed to determine changes in monthly and seasonal flow averages between pre-burn and post-burn periods. In addition, streamflow data will be useful in interpreting changes in riparian vegetation, native fish populations, aquatic habitat and floodplain geomorphology over time. We will re-map the extent of surface flow (post-burn) in Wildcat, Double R, Hot Springs and Bass in May, 1999, and every 2 years after this for at least 10 years after the funded project period. Once collected, the mapping data will be analyzed to determine changes in the extent of surface flow during the seasonal dry period between pre-burn and post-burn periods. Streamflow and mapping data will be summarized by TNC technician and analyzed by project scientist.

**Subtask 7c:** Native Fish and Aquatic Habitat Monitoring

Post-burn monitoring of native fish and aquatic habitat, including photopoint monitoring, will be conducted in Bass, Double R, Hot Springs and Wildcat in October 1998, 1999, and 2000. Native fish, aquatic habitat and photo monitoring will continue for at least 10 years after the funded project period; after this period the post-burn results will be evaluated and monitoring will continue as needed. Post-burn monitoring will be conducted using the same methods and personnel described in Task #6c. Data will be summarized by TNC technician and submitted annually to the Arizona Game and Fish Department Heritage Database. All fish population and aquatic habitat data will be analyzed by the project scientist to determine changes in measured parameters including changes in the relative and absolute abundance of fish species, changes in juvenile:adult ratios, and changes in aquatic habitat parameters, particularly the abundance of pools, woody debris and undercut banks. In addition, photographic data will be compared and qualitative assessments will be developed for changes in the structure and cover of riparian vegetation.

To determine the short-term impacts of prescribed burns on fish populations and aquatic habitat, we will conduct post-burn monitoring in both the affected and control reaches in Bass Creek using the methods and personnel described in 6c. Post-burn sampling of native fish and aquatic habitat will be conducted in October, 1998, April, 1999, and October, 2000. Habitat parameters and fish populations estimates will be compared in the affected reach before and after burning and with the upstream control reach; the analyses will be performed by the project scientist and BLM resource specialist.

**Subtask 7d:** Riparian Vegetation and Floodplain Geomorphology.

Post-burn monitoring of riparian vegetation, including photopoint monitoring, will be conducted in March-April, 2000, following the protocol described in Task 6d. After that, sites will be resampled every 2-years for at least 10 years after the funded project period, i.e., 2010. Floodplain transects (cross-sections) will be resurveyed, post-burn, for the first time in 2004 and again in 2010. After this, the post-burn results will be evaluated and monitoring will be continued as needed. Once collected, the riparian vegetation data will be analyzed by the project scientist to determine changes in the density of trees of different age classes and in sapling:mature tree ratios. In addition, photographic data will be compared and a qualitative assessment developed for changes observed in species composition, age structure of

woody tree species, and herbaceous and shrub cover. The floodplain cross-section data will be compared between sampling periods to identify changes in floodplain morphology and for evidence of sediment aggradation and terrace development. Summaries of riparian vegetation and floodplain cross-section data will be completed by TNC technician; analyses of post-burn results will be performed by project scientist.

**AWPF task cost:** \$20850

**Deliverable description:** Discussion of monitoring activities, data summaries and analyses in applicable semi-annual progress reports and final report. Since some of post-burn monitoring will be conducted in September-October, 2000 and the final report is due in December, 2000, it is unlikely that all of these data will be summarized and analyzed in time for the final report.

**Deliverable due date:** Semi-annual progress reports will be submitted in December, 1998; July, 1999; December 1999; and July, 2000; final report will be submitted in December, 2000.

**Task # 8 Description:** Distribute Project Information To Other Watershed Managers.

**Subtask 8a:** Meet with surrounding property owners and managers to discuss progress of project. These meetings will occur an average of twice per month and will last for an average of one hour.

**Subtask 8b:** Make 4 presentations to target audiences such as NRCO's, rural community organizations, and agency land managers. This will take place during the third year of the project and will incorporate monitoring results to date.

**Subtask 8c:** Conduct a 1-day watershed improvement workshop and project tour. The workshop will be targeted to the interested parties that we have interacted with during the first three years of the project.

**AWPF task cost:** \$0

**Deliverable description:**

**Subtask 8a:** Summary of land managers contacted and meeting dates in applicable semi-annual progress reports.

**Subtask 8b:** Summary of audiences contacted and results of presentations in final report.

**Subtask 8c:** List of participants, a summary of workshop results and discussions, and analysis of community/participant response in final report.

**Deliverable due date:**

**Subtask 8a:** July, 1998; December 1998; July, 1999; December 1999; and July, 2000 for semi-annual progress reports.

**Subtask 8b:** December, 2000.

**Subtask 8c:** December, 2000.

**Task #9 Description:** Post Signs at Hot Springs Wash.

Carsonite signs will be posted at 8 sites in upper Hot Springs and 2 sites in lower Hot Springs. These are high quality signs with a life expectancy of 10 years. Purpose of the signs is to notify the public that ORV use is not allowed in the sensitive privately owned riparian areas of Hot Springs. A duplicate set of signs will be obtained to replace signs that are vandalized or stolen.

**AWPF Cost:** \$ 440

**Deliverable Description:** Summary of activities including number and location of signs posted in applicable semi-annual progress report.

**Deliverable due date:** December, 1998.

**Task #10 Description:** Progress and Final Reports

Semi-annual progress reports will be provided to the Commission during the funded project period. The reports will provide updates on stream gauge installation, calibration and maintenance; pre-burn and post-burn monitoring activities, data summarization and results; and neighbor meetings. Annual fire summary reports that include approved fire plans as well as a summary of acreages burned and burn results will also be provided to the Commission. The final report will be submitted to the Commission in December, 2000. The report will include an analysis and presentation of all pre- and post-burn monitoring data collected prior to July, 2000, a qualitative evaluation of

photographic monitoring information, approved fire plans and prescribed burn summaries, and summaries of all information outreach activities (i.e., neighbor meetings, presentations to interested parties, watershed improvement workshop and project tour).

Final reports will be provided to the Redington, Willcox, and San Pedro NRCD's and to any other interested party.

**AWPF Task Cost:** \$ 0

**Deliverable Descriptions:** Semi-annual progress reports, annual fire summary reports, and final report.

**Deliverable Due Dates:** Semi-annual progress reports: July, 1998; December, 1998; July, 1999; December, 1999; and July, 2000. Fire summary reports: July, 1998; July, 1999; and July, 2000. Final report: December, 2000.

Start Date: February 1, 1998 Yrs of Benefit: > 20 years  
 End Date: December 31, 2000 Duration: 35 months

Project Name: Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch CMA.

**Project Categories and Tasks**

**Months Since Project Initiated (Year 1)**

Task No.	Task Cost	Task Description	1	2	3	4	5	6	7	8	9	10	11	12
1	\$2400	Obtain Permits		X	X	X	X	X	X	X	X	X		
2	0	Develop Site Fire Plans												
2a		Double R Fire Plan						X						
2b		Hot Springs Fire Plan												
2c		Wildcat Fire Plan												
3	59610	Conduct Prescribed Burns												
3a		Double R Unit Burn					X	X						
3b		Hot Springs Unit Burn												
3c		Wildcat Unit Burn												
4	17100	Fence Construction												X
5	0	Fence Maintenance												

Start Date: <u>February 1, 1998</u> Yrs of Benefit: <u>&gt; 20 years</u> End Date: <u>December 31, 2000</u> Duration: <u>35 months</u>			Project Name: <u>Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch CMA.</u>											
Project Categories and Tasks			Months Since Project Initiated (Year 1)											
Task No.	Task Cost	Task Description	1	2	3	4	5	6	7	8	9	10	11	12
6	\$19900	Baseline Monitoring												
6a		Watershed Monitoring									X		X	
6b		Streamflow Monitoring	X	X	X	X		X						
6c		Fish/Aquatic Habitat Monitoring				X	X							
6d		Riparian Monitoring			X	X	X							
7	20850	Post-Burn Monitoring/Data Analysis												
7a		Watershed Monitoring									X		X	
7b		Streamflow Monitoring						X	X	X	X	X	X	X
7c		Fish/Aquatic Habitat Monitoring										X	X	
7d		Riparian Monitoring		X	X	X	X	X						
8	0	Information Outreach												
8a		Neighbor Meetings	X	X	X	X	X	X	X	X	X	X	X	X
8b		Presentations												
8c		Workshop and Project Tour												
9	440	Post Signs at Hot Springs										X		
10	0	Reports (Semi-annual Progress, Fire Summary and Final)							X					X
<b>Total</b>	<b>120,300</b>													

Project Name: Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch CMA.

