

Arizona Strip Desert Bighorn Sheep Management Plan, as amended

May 2001

Prepared by The Bighorn Sheep Core Team

John Goodwin, AGFD
Michael Herder, BLM
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Rick Langley, AGFD
Robert Price, AGFD
John Sims, AGFD
Mike Small, BLM

BLM Arizona Strip Field Office
345 E. Riverside Drive
St. George, UT 84790
(435) 688-3200

Arizona Game and Fish Department
3500 South Lake Mary Road
Flagstaff, AZ 86001-9342
(520) 774-5045

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Mike Small, BLM

Approved by:


Field Manager, Arizona Strip BLM

8/22/01
Date


Regional Supervisor, Arizona Game and Fish Department

8/26/01
Date

INTRODUCTION

Desert bighorn sheep (*Ovis canadensis nelsoni*) are presently found on the Arizona Strip, but are generally believed to have been more abundant and more widely distributed historically. These animals are highly valued by the public for wildlife viewing, photography, and hunting opportunities. Bighorn sheep were essentially extirpated from the Arizona Strip by the early 1900's, except in lower Kanab Creek and the Grand Wash Cliffs. Since the late 1970's, the Arizona Game and Fish Department (AGFD) and the Bureau of Land Management (BLM) have been cooperatively working to re-introduce desert bighorn sheep to the Arizona Strip. Overall, these re-introduction efforts have been successful. As of the beginning of 2001, there were four separate populations of desert bighorn occupying four distinct habitat areas on the Strip: the Virgin and Beaver Dam Mountains, Grand Wash Cliffs, Kanab Creek, and Paria - Vermillion Cliffs (Map 1). The four desert bighorn populations were essentially stable, with a total population of approximately 550 animals on BLM administered lands. One additional habitat area, the Hurricane Cliffs Habitat Area has been identified, but is currently unoccupied. The delineation of this habitat area is the primary reason for amending the 1997 Arizona Strip Desert Bighorn Sheep Management Plan.

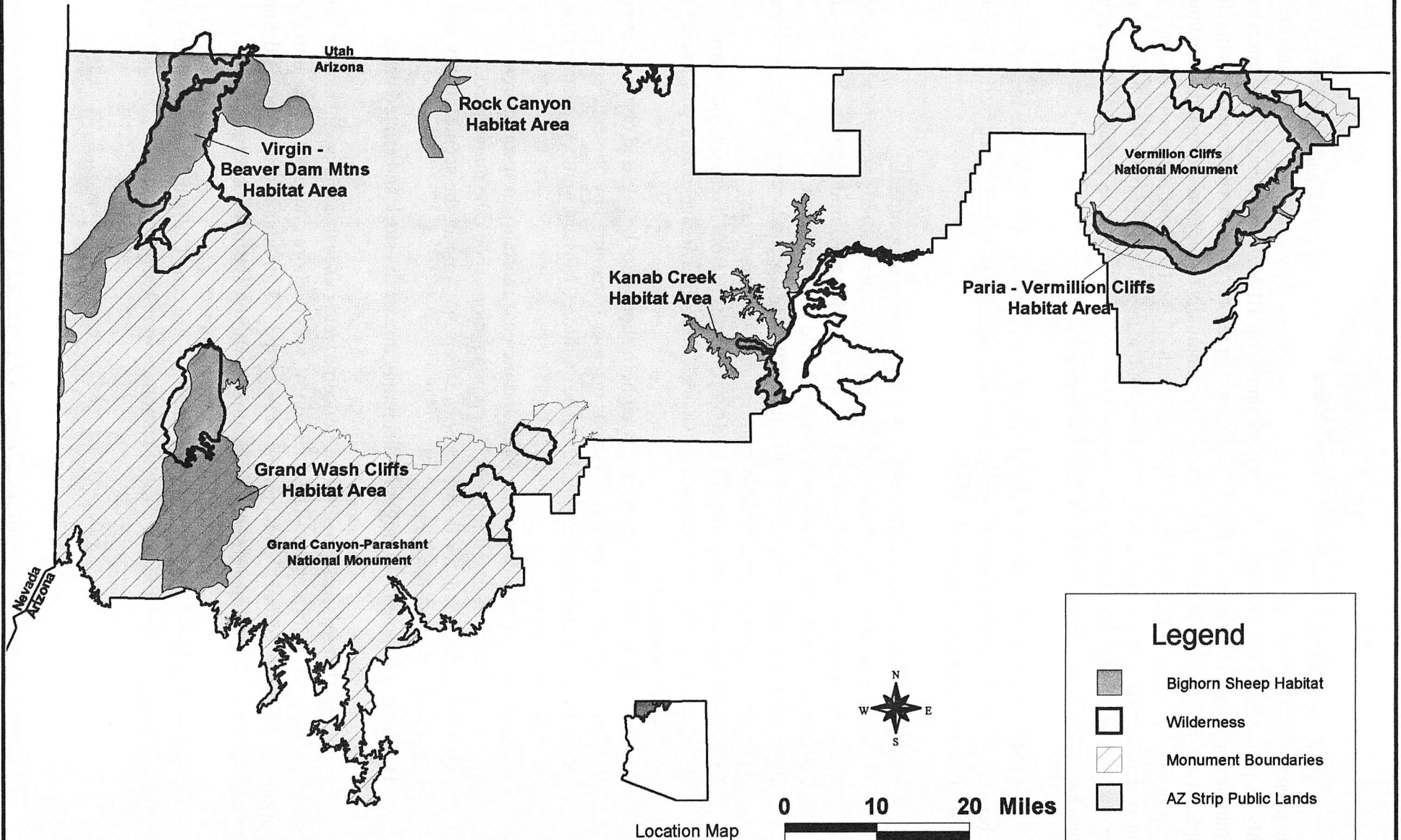
Bighorn sheep in Arizona are managed in accordance with guidance provided in the BLM publication *Mountain Sheep Ecosystem Management Strategy in the 11 Western States and Alaska* (September 1995) and the Arizona Game and Fish Department's *Wildlife 2000 Strategic Plan*. Public lands administered by the Arizona Strip BLM are managed in accordance with decisions detailed in the 1992 Arizona Strip Resource Management Plan (RMP). The RMP provides a means for accomplishing wildlife management objectives through the habitat management plan (HMP) process.

Of the five desert bighorn sheep habitat areas on the Arizona Strip, three are either partially or totally within either the recently designated Vermilion Cliffs or Grand Canyon-Parashant National Monuments. In accordance with the Presidential proclamations designating these areas as national monuments, actions which do not conflict with the established purposes of the Monuments may continue. Restoring native bighorn sheep generally enhances Monument resources. Therefore, actions described in this plan amendment are compatible with BLM interim guidance for the Monuments. However, projects and releases which occur within the Monuments will be reviewed individually for compatibility with the Proclamation and interim management guidance.

Most bighorn sheep population objectives listed in HMPs were met by 1996. However, substantial portions of suitable bighorn habitat remained unoccupied. In an effort to develop a consistent approach for future desert bighorn sheep management on the Arizona Strip, a team of biologists was assembled to develop a management strategy. The Core Team was assembled from BLM biologists responsible for managing bighorn sheep habitat on the Arizona Strip; AGFD wildlife managers from Game Management Units (GMUs) 12B, 13A and 13B; and AGFD habitat specialists or game biologists. The Core Team met six times over a two year period to develop the objectives and list of management actions in the original document.

Map 1. Desert Bighorn Sheep Habitat

Public Lands Administered by the Arizona Strip BLM



This Amended Plan presents the objectives, management actions, and monitoring strategy for the purpose of directing future bighorn management on the Arizona Strip. These guidelines apply only to public lands administered by the Arizona Strip BLM. The Plan is also intended to be dynamic and adaptive, to respond rapidly to changes in resource needs, while meeting objectives for bighorn sheep. This Amended Plan will be reviewed annually by the Core Team with assistance from geographically-based interdisciplinary teams for each of the five habitat areas to balance bighorn sheep management on the Arizona Strip with other public land uses. The objectives and management actions for desert bighorn sheep in this Plan amend and replace those found in the Black Rock, Parashant, and Paria - Kanab Creek Habitat Management Plans.

Public concerns and issues were elicited by mailing out 665 requests for information in February, 1996 about bighorn sheep management on public lands administered by the Arizona Strip BLM. Issues and concerns raised include:

1. Suitable bighorn sheep habitat on the Arizona Strip is unoccupied.
2. Bighorn sheep add to the aesthetics and recreation experience in areas where they are found.
3. Water availability, especially during summer months, may limit bighorn sheep distribution and habitat utilization. Developed waters should be maintained.
4. Bighorn sheep tend to concentrate locally, particularly around water sources, and may cause damage to vegetation, watersheds, cultural and other resources.
5. Bighorn sheep are moderately affected by competition from livestock and burros.
6. Bighorn sheep may compete with livestock for range forage plants and impact grazing allotment management.
7. Sick, injured or otherwise unfit desert bighorn should not be released on the Arizona Strip.
8. Bighorn sheep are susceptible to various diseases transmitted by domestic sheep.
9. Desert bighorn sheep populations should be monitored to assess numbers, distribution, health, and resource impacts.
10. Human activities may disturb lambing and increase mortality in specific areas.
11. Genetic diversity of desert bighorn sheep populations should be maintained.
12. Habitat developments for desert bighorn sheep may impact the scenic quality and natural component of wilderness areas.
13. Habitat developments for bighorn sheep may impact livestock and related uses.

In addition to the issues listed above, concerns were raised that management agencies should cooperate and share information. The question of why bighorn sheep are being introduced and relationship between releases and hunting was raised. Individuals also expressed support or opposition to the plan to expand sheep distributions without specific concerns.

In amending the original plan to include the Hurricane Cliffs habitat area over 100 letters went out soliciting public concerns. Eight responses were received, but no significant issues were raised.

BACKGROUND

The Arizona Strip consists of those lands in Arizona north and west of the Colorado River. Most of these lands are federally administered by either the National Park Service, U.S. Forest Service, or BLM. Other land ownership includes Indian, private, and state. This plan addresses only BLM administered lands. However, bighorn sheep populations also occur on adjacent National Park Service and U.S. Forest Service lands on the Arizona Strip.

Bighorn sheep were historically present in the Virgin and Beaver Dam Mountains, Grand Wash Cliffs, Kanab Creek and the Paria Canyon - Vermillion Cliffs areas. By the early 1900s desert bighorn were believed extirpated from the Virgin and Beaver Dam Mountains and Paria Canyon - Vermillion Cliffs areas. Small remnant populations were still extant in the Grand Wash Cliffs and Kanab Creek through the early 1980s when supplemental transplants began. By 1996, bighorn sheep had been reintroduced into each of these four Habitat Areas.

Desert Bighorn Sheep Habitat

Desert bighorn sheep habitat was identified from habitat analyses for each of the three HMPs. Habitat was rated by evaluating a combination of slope, topography, aspect, vegetation, proximity to escape cover, and water availability based upon the model described by Charles G. Hansen (1980. Habitat Evaluation in *The Desert Bighorn, Its Life History, Ecology and Management*. Eds. Gale Monson and Lowell Sumner. pp.320-335). Habitat areas were mapped on and digitized from USGS quads for preparation of the Arizona Strip RMP. Most of the steeper terrain was included. To escape predators bighorn sheep prefer rough, rocky terrain with slopes greater than 20 percent, and are rarely found far from this escape cover.

The absence of perennial water did not necessarily exclude an area from consideration as bighorn habitat. Recent literature on water availability in bighorn habitat indicates that desert sheep may be able to obtain some of the moisture they need from succulent vegetation. During the hot summer months, wild sheep stay in shaded areas near water as much as possible and are seldom found more than three miles from dependable water sources. When rain or snowfall occurs, bighorn sheep expand their use of suitable habitat and range out from permanent waters. They also commonly drink from ephemeral pools of water found in rock pockets. Bighorn sheep may be found in woodland habitats on canyon rims throughout the year.