Project Categories and Tasks

Months Since Project Initiated (Year 2)

Task No.	Task Cost	Task Description	13	14	15	16	17	18	19	20	21	22	23	24
1		<b>Obtain Permits</b>												
2		<b>Develop Site Fire Plans</b>												
2a		<b>Double R Fire Plan</b>												
2b		<b>Hot Springs Fire Plan</b>						X						
2c		<b>Wildcat Fire Plan</b>												
3		<b>Conduct Prescribed Burns</b>												
3a		<b>Double R Unit Burn</b>												
3b		<b>Hot Springs Unit Burn</b>					X	X						
3c		<b>Wildcat Unit Burn</b>												
4		<b>Fence Construction</b>												
5		<b>Fence Maintenance</b>												X
6		<b>Baseline Monitoring</b>												
6a		<b>Watershed Monitoring</b>	X	X	X						X		X	
6b		<b>Streamflow Monitoring</b>												
6c		<b>Fish/Aquatic Habitat Monitoring</b>				X						X		
6d		<b>Riparian Monitoring</b>												
7		<b>Post-burn Monitoring/Data Analysis</b>												

Project Categories and Tasks			Project Name: <u>Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch CMA.</u>											
			Months Since Project Initiated (Year 2)											
Task No.	Task Cost	Task Description	13	14	15	16	17	18	19	20	21	22	23	24
7a		<b>Watershed Monitoring</b>	X	X	X						X		X	
7b		<b>Streamflow Monitoring</b>	X	X	X	X	X	X	X	X	X	X	X	X
7c		<b>Fish/Aquatic Habitat Monitoring</b>										X	X	
7d		<b>Riparian Monitoring</b>		X	X	X	X	X						
8		<b>Information Outreach</b>												
8a		<b>Neighbor Meetings</b>	X	X	X	X	X	X	X	X	X	X	X	X
8b		<b>Presentations</b>												
8c		<b>Workshop and Project Tour</b>												
9		<b>Post Signs at Hot Springs</b>												
10		<b>Reports (Semi-annual Progress, Fire Summary and Final)</b>							X					X



**Project Name: Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch CMA.**

**Project Categories and Tasks**

**Months Since Project Initiated (Year 3)**

Task No.	Task Cost	Task Description	25	26	27	28	29	30	31	32	33	34	35	36
1		Obtain Permits												
2		Develop Site Fire Plans												
2a		Double R Fire Plan												
2b		Hot Springs Fire Plan												
2c		Wildcat Fire Plan						X						
3		Conduct Prescribed Burns												
3a		Double R Unit Burn												
3b		Hot Springs Unit Burn												
3c		Wildcat Unit Burn					X	X						
4		Fence Construction												
5		Fence Maintenance												X
6		Baseline Monitoring												
6a		Watershed Monitoring	X	X	X									
6b		Streamflow Monitoring												
6c		Fish/Aquatic Habitat Monitoring										X		
6d		Riparian Monitoring												
7		Post-burn Monit/Data Analysis												
7a		Watershed Monitoring	X	X	X						X			

Project Categories and Tasks			Project Name: Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch CMA.											
			Months Since Project Initiated (Year 3)											
Task No.	Task Cost	Task Description	25	26	27	28	29	30	31	32	33	34	35	36
7b		Streamflow Monitoring	X	X	X	X	X	X	X	X	X	X	X	X
7c		Fish/Aquatic Habitat monitoring	X	X	X							X	X	
7d		Riparian Monitoring			X	X	X	X						
8		Information Outreach												
8a		Neighbor Meetings	X	X	X	X	X	X	X	X	X	X	X	X
8b		Presentations											X	X
8c		Workshop and Project Tour											X	X
9		Post Signs at Hot Springs												
10		Reports (Semi-annual Progress, Fire Summary and Final)							X					X

**PROJECT BUDGET**

	<b>FUNDING SOURCES</b>			
	<b>AWPF</b>	<b>Other</b>	<b>Donated Mat./Serv.</b>	<b>TOTAL</b>
<b>ADMINISTRATION COSTS (1)</b>				
5% OF 120300	6015			6015
14.4% OF 120300			17323	17323
<b>DIRECT LABOR COSTS (2)</b>				
PROJ. MGR. 80DAYS @160			12800	12800
PROJ.SCIENTIST 84 DAYS @160			13440	13440
TNC FIELD TECH 215 DAYS@115			24725	24725
TNC FIELD TECH 120 DAYS @115	13800			13800
TNC INTERNS 180 DAYS @85	15300			15300
BLM RESOURCE MGR38DAYS@255			9690	9690
BLM RESOURCE TECH41 DAYS@155			6355	6355
<b>OTHER DIRECT COSTS</b>				
RX FIRE SUPPLIES	3150			3150
FENCE MATERIAL @2500/MILE	7500			7500
SIGNS 20 @22/PER	440			440
FIELD MONITORING SUPPLIES	1200			1200
FILM, POSTAGE, PHOTOCOPIES			1035	1035
FENCE MATERIAL-MAINT.			200	200
MILEAGE:RX FIRE, FIELD WORK, MONITORING			6480	6480

	FUNDING SOURCES			TOTAL
	AWPF	Other	Donated Mat./Serv.	
<b>OUTSIDE SERVICES</b>				
BOTANIST 50 DAYS @115	5750			5750
FENCE CONTRACTOR 3@3200/MILE	9600			9600
RIPARIAN SURVEY CREW 3PERSON X 9 DAY @100/DAY	2700			2700
20 PERSON TYPE 2 FIRE CREW 15 DAYS X 3764/DAY	56460			56460
CLASS 2 CUTURAL RESOURCE SURVEY	2400			2400
<b>CAPITAL OUTLAY</b>				
Tech/Industrial Equip. (3) PALM TOP COMPUTERS 2 @ 1000	2000			2000
Water (CAP/Effluent)				
Other (describe)				
<b>TOTALS</b>	<b>126315</b>		<b>92048</b>	<b>218363</b>

- (1) Administration costs are limited to 5% of the total dollars requested for a project.
- (2) Include wages, salaries, and fringe benefits.
- (3) Attach list of capital equipment expenditures over \$1,000.00

**Budget Information:**

**Direct labor costs:**

Project Manager (TNC Staff) 80 days @ \$160 per day= total cost \$12800  
Project Scientist (TNC staff) 84 days @ \$160 per day=total cost \$13400  
Field Technicians (TNC staff) 335 days @ \$115 per day=total cost \$38525  
Interns (TNC staff) 180 days @ \$85 per day=total cost \$15300  
Resource Specialists (BLM staff) 41 days @ \$155 per day= total cost \$6355  
Resource Specialists (BLM staff) 38 days @ \$255 per day(overtime included)= total cost \$9690

**Other Direct costs:**

Monitoring supplies: Various supplies, including fish seines, rebar, field scales, measuring tapes, flagging tape.

Fence material cost total \$2500/mile. Total cost for 3 miles is \$7500  
Material includes: barb and smooth wire, 6 1/2 foot T posts, stays, clips, RR tie corner posts, pipe braces and staples.

Carsonite signs: 20 signs will be purchased at a cost of \$22/per sign

Fire Equipment: a variety of equipment will be purchased and used in conducting the prescribed burns. This equipment will cost \$1050 per year. Prices for various equipment is detailed on the attached list.