Virgin and Beaver Dam Mountains

The Virgin and Beaver Dam Mountains Habitat Area is located entirely within AGFD Game Management Unit (GMU) 13B (Map 2). The Habitat Area includes over 220 square miles (141,770 acres) of bighorn habitat on BLM lands. The vegetation is primarily Mohave desert shrub community. Dominant species include creosote bush (*Larrea tridentata*) and Joshua tree (*Yucca brevifolia*) in the Virgin River Gorge and Beaver Dam Slope. Higher elevations are dominated by blackbrush (*Coleogyne ramosissima*) merging into pinyon-juniper woodlands (*Pinus monophylla* and *Juniperus osteosperma*).

Reliable permanent waters include the Virgin River, a number of perennial springs in Hedricks, Frehner, Hancock, and Elbow Canyons, and two wildlife catchments at Figure 4 Canyon and above Hatchet Valley. This habitat area borders a block of suitable bighorn habitat administered by the BLM in Nevada and Utah. However, this plan does not address those lands.

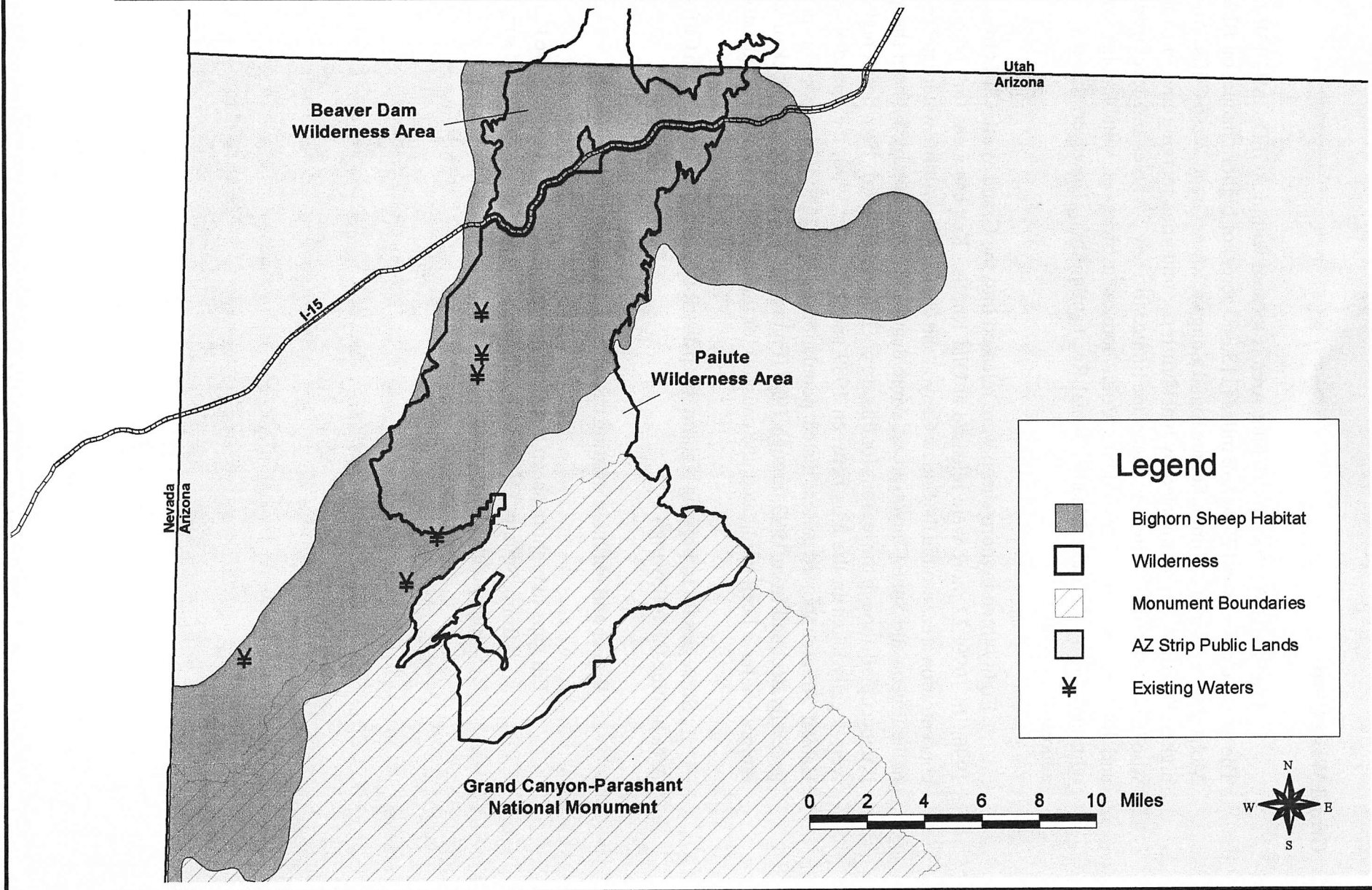
Sixty-two desert bighorn were released into the Virgin and Beaver Dam Mountains from 1979 to 1982 in three locations. Transplants at Buck and Hedricks Springs failed to establish sustainable populations. Key habitat use areas for bighorn sheep include concentration areas along the Virgin River and at reliable waters in the Virgin and Beaver Dam Mountains. More than 86% of the suitable bighorn sheep habitat is unoccupied, though the reasons for this are not fully understood. Bighorn sheep hunts were initiated in the area in 1989. Nine bighorn rams were legally taken from 1989 through 1996. In 1996, the area supported an estimated population of 120 desert bighorn. The population was stable from 1990 through 1996 (Figure 1).

Strategies for improving bighorn sheep distributions in the Virgin and Beaver Dam Mountains Habitat Area include the following:

- Repair and maintain existing catchments and spring developments.
- Extend bighorn sheep distributions along the Virgin River from the northern most I15 Bridge to the Utah State Line and in the Virgin Mountains from Figure 4 Canyon to Lime Kiln Canyon by conducting supplemental transplants at new or existing waters.

Map 2. Virgin - Beaver Dam Mountains Bighorn Sheep Habitat Area

Public Lands Administered by the Arizona Strip BLM



Grand Wash Cliffs

The Grand Wash Cliffs Habitat Area is located within AGFD GMU 13B (Map 3). The area includes over 175 square miles (113,360 acres) of bighorn habitat on BLM lands. Mohave desert shrub communities are found along the lower Grand Wash Cliffs. Middle and higher elevations are dominated by blackbrush communities merging into pinyon-juniper woodlands. Reliable permanent waters are limited to a few pot holes and developed wildlife and livestock waters. This Habitat Area borders a block of suitable bighorn habitat administered by the Lake Mead National Recreation Area. However, this plan does not address those lands.

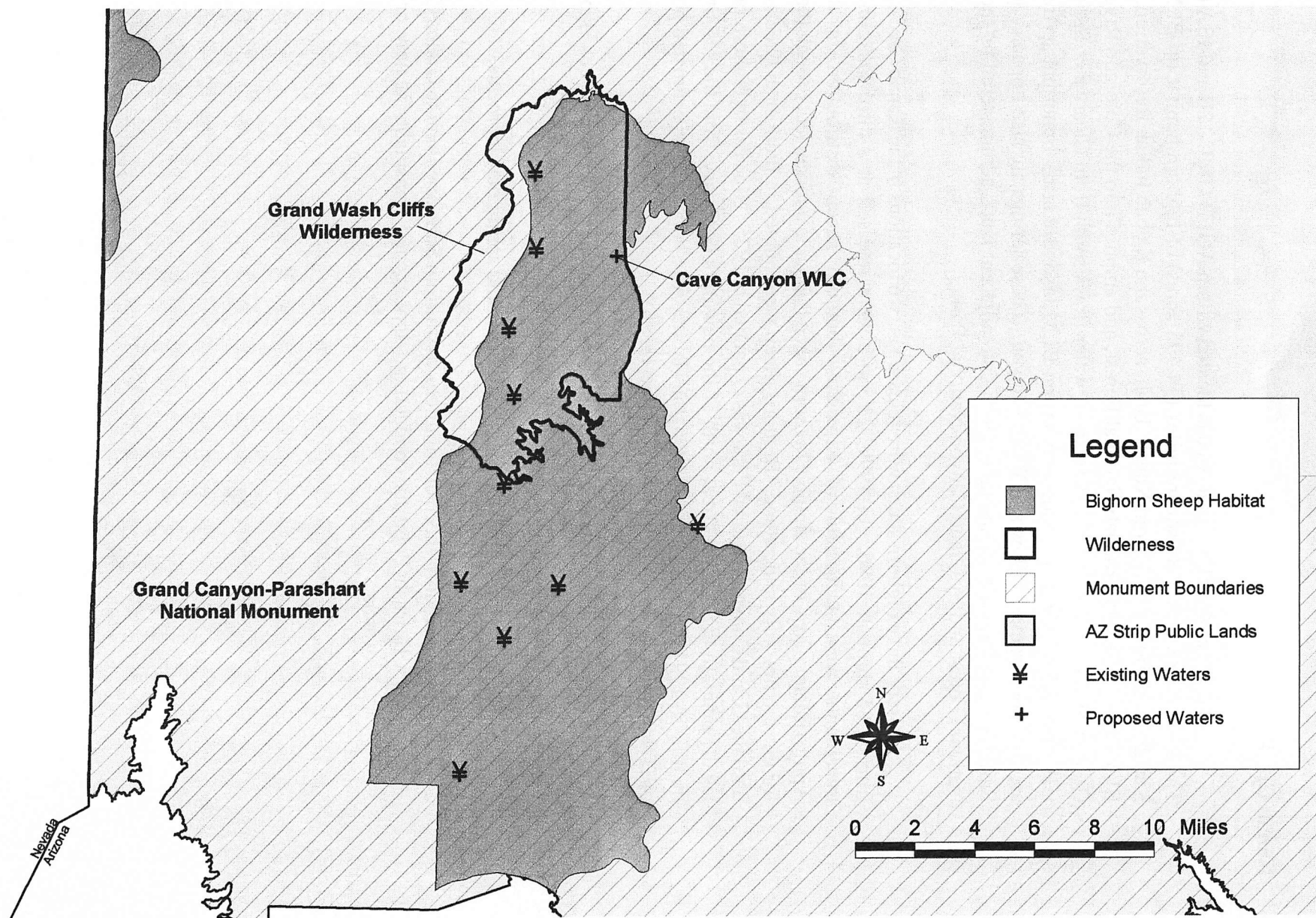
Eighty-three bighorn sheep were released into the Grand Wash Cliffs from 1983 to 1996. In 1999, 22 more were released at Olaf Knolls. Key use areas for bighorn include concentration areas around the Squaw Canyon and Olaf Knolls wildlife water catchments, and in the Pigeon and Snap Canyon areas. More than 87% of the suitable bighorn sheep habitat is unoccupied, though the reasons for this are not fully understood. Four desert bighorn rams were legally taken in the area between 1989 and 1996. In 1996, the Grand Wash Cliffs Habitat Area supported an estimated population of 90 bighorn sheep. The population generally declined from 1993 through 1995 (Figure 1). While predation, lack of water and emigration have been implicated, the cause(s) for the decline are not fully understood.

Strategies for improving bighorn sheep distributions in the Grand Wash Cliffs Habitat Area include the following:

- Repair and maintain existing catchments and spring developments.
- Fill gaps in bighorn sheep distributions from Hidden Canyon to Cave Canyon and from Squaw Canyon to Pigeon Canyon by conducting supplemental transplants at new or existing waters.

Map 3. Grand Wash Cliffs Desert Bighorn Habitat Area

Public Lands Administered by the Arizona Strip BLM



Kanab Creek

The Kanab Creek Habitat Area is located within AGFD GMU 12B and 13A (Map 4). The area includes over 85 square miles (54,495 acres) of bighorn habitat on BLM lands. Kanab Creek flows south from Kanab, Utah, across the Kaibab Indian Reservation, through BLM land, crosses the Kaibab National Forest, and empties into the Colorado River within Grand Canyon National Park. Permanent water flows south from Clearwater Spring for at least five miles. The major side canyons on BLM lands are arid. Important springs in the area include Grama, Willow and Water Canyon. These springs are also impacted by cattle. Suitable occupied bighorn habitat extends onto adjacent lands administered by the Kaibab National Forest and by Grand Canyon National Park.