Mileage is calculated for trips to the project site.  
For BLM truck: .31 per mile X 200 mile/trip X 25 trips=\$1550  
For TNC truck: .31 per mile X 247 mile/trip X 58 trips=\$4930

**Outside services:**

Pre- and post-burn upland monitoring will be done by a contract Botanist. 50 days @ \$115 per/day=\$5750

Riparian transect survey crew. Three person crew @ \$100 per person X 9 days= \$2700

Contract fence construction. 3 mile fence @ \$3200 per mile=\$9600

Twenty person Type 2 fire crew. Total cost per day: \$3764 X 15 days=\$56460. This includes transportation costs.

Class 2 Archeological survey. Contract archeologist, Cost: \$2400

## Existing Plans

Discuss any existing plans, reports or information that are relevant to the project and that the Commission should be aware of when evaluating your proposal. This might include other projects that are being performed or being planned in the area that may affect your project, or local planning/zoning changes that could impact the project area.

### Existing Plans:

1. Muleshoe Ecosystem Management Plan, draft date 9/96. This comprehensive document details the preferred management strategies for the Muleshoe Ranch CMA. The plan calls for prescribed fire, fencing, and extensive monitoring. This grant will help in implementing many of the called for management activities.

See Attachment C

## Community Support

Describe the community support for your project. Include signed copies of letters from community organizations or groups that support your project. If pertinent, describe your commitment to work jointly with affected cities, towns, counties, NRCDs, special districts, and/or Indian tribes. Please be aware that for public support to affect your proposal's criteria rating score, it must be included with your application. Indications of public support for your proposal that are received after your application is submitted will be summarized for the Commission and may affect their decisions on which proposals to fund, but will not affect the criteria rating score.

### Community Support:

1. The Saguaro Juniper Corporation has submitted a letter in support of this application.
2. BLM has submitted a letter of support for the project.
3. The Redington NRCD Districts has submitted a letter of support.
4. Arizona Game and Fish Department has submitted a letter of support.
5. Bill McDonald has submitted a letter of support.

All letters are attached as attachment D.

## Personnel

Identify the key personnel associated with this project. Include brief biographical sketches that indicate relevant qualifications.

### **Personnel:**

1. Ed Brunson, Aravaipa/Muleshoe Preserves Manager, The Nature Conservancy, Arizona Chapter. Mr. Brunson holds a M.S. degree in Marine Resource Management (1987) and has been with TNC in Arizona since 1991. As Preserve Manager for Aravaipa and Muleshoe Preserves, he oversees all TNC administration and management activities in the project area. Additionally, he is the coordinator for the TNC fire program in Arizona. He is a TNC certified Fire Leader and has planned and supervised TNC conducted prescribed burns in various sites, including Muleshoe.

2. Dr. David Gori-Stewardship Ecologist, The Nature Conservancy  
Ph.D. (1983), University of Arizona-Ecology and Evolutionary Biology.

Dr. Gori has worked for TNC since 1989, and before that as a research associate for 4 years at the University of Washington, Seattle. He has designed and implemented numerous research studies and monitoring programs for rare plants, native fish, and riparian and upland vegetation; he has also served as a contract manager for a number of research studies on wetland and riparian ecology and he is currently directing 2 riparian restoration projects. Dr. Gori has published over 15 scientific articles on plant and avian ecology in peer-reviewed books and journals.

3 . Rick Belger, Fire Management Specialist, BLM Safford District. Mr. Belger is the primary fire planner for the Safford District. He is trained and qualified to plan and implement prescribed burns and is also qualified to lead suppression efforts on wildfires. He has extensive fire management experience throughout the western U.S.

Resumes for 1. & 2. Above are attached (G).



State Historic Preservation Office Information (must be submitted)

SHPO Certification

This certification is required by regulations implementing the State Preservation Act (A.R.S. 41-861 through 41-864), effective July 24, 1982. It is understood that recipients of state funds are required to comply with this law throughout the project period. The State Historic Preservation Act mandates that all State agencies consider the potential of activities or projects to impact significant cultural resources. Each State agency is required to consult with the State Historic Preservation Officer with regard to those activities or projects that may impact cultural resources.

PROJECT TITLE: Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch Cooperative Management Area.

Please answer the following questions which provide information about the potential of the project to impact cultural resources:

Does the project have the potential to disturb the surface and/or subsurface of the ground?

YES:  NO:

Are there any buildings or structures (including mines, bridges, dams, canals, etc.) which are 50 years or older within the project area that have the potential to be disturbed by the proposed activity?

YES:  NO:

Are there any known prehistoric and/or historic archaeological sites within the project area?

YES:  NO:

Are you aware of any archeological investigations that have been performed within one (1) mile of the project area?

YES:  NO:

If you have answered "NO" to all of the above questions, please sign on the line below certifying that the activity or project is in compliance (and will remain in compliance throughout the project period) with the State Historic Preservation Act. **YOU MUST SUBMIT THIS FORM WITH YOUR COMPLETED APPLICATION.**



Authorized Signature

7/30/97

Date

If you have answered "YES" to any of the questions above, please answer all applicable questions on the other side of this form.

If you answered yes to question #1, specifically identify any surface or subsurface impacts that are expected. Attach extra sheets if more space is needed.

**Disturbance to the ground surface and subsurface will be minimal during fence construction since the fenceline and fence will be constructed using only handtools and mules and horses will be used to transport fencing materials to the construction site. According to Ann Howard, an archaeologist with SHPO, the prescribed burns have a potential to negatively impact rock art and rock shelters. Per my conversation with Ms. Howard on July, 29, 1996, I asked Max Witkind, an archaeologist with the BLM, Tucson Resource Area, what the probability would be of finding rock art or rock shelters on TNC-owned land in the project area. Mr. Witkind performed a Class III examination of a 2,300 acre burn unit within the project area in 1994 and found no rock shelters or rock art. He concludes that the probability of rock art or rock shelters occurring on TNC land is low; if present they would be on secondary terraces in ephemeral drainage leading into the perennial streams within the project area. He suggested that Class II examinations be conducted in areas that he can identify as most sensitive. Alternatively, if feasible, these sensitive areas can be excluded from burn units by creating burned fuel breaks around them. Mr. Witkind stated that rock shelters and art would most likely occur in the canyon bottoms of perennial streams on the Muleshoe, including Bass, Hot Springs, Wildcat, and Double R. These canyon bottoms are not included in our burn units and will not be burned.**

If you answered yes to question #1, describe the current ground surface condition within the entire project area boundary (i.e., is the ground in a natural undisturbed condition, or has it been bladed, paved, graded, used for agriculture, etc.). Attach extra sheets if more space is needed.

**Except for a network of two-track dirt roads which provide access to various portions of the Muleshoe Ranch, the only use impacting the project area in the past has been livestock grazing.**

If you answered yes to question #2, list the sites, their names, and provide a brief description of the site.

**The historic occupation of the CMA is represented by six ranch and homestead sites, which include Hookers Hot Springs, Pride and Browning ranches and the Patterson, Jackson and Bradbury cabins. All of these sites have 1 or more structures constructed out of wood or masonry. Other historic resources include several line shacks and corrals. Hookers Hot Springs is the only site in the CMA that is listed on the National Register of Historic Places. Although the existing Pride Cabin is of fairly recent construction (1950's) several adjacent buildings and structures date back to the original homestead claim. As such the Pride Ranch Homestead site is believed to be eligible for listing as a National Register Site. None of these historic sites are located within identified burn units.**

Has the project area been previously surveyed for cultural resources by a qualified Archaeologist?

YES:   X   NO: \_\_\_\_\_

DON'T KNOW: \_\_\_\_\_

If yes, submit a copy of the Archaeologist's report with your application.