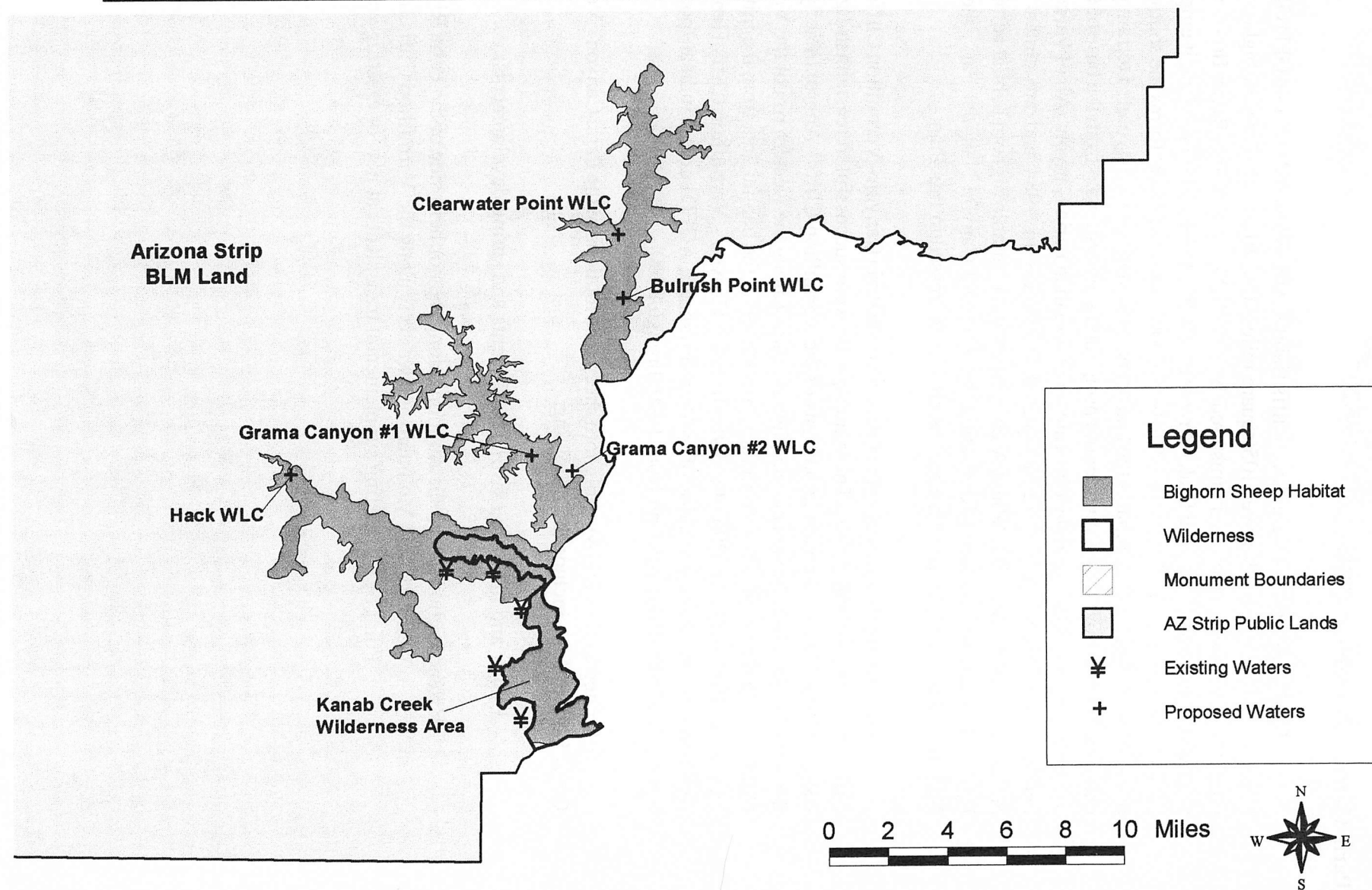
Sixty-three bighorn sheep were released at two locations in the Kanab Creek drainage from 1985 through 1996. In 1999, 22 more were released at a third location. These transplants were successful in expanding bighorn sheep distribution in the area. Approximately 20% of the suitable bighorn sheep habitat is unoccupied, though the reasons for this are not fully understood. Bighorn sheep were hunted in the Kanab Creek drainage until the Grand Canyon National Park was expanded in 1975. Nine desert bighorn rams were legally taken in the Habitat Area, north of the new park boundary, from the re-initiation of hunting in 1991 through 1996. In 1996, the Habitat Area supported an estimated population of 200 bighorn sheep on BLM lands (Figure 1).

Strategies for improving bighorn sheep distributions in the Kanab Creek Habitat Area include:

- Repair and maintain existing catchments and spring developments.
- Extend bighorn sheep distributions north from Sunshine Point to Grama Canyon at Bulrush Point by conducting supplemental transplants at new or existing waters.

Map 4. Kanab Creek Desert Bighorn Sheep Habitat Area

Public Lands Administered by the Arizona Strip BLM



Paria Canyon - Vermillion Cliffs

The Paria Canyon - Vermillion Cliffs Habitat Area is located within AGFD GMU 12B (Map 5). The area includes over 105 square miles (62,030 acres) of desert bighorn habitat on public lands in Arizona administered by the BLM. The Paria River flows yearlong through Paria Canyon from the Utah - Arizona state line to Lee's Ferry, where it empties into the Colorado River. The Vermillion Cliffs, a 3,000 foot escarpment forms the southern edge of the Paria Plateau and dominates the landscape. The rough and convoluted terrain provides excellent bighorn habitat. A number of springs and seeps emanate from the base of the cliffs and side canyons. However, the cliffs are more arid than Paria Canyon. All of Paria Canyon and the Vermillion Cliffs were designated wilderness in 1984 and are almost entirely administered by BLM. The Habitat Area borders other suitable bighorn habitat administered by the Glen Canyon National Recreation Area, Grand Canyon National Park, the Navajo Nation, and the Utah BLM. These areas are not addressed in this Plan.

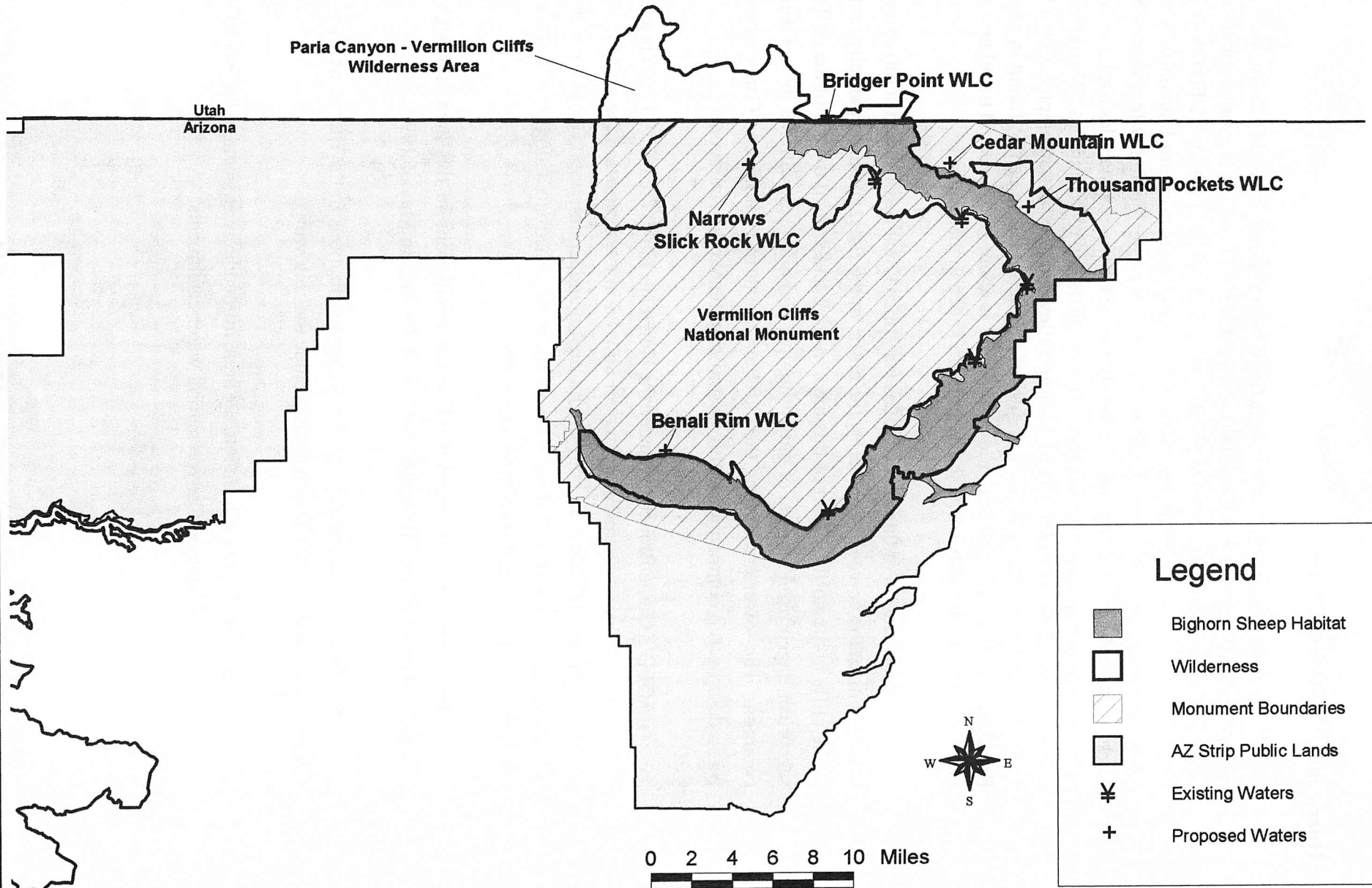
Fifty-two bighorn sheep were released in the Paria Canyon - Vermillion Cliffs Habitat Area from 1984 through 1985. These transplants were successful in reestablishing bighorn sheep in Paria Canyon and along portions of the Vermillion Cliffs. Approximately 65% of the suitable bighorn habitat is unoccupied, primarily along the western rim of the Vermillion Cliffs. A total of 14 desert bighorn rams were taken in the habitat area from the initiation of hunting in 1991 through 1996. In 1996, the Paria Canyon - Vermillion Cliffs Habitat Area supported an estimated population of 140 bighorn sheep. AGFD surveys indicate populations were stable to slightly declining from 1990 through 2000.

Strategies for improving bighorn sheep distributions in the Paria Canyon - Vermillion Cliffs Habitat Area include the following:

- Repair and maintain existing catchments and spring developments.
- Extend bighorn sheep distributions along the northern side of the Paria River in the vicinity Cedar Mountain and westerly along the Vermillion Cliffs from Paria Point by conducting supplemental transplants at new or existing waters.

Map 5. Paria Canyon - Vermilion Cliffs Desert Bighorn Sheep Habitat Area

Public Lands Administered by the Arizona Strip BLM



Hurricane Cliffs Habitat Area

The Hurricane Cliffs Habitat Area (in the vicinity of Rock and Cottonwood Canyons) includes at least 15 square miles (9600 acres) of potential desert bighorn habitat on public lands in Arizona administered by the BLM. The area is located within AGFD GMU 13B and GMU 13A, with the Utah/Arizona state line serving as its northern boundary. Unlike the other Arizona Strip bighorn habitat areas, it contains no designated wilderness or National Monument lands. The topography of the Hurricane Cliffs area includes a relatively narrow band of steep and rugged terrain with sections of cliffs and rock outcrops. The terrain above and below the cliffs is level to slightly rolling valley and plateau topography. Overall aspect of the area is west-northwest, but a variety of different aspects can be found in and around Rock and Cottonwood Canyons. Elevation relief is about 1000 feet and travel up and down the terrain could be easily traversed by bighorn sheep in many areas.