**YOU MUST SUBMIT THIS FORM WITH YOUR COMPLETED APPLICATION**

<b>AWPF Task Form for Fencing</b>	
<b>Item</b>	<b>Applicant's response</b>
Fence type:	<b>4-strand barbed wire</b>
Fence description:	<b>4-strand barbed wire with smooth bottom wire.</b>
Purpose of fence:	<b>Exclude trespass livestock from Bass Creek and its watershed on CMA.</b>
Approximate fence length:	<b>3.0 miles</b>
Approximate number of gates to be installed:	<b>2</b>
Approximate number of cattle guards to be installed:	<b>0</b>
Cost of fence in budget:	<b>\$17,100</b>
Cost of gates and cattle guards in budget:	<b>included</b>
Have you included a map indicating the approximate location of all fence segments? If NO, please explain WHY.	<b>Yes, see project area map</b>
Who will be responsible for fence maintenance once the fence is complete?	<b>The Nature Conservancy will be responsible for fence maintenance for at least 10 years after the funded project period.</b>
Additional information if required	<b>None</b>

AWPF Task Form for common Monitoring Activities	
Item	Applicant's response
Surface water monitoring (Y/N)	Yes
Discharge (Y/N): if Y	Yes
method?	streamflow using a Marsh-McBirney meter (Flo-mate Model 2000)
approx. # of sample pts.?	2 sites in Hot Springs Creek, 1 site in Wildcat Creek, 1 site in Bass Creek, and 1 site in Double R
sample frequency?	1 streamflow measurement per month at all sites.
start date & end date?	Streamflow measurements (1 measurement/month) were initiated in Hot Springs, Wildcat and Bass in 1989. Monthly measurements in these streams and in Double R will be taken throughout the funded project period, beginning in January, 1998; measurements will continue for at least 10 years after the funded project period.
Stage (Y/N): if Y	no
method?	
approx. # of sample pts.?	
sample frequency?	
start date and end date?	
Photo point monitoring (Y/N): If Y,	Yes
Approximate number of points, and photos per point?	<b>Riparian vegetation:</b> 4 points in Hot Springs, 2 points in Bass, and 2 points in Double R; 2 photos per point. <b>Native fish/aquatic habitat:</b> 10 points in Hot Springs, 16 points in Bass, 4 points in Wildcat and 4 points in Double R; 2 photos per point. <b>Floodplain geomorphology:</b> 5 points each in Hot Springs and Bass, 4 points each in Wildcat and Double R; 2 photos per point. <b>Upland watershed vegetation:</b> A total of 120 points in the 3 burn units; 2 photos per point.
How often will photos be taken?	<b>Riparian vegetation:</b> once every 2 years, beginning in 1998, until at least 10 years after the funded project period. <b>Native fish/aquatic habitat:</b> annually for at least 10 years after the funded project period. <b>Floodplain geomorphology:</b> once every 4 years, beginning in 1997, until at least 10 years after the funded project period. <b>Upland watershed vegetation:</b> once in the growing season before burning, once in the growing season immediately following the burn; 5- and 10- years after the unit was burned for at least 10 years after the funded project period.
Additional information if needed	None
Wildlife monitoring (Y/N): If Y,	Yes
Aquatic (Y/N): If Y,	Yes
Which plant and/or animal categories?	native fish

Which parameters?	Length of each seine haul or duration of shocking time per sample; number of fish captured per seine haul or per electroshocking sample by species and by stream macrohabitat, age-class (juvenile vs. adult) of captured fish.
How often will monitoring be performed?	One time annually, in October, except for two stream reaches used to track the short-term effect of burning on native fish populations and aquatic habitat. The latter reaches will be sampled 2 times per year for 2 years.
Start and end dates for monitoring?	Native fish monitoring was initiated in Bass, Double R, and Hot Springs in 1991, and in Wildcat in 1994. Monitoring will continue in October, 1998, and annually after this for at least 10 years after the funded project period. Monitoring to determine the short-term impacts of burning will be initiated in April, 1998, with resampling in October, 1998, April, 1999 and October, 1999.
Terrestrial (Y/N): If Y,	None
Which plant and/or animal categories?	Upland vegetation monitoring in permanent macroplots established in the 3 burn units.
Which parameters?	Shrub cover; frequency sampling for perennial and annual grasses by species and perennial and annual forbs by category; comparative yield; dry-weight rank; and substrate cover of rock, soil, gravel, litter and live basal vegetation using a point-intercept method.
How often will monitoring be performed?	The above measurements will be made in macroplots in the growing season (September) preceding the scheduled burn and in the growing season (September) immediately following the spring-summer burn. The plots will be resampled 5- and 10-years after the burn. After this, the monitoring data will be evaluated and vegetation monitoring continued as needed.
Start and end dates for monitoring?	Pre-burn sampling of plots established in Double R Unit were conducted in September, 1996, before the funded project period; pre-burn monitoring will be conducted in the Hot Springs Unit in September, 1998, and in the Wildcat Unit in September, 1999. Post-burn monitoring will continue according to the schedule described above.
Additional information if needed	None
Fisheries habitat (Y/N): If Y,	Yes
List abiotic parameters	Macrohabitat type; length, width, average depth and maximum depth of each macrohabitat; cover by woody debris (m <sup>2</sup> ); amount of undercut bank (m/m of stream habitat along transect); number of pools per mile; linear percent of pool habitat; percent of pools with maximum depth > 0.6 meters.
List biotic parameters	None
How often will monitoring be performed?	Annually, in October, except the two stream reaches used to assess short-term impacts of burn which will be sampled 2 times per year.
Start and end dates for monitoring?	Aquatic habitat monitoring was initiated in Bass, Hot Springs, and Double R in 1991 and in Wildcat in 1994. Monitoring will continue in October, 1997 and annually after this for at least 10 years after the funded project period. Monitoring to determine the short-term impacts of burning on aquatic habitat will be initiated in April, 1998 and will continue until October, 1999.

<b>Climatic data (Y/N): If Y,</b>	<b>Yes</b>
List types of data?	<b>Precipitation</b>
How often will monitoring be performed?	<b>Gauges will be checked on every 3 months.</b>
Start and end dates of monitoring?	<b>Monitoring will begin within 2 months of effective date of contract and continue throughout the funded project period; monitoring will be continued indefinitely thereafter.</b>
Additional information if needed	<b>A minimum of 1 precipitation gauge will be installed in each burn unit.</b>
<b>Channel morphology (Y/N): If Y,</b>	<b>Yes</b>
List parameters measured?	<b>Elevational profile of the floodplain cross-section (i.e. cross-section of the floodplain perpendicular to the stream).</b>
How often will monitoring be performed?	<b>The floodplain cross-sections will be resurveyed every 6 years.</b>
Start and end dates for monitoring?	<b>March/April, 1998 and every 6 years thereafter until at least 10 years after the funded project period.</b>
<b>Will transects be used (Y/N) during any of the activities mentioned above: If Y,</b>	<b>Yes</b>
List which activities involve the use of transects	<b>upland and riparian vegetation, aquatic habitat, floodplain geomorphology (cross-sections)</b>
Transect dimensions? (If more than one type/size, please indicate)	<b><u>Upland vegetation:</u> 40-meter linear transects per macroplot. <u>Riparian vegetation:</u> Variable length belt transects; transects extend the entire width of the floodplain and, thus, are variable in length depending on the site; transect width is 3 meters. All transect lengths are recorded during monitoring. <u>Native fish/aquatic habitat:</u> 50 m - 200 m linear stream transects depending on the site (or station). <u>Floodplain geomorphology:</u> variable length depending on the width of the floodplain.</b>
Approximate number?	<b><u>Upland vegetation:</u> Five 40-meter transects per macroplot; there are a total of 24-30 upland macroplots in the 3 burn units. <u>Riparian vegetation:</u> Ten belt transects per site in Hot Springs (2 sites), Bass (1 site), Wildcat (1 site) and Double R (1 site). <u>Native fish/aquatic habitat:</u> There are 5 monitoring stations or stream transects in Hot Springs, 8 stations in Bass, 2 stations in Wildcat, and 2 stations in Double R; 2 additional transects may be added to these streams to monitor the short-term impacts of burns on fish and aquatic habitat. <u>Floodplain geomorphology:</u> There will be 5 transects (cross-sections) in both Bass and Hot Springs and 4 transects in Double R.</b>