The vegetation of this area includes very open Great Basin desert scrub communities overall with creosote vegetation below the cliffs, in the flats, and even partially up the base of the cliffs in the northern part of this area. Above and around the top of the cliffs are big sagebrush, sagebrush/cliffrose, or pinyon-juniper communities, with the former being more common. The lower areas along the cliffs and south of Cottonwood Canyon have Great Basin desert scrub communities with a significant blackbrush component.

AGFD's Game Branch evaluated the Hurricane Cliffs area in 1995. This area scored well under the Cunningham/Brown model utilized in the evaluation (score 51). There are natural catchments (tinajas) in both Rock Canyon and Cottonwood Canyon which provide perennial water to the area. Additional waters may be constructed along the Hurricane Cliffs in the future, but would probably not be needed.

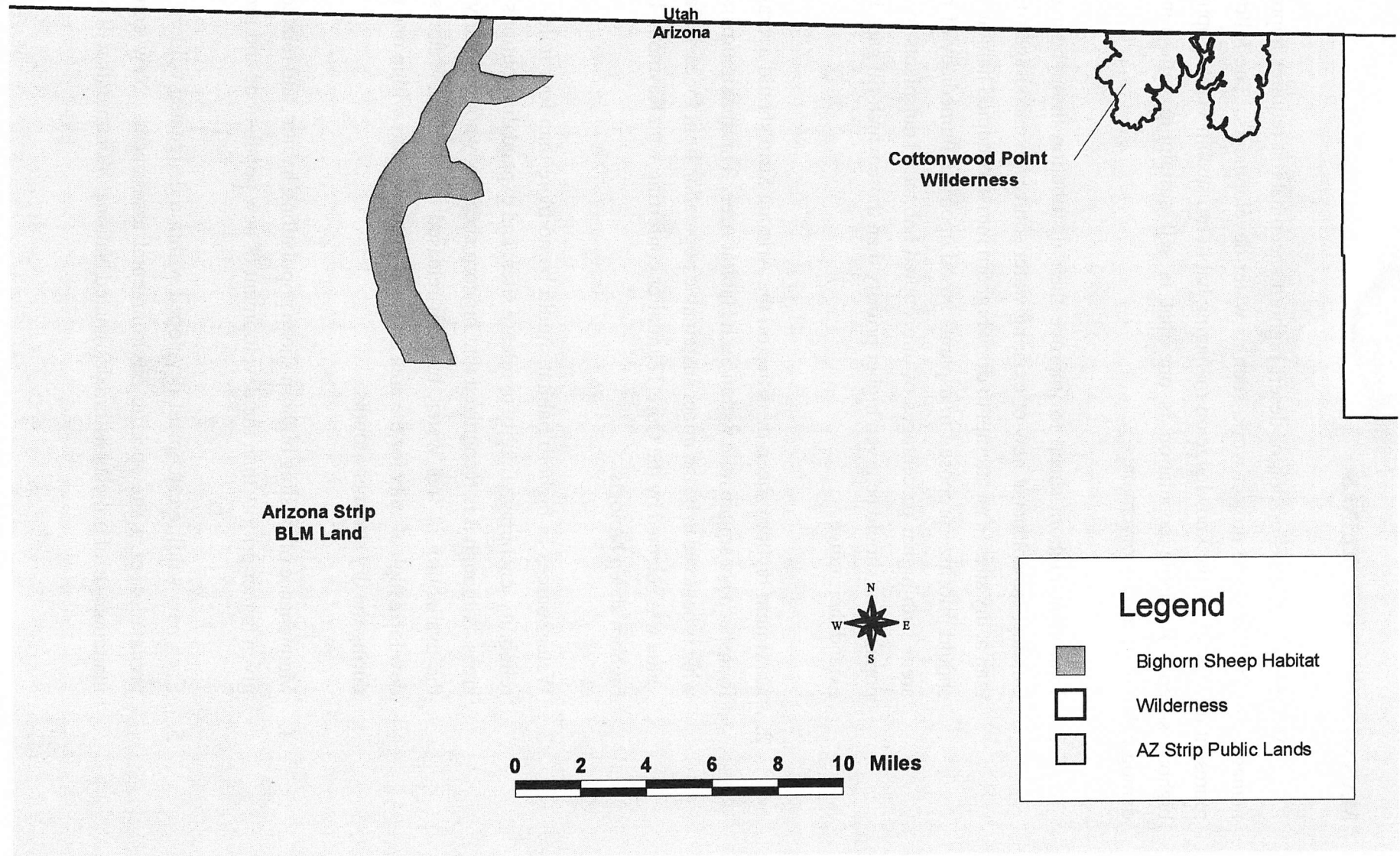
There are currently no known bighorn populations in this area, although a BLM employee spotted a lone ram within 5 miles of this area in May of 1999.

Strategies for improving bighorn sheep distributions in the Hurricane Cliffs – Rock Canyon and Cottonwood Canyon areas include the following:

- Transplant bighorn sheep into the area, immediately adjacent to the Rock Canyon or Cottonwood Canyon natural water catchments.

Map 6. Hurricane Cliffs Bighorn Sheep Habitat Area

Public Lands Administered by the Arizona Strip BLM



MANAGEMENT GUIDELINES

Maintenance and restoration of desert bighorn sheep habitat requires appropriate land-use management in addition to project work, such as water developments. The following guidelines represent the best available knowledge on managing habitat to sustain viable populations of desert bighorn sheep. A viable population is one that is self sustaining with minimal long-term demographic or genetic intervention.