<p>Location selection parameters?</p>	<p><b>Upland vegetation:</b> transects will be randomly selected within macroplots, using a stratified random design; macroplots are selected to provide uniform coverage of the burn unit and to be representative of vegetation in that part of the unit.  <b>Riparian vegetation:</b> one transect approximately every 75 meters; monitoring sites were selected in representative stream reaches.  <b>Native fish/aquatic habitat:</b> monitoring transects were selected in representative stream reaches and are distributed along the stream so as to provide uniform coverage of available aquatic habitat.  <b>Floodplain geomorphology:</b> In different, representative stream reaches with 1 or more transects located in riparian and fish monitoring sites.</p>
<p>Will quadrats be established along transects (Y/N): If Y,</p>	<p>Yes</p>
<p>Quadrat dimensions? (If more than one size/type please indicate)</p>	<p>Upland vegetation: 40 cm x 40 cm quadrats--grasses and herbaceous vegetation</p>
<p>Approximate number?</p>	<p>100 quadrats per upland vegetation macroplot; there are a total of 24-30 upland macroplots in the 3 burn units.</p>
<p>Location selection parameters?</p>	<p>Quadrats are located every 2 m along the transect.</p>
<p>Additional information if needed</p>	<p>None</p>

<b>AWPF Task Form for Fencing</b>	
<b>Item</b>	<b>Applicant's response</b>
Fence type:	<b>4-strand barbed wire</b>
Fence description:	<b>4-strand barbed wire with smooth bottom wire.</b>
Purpose of fence:	<b>Exclude trespass livestock from Bass Creek and its watershed on CMA.</b>
Approximate fence length:	<b>3.0 miles</b>
Approximate number of gates to be installed:	<b>2</b>
Approximate number of cattle guards to be installed:	<b>0</b>
Cost of fence in budget:	<b>\$17,100</b>
Cost of gates and cattle guards in budget:	<b>included</b>
Have you included a map indicating the <b>approximate</b> location of all fence segments? If NO, please explain WHY.	<b>Yes, see project area map</b>
Who will be responsible for fence maintenance once the fence is complete?	<b>The Nature Conservancy will be responsible for fence maintenance for at least 10 years after the funded project period.</b>
Additional information if required	<b>None</b>

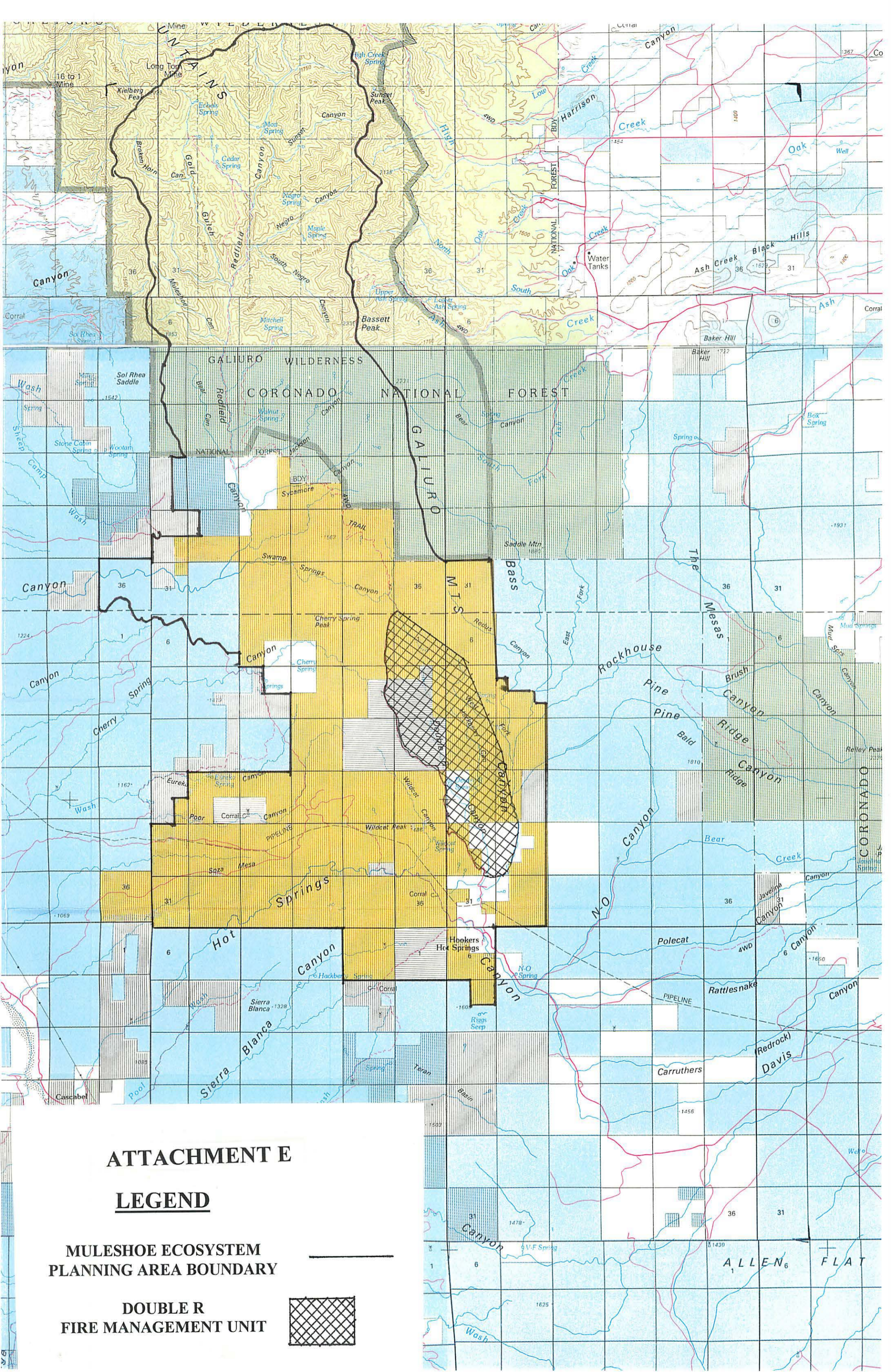


AWPF Task Form for common Monitoring Activities	
Item	Applicant's response
Surface water monitoring (Y/N)	Yes
Discharge (Y/N): if Y	Yes
method?	streamflow using a Marsh-McBirney meter (Flo-mate Model 2000)
approx. # of sample pts.?	2 sites in Hot Springs Creek, 1 site in Wildcat Creek, 1 site in Bass Creek, and 1 site in Double R
sample frequency?	1 streamflow measurement per month at all sites.
start date & end date?	Streamflow measurements (1 measurement/month) were initiated in Hot Springs, Wildcat and Bass in 1989. Monthly measurements in these streams and in Double R will be taken throughout the funded project period, beginning in January, 1998; measurements will continue for at least 10 years after the funded project period.
Stage (Y/N): if Y	no
method?	
approx. # of sample pts.?	
sample frequency?	
start date and end date?	
Photo point monitoring (Y/N): If Y,	Yes
Approximate number of points, and photos per point?	<u>Riparian vegetation</u> : 4 points in Hot Springs, 2 points in Bass, and 2 points in Double R; 2 photos per point. <u>Native fish/aquatic habitat</u> : 10 points in Hot Springs, 16 points in Bass, 4 points in Wildcat and 4 points in Double R; 2 photos per point. <u>Floodplain geomorphology</u> : 5 points each in Hot Springs and Bass, 4 points each in Wildcat and Double R; 2 photos per point. <u>Upland watershed vegetation</u> : A total of 120 points in the 3 burn units; 2 photos per point.
How often will photos be taken?	<u>Riparian vegetation</u> : once every 2 years, beginning in 1998, until at least 10 years after the funded project period. <u>Native fish/aquatic habitat</u> : annually for at least 10 years after the funded project period. <u>Floodplain geomorphology</u> : once every 4 years, beginning in 1997, until at least 10 years after the funded project period. <u>Upland watershed vegetation</u> : once in the growing season before burning, once in the growing season immediately following the burn; 5- and 10- years after the unit was burned for at least 10 years after the funded project period.
Additional information if needed	None
Wildlife monitoring (Y/N): If Y,	Yes
Aquatic (Y/N): If Y,	Yes
Which plant and/or animal categories?	native fish

Which parameters?	Length of each seine haul or duration of shocking time per sample; number of fish captured per seine haul or per electroshocking sample by species and by stream macrohabitat, age-class (juvenile vs. adult) of captured fish.
How often will monitoring be performed?	One time annually, in October, except for two stream reaches used to track the short-term effect of burning on native fish populations and aquatic habitat. The latter reaches will be sampled 2 times per year for 2 years.
Start and end dates for monitoring?	Native fish monitoring was initiated in Bass, Double R, and Hot Springs in 1991, and in Wildcat in 1994. Monitoring will continue in October, 1998, and annually after this for at least 10 years after the funded project period. Monitoring to determine the short-term impacts of burning will be initiated in April, 1998, with resampling in October, 1998, April, 1999 and October, 1999.
Terrestrial (Y/N): If Y,	None
Which plant and/or animal categories?	Upland vegetation monitoring in permanent macroplots established in the 3 burn units.
Which parameters?	Shrub cover; frequency sampling for perennial and annual grasses by species and perennial and annual forbs by category; comparative yield; dry-weight rank; and substrate cover of rock, soil, gravel, litter and live basal vegetation using a point-intercept method.
How often will monitoring be performed?	The above measurements will be made in macroplots in the growing season (September) preceeding the scheduled burn and in the growing season (September) immediatly following the spring-summer burn. The plots will be resampled 5- and 10-years after the burn. After this, the monitoring data will be evaluated and vegetation monitoring continued as needed.
Start and end dates for monitoring?	Pre-burn sampling of plots established in Double R Unit were conducted in September, 1996, before the funded project period; pre-burn monitoring will be conducted in the Hot Springs Unit in September, 1998, and in the Wildcat Unit in September, 1999. Post-burn monitoring will continue according to the schedule described above.
Additional information if needed	None
Fisheries habitat (Y/N): If Y,	Yes
List abiotic parameters	Macrohabitat type; length, width, average depth and maximum depth of each macrohabitat; cover by woody debris (m <sup>2</sup> ); amount of undercut bank (m/m of stream habitat along transect); number of pools per mile; linear percent of pool habitat; percent of pools with maximum depth > 0.6 meters.
List biotic parameters	None
How often will monitoring be performed?	Annually, in October, except the two stream reaches used to assess short-term impacts of burn which will be sampled 2 times per year.
Start and end dates for monitoring?	Aquatic habitat monitoring was initiated in Bass, Hot Springs, and Double R in 1991 and in Wildcat in 1994. Monitoring will continue in October, 1997 and annually after this for at least 10 years after the funded project period. Monitoring to determine the short-term impacts of burning on aquatic habitat will be initiated in April, 1998 and will continue until October, 1999.

Climatic data (Y/N): If Y,	Yes
List types of data?	Precipitation
How often will monitoring be performed?	Gauges will be checked on every 3 months.
Start and end dates of monitoring?	Monitoring will begin within 2 months of effective date of contract and continue throughout the funded project period; monitoring will be continued indefinitely thereafter.
Additional information if needed	A minimum of 1 precipitation gauge will be installed in each burn unit.
Channel morphology (Y/N): If Y,	Yes
List parameters measured?	Elevational profile of the floodplain cross-section (i.e. cross-section of the floodplain perpendicular to the stream).
How often will monitoring be performed?	The floodplain cross-sections will be resurveyed every 6 years.
Start and end dates for monitoring?	March/April, 1998 and every 6 years thereafter until at least 10 years after the funded project period.
Will transects be used (Y/N) during any of the activities mentioned above: If Y,	Yes
List which activities involve the use of transects	upland and riparian vegetation, aquatic habitat, floodplain geomorphology (cross-sections)
Transect dimensions? (If more than one type/size, please indicate)	<b>Upland vegetation:</b> 40-meter linear transects per macroplot. <b>Riparian vegetation:</b> Variable length belt transects; transects extend the entire width of the floodplain and, thus, are variable in length depending on the site; transect width is 3 meters. All transect lengths are recorded during monitoring. <b>Native fish/aquatic habitat:</b> 50 m - 200 m linear stream transects depending on the site (or station). <b>Floodplain geomorphology:</b> variable length depending on the width of the floodplain.
Approximate number?	<b>Upland vegetation:</b> Five 40-meter transects per macroplot; there are a total of 24-30 upland macroplots in the 3 burn units. <b>Riparian vegetation:</b> Ten belt transects per site in Hot Springs (2 sites), Bass (1 site), Wildcat (1 site) and Double R (1 site). <b>Native fish/aquatic habitat:</b> There are 5 monitoring stations or stream transects in Hot Springs, 8 stations in Bass, 2 stations in Wildcat, and 2 stations in Double R; 2 additional transects may be added to these streams to monitor the short-term impacts of burns on fish and aquatic habitat. <b>Floodplain geomorphology:</b> There will be 5 transects (cross-sections) in both Bass and Hot Springs and 4 transects in Double R.

Location selection parameters?	<p><b><u>Upland vegetation:</u></b> transects will be randomly selected within macroplots, using a stratified random design; macroplots are selected to provide uniform coverage of the burn unit and to be representative of vegetation in that part of the unit.</p> <p><b><u>Riparian vegetation:</u></b> one transect approximately every 75 meters; monitoring sites were selected in representative stream reaches.</p> <p><b><u>Native fish/aquatic habitat:</u></b> monitoring transects were selected in representative stream reaches and are distributed along the stream so as to provide uniform coverage of available aquatic habitat.</p> <p><b><u>Floodplain geomorphology:</u></b> In different, representative stream reaches with 1 or more transects located in riparian and fish monitoring sites.</p>
Will quadrats be established along transects (Y/N): If Y,	Yes
Quadrat dimensions? (If more than one size/type please indicate)	Upland vegetation: 40 cm x 40 cm quadrats--grasses and herbaceous vegetation
Approximate number?	100 quadrats per upland vegetation macroplot; there are a total of 24-30 upland macroplots in the 3 burn units.
Location selection parameters?	Quadrats are located every 2 m along the transect.
Additional information if needed	None

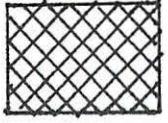


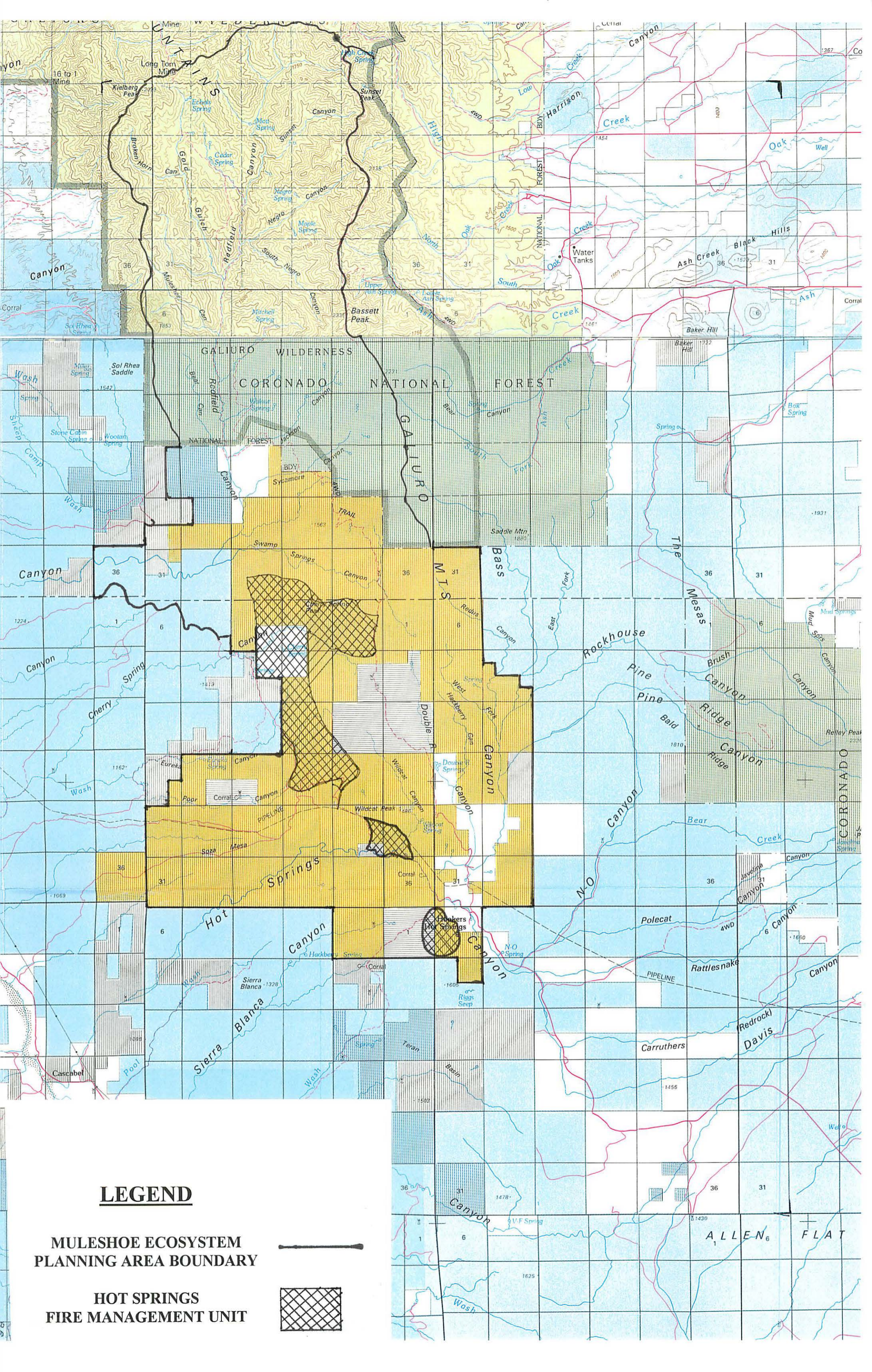
# ATTACHMENT E

## LEGEND

MULESHOE ECOSYSTEM  
PLANNING AREA BOUNDARY

DOUBLE R  
FIRE MANAGEMENT UNIT



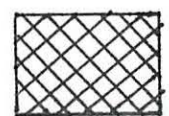


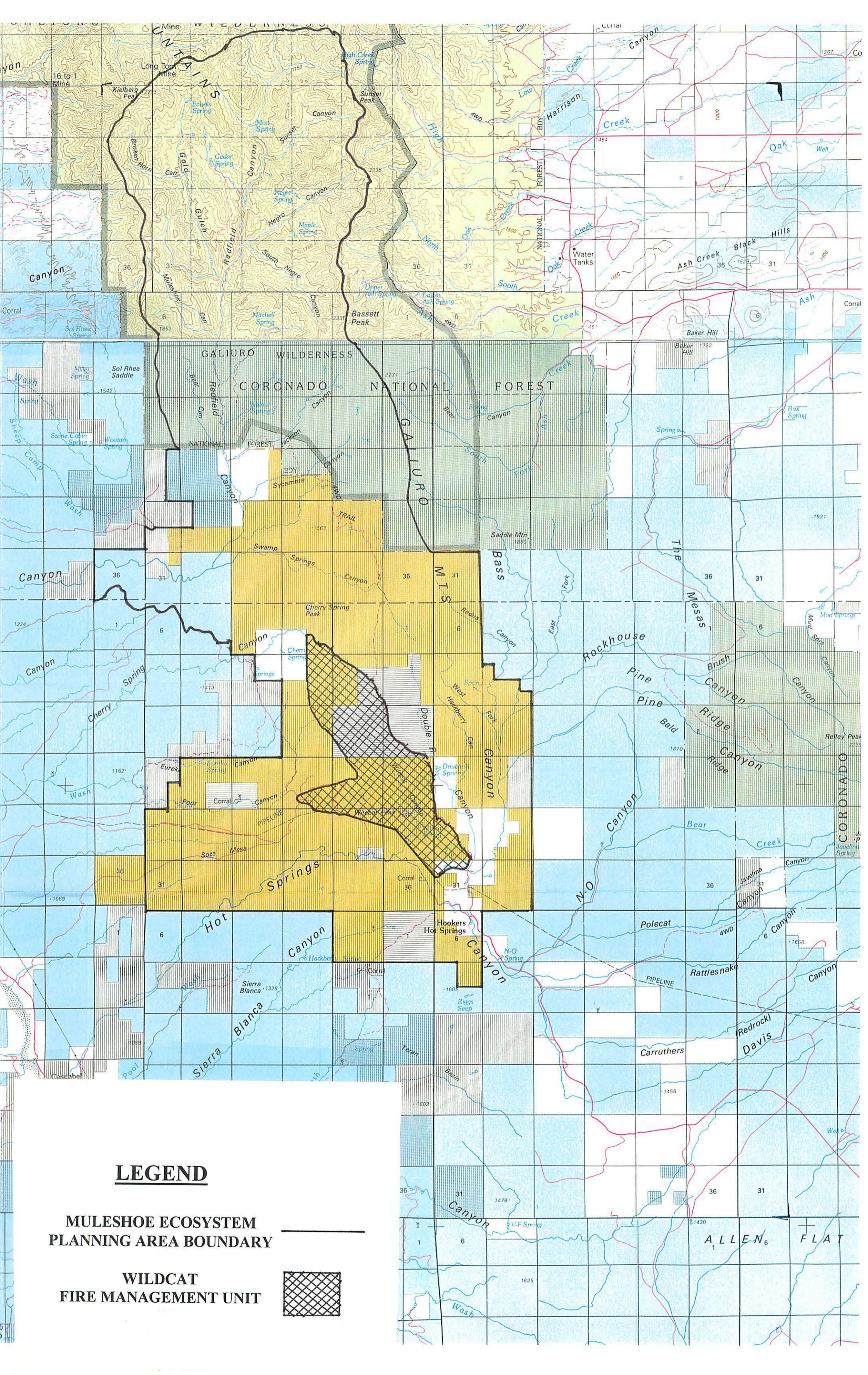
**LEGEND**

**MULESHOE ECOSYSTEM  
PLANNING AREA BOUNDARY**



**HOT SPRINGS  
FIRE MANAGEMENT UNIT**





**LEGEND**

MULESHOE ECOSYSTEM  
PLANNING AREA BOUNDARY

WILDCAT  
FIRE MANAGEMENT UNIT



THE STATE



OF ARIZONA

# ATTACHMENT D

## GAME & FISH DEPARTMENT

2221 West Greenway Road, Phoenix, Arizona 85023-4399 (602) 942-3000

**Tucson Office, 555 N Greasewood Rd, Tucson, AZ 85745**

*Governor*  
Fife Symington

*Commissioners:*  
Chairman, Nonie Johnson, Snowflake  
Michael M. Golightly, Flagstaff  
Herb Guenther, Tacna  
Fred Belman, Tucson  
M. Jean Hassell, Scottsdale

*Director*  
Duane L. Shroufe

*Deputy Director*  
Thomas W. Spalding

July 28, 1997

Arizona Water Protection Fund Grant Committee  
Arizona Department of Water Resources  
500 North Third Street  
Phoenix, Arizona 85004

Re: Watershed Improvement to Restore Riparian and Aquatic Habitat  
on the Muleshoe Ranch CMA

Dear Committee:

The Arizona Game and Fish Department is pleased to offer its support for the above-mentioned Water Protection Fund Grant application submitted by the Nature Conservancy. As a participant in the planning process for the Muleshoe Ecosystem Management Plan, we believe the proposed project supports the prescribed fire objectives set forth in the draft plan. The combined use of prescribed fire and rest from grazing is an essential step in restoring the natural balance of grasses, forbs, and woody plants that protect the soil from erosion and provide nutritious forage for wildlife and livestock.

The invasion of woody plants on southern Arizona's rangelands is plainly evident. Suppression of wildfires, droughts, and grazing pressure by domestic livestock over the last century are undoubtedly to blame. Better livestock management alone can not reverse the trend toward more woody plants and less ground cover. Results from several large burns completed in southern Arizona within the last 5 years clearly indicate that prescribed burning is one of the most cost effective methods to reduce competition from woody vegetation. We encourage the Water Protection Fund Committee to join in supporting the wise use of prescribed fire to restore the health and vigor of our watersheds.

Sincerely,

A handwritten signature in cursive script that reads "Glenn Frederick".

Glenn Frederick  
Habitat Specialist

cc: Ed Brunson, Preserve Manager, The Nature Conservancy





# United States Department of the Interior

## BUREAU OF LAND MANAGEMENT

Safford Field Office

711 14th Avenue

Safford, AZ 85546-3321

(520) 348-4400

In reply refer to:

1782

(040)

The Nature Conservancy  
300 East University #230  
Tucson, Az 85705

Gentlemen:

The Bureau of Land Management supports the application and proposal prepared by the Nature Conservancy to acquire funding from the Arizona Water Protection Fund for watershed enhancement through prescribed fires.

The Safford and Tucson Field Offices of the Bureau of Land Management have been working with The Nature Conservancy to develop a management plan for the Muleshoe Ranch that includes fire management needs. Both the Bureau of Land Management and the Nature Conservancy agree that with fire management, including prescribed burning, the watersheds of portions of the ranch, as described in the Arizona Water Protection Fund application, will be significantly improved.

There is an existing Cooperative Management Agreement between the Nature Conservancy, Bureau of Land Management and the U.S. Forest Service. We feel the proposed burns would improve watershed conditions by decreasing woody shrubs and increasing native grasses. This in turn would improve condition and function of the watersheds in the Bass, Hot Springs, Double R and Wildcat Creeks.

This letter can be used as a part of the application, to indicate support from the Safford Field Office of the Bureau of Land Management.

Sincerely,

Vernon L. Saline  
Program Manager for  
Planning & Monitoring



Rediscover Your Public Lands



William and Mary McDonald

## McDonald Cattle Company, Inc.

1553 10th Street • Douglas, AZ 85607 • (602) 558-2475

Arizona Water Protection Fund Commission  
John Keane, Commission Chair  
Arizona Department of Water Resources

July 24, 1997

Dear Mr. Keane:

I have been asked to comment on my experience with prescribed fire as a tool to restore rangeland health and usefulness. This is in connection with the proposal by the Muleshoe Ranch to the Water Protection Fund entitled "Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch CMA".

I am the fifth generation on my family's cattle ranch in southeastern Cochise County. Over the past four years, through prescribed burning and a flexible response to natural fire starts, we have impacted over 8,000 acres of our 21,000 acre ranch with fire. Because of a cooperative effort here between landowners and government agencies, over 100,000 acres has been impacted by fire in our area since 1993. In almost every case, the result of these burns has been more grass cover and decreased shrub and small tree presence and, within a short time, improved watershed function. Almost all of the burning has taken place in June and July, when fires naturally would occur in our area. Usually monsoon rains follow the burns within a month's time. The grass response is sometimes nearly unbelievable and the kill rate on whitethorn, mesquite, juniper and other major water grabbers in the uplands is often significant. The kill on broomweed, burroweed, and turpentine bush is always significant. Most all of our fires have occurred on land which is also grazed by livestock. In the case of the prescribed burns, we have made an effort to defer grazing for a growing season prior, in the area to be burned, in order to enhance the fuel height and density to better impact the targeted brush species. We recently completed a 12,500 acre prescribed burn which included part of my ranch. Two years ago, a 6,000 acre prescribed burn was completed nearby. Each of these burns contained numerous monitoring plots which were established within their boundaries prior to ignition and we will soon have the data to verify what our eyes are telling us.

I encourage all land managers to consider fire as a primary tool in striving to reach their goals for uplands and riparian areas and I encourage those who have the means, such as the Water Protection Fund, to support them in their efforts.

Sincerely,

Bill McDonald

Saguaro Juniper Corp.  
2018 W. Los Reales Rd.  
Tucson, AZ 85746  
July 20, 1997

Ed Brunson  
The Nature Conservancy, Arizona Chapter  
300 E. University Blvd., Suite 230  
Tucson, AZ 85705

Re. Arizona Water Protection Fund Proposal

Dear Mr. Brunson,

This is a letter in support of your grant proposal to the Arizona Water Protection Fund Commission entitled "Watershed improvement to restore riparian and aquatic habitat on the Muleshoe Ranch Cooperative Management Area". Saguaro Juniper's state lease land and private deeded land includes approximately 2.5 miles of Hot Springs Canyon immediately downstream from the Muleshoe. Volunteers from Saguaro Juniper trained by a BLM hydrologist monitor stream flow in Hot Springs Creek about once a month near the Saguaro Juniper/Muleshoe boundary. The perennial flow of Hot Springs Creek extends from 1/4 to 1/2 mile into our lease land throughout most years. It seems to us that the proposed plan has a real chance to extend the perennial base flow downstream with benefits to both native vegetation and wildlife. The proposal also addresses problems related to frequent and eroding floods. We estimate we have lost over four acres of prime bottom land in three major flood since 1989. Currently, erosion threatens to destroy an important windmill on our land. We will benefit greatly from efforts to decrease frequency and intensity of floods.

We think that this proposal is well conceived and based on the Coordinated Resource Management Plan that represents years of planning and community input. We particularly support the plan to do prescribed burns and feel that the funding requested here will provide resources to do the burns in a way that will maximize their beneficial effect. We also feel that the ongoing resource monitoring program will provide information of benefit to us as we try to understand our impact on the Hot Springs Canyon ecosystem.

We hope that the Arizona Water Protection Fund Commission reviews your proposal favorably and funds it.

Sincerely,



Thomas V. Orum,  
Secretary



---

**Redington Natural Resource Conservation District**  
247 South Curtis - Willcox, AZ 85643

July 24, 1997

Ed Brunson, Preserve Manager  
The Nature Conservancy, AZ Chapter  
P.O. Box 5385  
Oracle, AZ 85623

Subject: Water Protection Fund Grant Proposal  
Watershed Improvement to Restore Riparian and  
Aquatic Habitat on the Muleshoe Ranch CMA

The Redington Natural Resource Conservation District board members have reviewed and discussed the Muleshoe Water Protection Fund grant proposal with Preserve Manager, Ed Brunson. We fully support this watershed improvement project and urge the Arizona Water Protection Fund Commission to give favorable consideration to the award of a grant.

The watershed improvements that will occur as a result of this project will directly benefit the Redington NRCD (located at the lower part of the watershed) and tie in with our current riparian improvement projects. The planned practices will have a direct beneficial affect on us by, reducing flooding frequency and intensity, and reducing soil loss and sedimentation in the riparian area.

This project will be of value towards watershed restoration, and the Redington NRCD offers its support to this grant application.

Sincerely,

A handwritten signature in cursive script that reads "Barbara Clark".

Barbara Clark, Chairwoman  
Redington NRCD