1. Transplant bighorn sheep to improve their distribution throughout suitable habitat. Conduct transplants at new or existing water sources to encourage site fidelity, rather than at dry sites in an attempt to draw bighorn into unoccupied habitat. The Core Team should prioritize proposed transplants based upon the immediacy of need and habitat areas with higher percentages of unoccupied habitat. Transplants to support existing populations should be given higher priority than those which fill gaps in distribution or extend their range.
2. Maximum bighorn sheep densities on the Arizona Strip should average no more than four sheep per square mile within each Habitat Area. This maximum number represents what is believed to be the upper sustainable population limit for each Habitat Area. This value was selected by the Core Team after conferring with Raymond Lee, noted desert bighorn sheep biologist.
3. Water sources in bighorn habitat should be no more than four miles apart to provide reliability, encourage fidelity to release sites, and expand distributions into unoccupied areas. Although it is recognized that bighorn sheep may not be totally dependant upon the availability of free water, bighorn released at perennial water sources typically develop a high affinity for the area and tend to concentrate within one mile of the water during the dry summer months.
4. Maintenance of existing bighorn sheep populations, habitat, and related projects will be given higher priority than the development of new populations and projects.
5. Each new wildlife catchment developed within a designated wilderness area requires preparation of a site specific environmental assessment. New construction and/or maintenance of projects within designated National Monuments will be consistent with

the interim guidance until such time as Monument management plans are finalized. For non-wilderness area and non-Monument wildlife catchments proposed in this plan, the environmental assessment and accompanying record of decision provide sufficient evaluation of impacts. No additional site specific environmental analysis would be conducted for non-wilderness catchments.

6. Bighorn sheep should only be introduced into areas where domestic sheep are not permitted. This will be a significant consideration when introductions are proposed along the Arizona-Utah and Arizona-Nevada state lines, near the Navajo Nation, and close to private property where domestic sheep are raised.
7. No domestic sheep grazing will be allowed within nine miles of bighorn habitat areas on the Arizona Strip. Domestic sheep grazing will not be authorized in areas on the Strip that are adjacent to bighorn habitat in accordance with the Arizona Strip RMP.
8. Key use areas, such as lambing grounds, migration routes, and areas within one mile of reliable waters, should be identified and monitored. Seasonal use restrictions may be imposed upon activities that could impact these areas, such as commercial recreation activities and mineral development. Bighorn sheep will likely concentrate in key use areas rather than distribute evenly across their habitat. Conflicts between bighorn use and other activities in key areas will be resolved on a case by case basis.
9. When utilization of vegetation in key desert bighorn sheep use areas exceeds 50% of the current year's growth, impacts will be evaluated. Other types of resource impacts will be assessed on a case by case basis. In the event that resource damage is attributed to or related to desert bighorn sheep, actions will be taken to mitigate the problem. Such actions include, but are not limited to, fencing, removal, relocation, regulated hunting, vegetative treatments, or water developments. These guidelines recognize that favored watering areas often receive heavy animal impacts and that some sacrifice zones are to be expected.
10. Fencing will be avoided around bighorn waters, except where necessary to reserve water for wildlife. Fencing may be necessary to exclude livestock while allowing bighorn sheep to pass or to exclude bighorn from sensitive resource areas. Bighorn sheep-passable fences will be in accordance with BLM standards (Fencing Handbook 1741-1,

USDI, BLM 1989). Rationale for departures from the standards described in the Fencing Handbook must be documented.

11. Other public land uses such as livestock (cattle) grazing, recreation, mineral development, off-road vehicle activities, road construction, special status species management, etc., within desert bighorn habitat will be managed in accordance with the Arizona Strip RMP to ensure objectives for desert bighorn are being achieved and that adequate coordination with other users occurs.
12. Unpermitted exotic animals which may appear within bighorn Habitat Areas will be eradicated consistent with state and federal laws.
13. Wild burros will be managed in accordance with the Arizona Strip RMP.
14. Management actions for desert bighorn sheep within designated wilderness areas will be implemented in a manner consistent with conservation of wilderness values as defined in the applicable wilderness management plans.
15. The Core Team will meet at least annually to review and prioritize desert bighorn sheep management projects with assistance from an interdisciplinary team to balance bighorn sheep management on the Arizona Strip with other public land uses. Projects will be prioritized in accordance with Management Guidelines 1 and 4.
16. The Core Team should coordinate with adjacent land owners and managers to ensure the uniformity of goals and objectives for managing bighorn sheep across geo-political boundaries.

INFORMATION NEEDS AND STANDARDS

Monitoring of bighorn sheep populations and habitats is essential to determine if management objectives are being achieved. Monitoring is necessary to obtain specific information such as the success of population transplants, mortality levels, the extent of movements, or competition with other ungulates. Studies will be conducted as information is needed for management and as funding is available. Studies may include, but are not limited to, vegetation condition, movement/distribution, population trends, health/disease monitoring, and genetic studies.

FUTURE ACTIVITIES, PLAN REVISIONS, AND EVALUATIONS

Long-range plans incorporating vast areas must be adaptive if they are to continue to be useful as management guidelines. Therefore, the stated goal, objectives, and guidelines described in this plan will be revised as necessary. Management practices and information needs will be modified or amended as new information becomes available. The Core Team will evaluate the success of bighorn sheep management actions on the Arizona Strip and amend or revise this plan as necessary with appropriate public involvement. The Core Team will meet at least annually to evaluate information from inventory, monitoring, and research to assess progress towards meeting the stated objectives, schedule proposed transplants or removals, plan water development maintenance and construction actions, and address information needs. Results and recommendations of the team will be summarized and presented at annual AGFD - BLM coordination meetings.

The recommendations of the team are shown in the Implementation Schedules (Appendices A-C), which lists proposed projects, releases, and maintenance in priority order. Appendices A-C will be revised annually and the priority order may change.

Compatibility with this desert bighorn sheep plan amendment and the designation and management of both the Grand Canyon-Parashant and the Vermilion Cliffs National Monuments is important. BLM and AGFD activities related to desert bighorn sheep management inside the Monuments, such as new projects and releases, will be consistent with the interim guidance until such time as Monument management plans are finalized. The final Monument management plans will provide overall direction for their lands, once these plans are approved.

Copies of this amended plan will be available to the public upon request. The Core Team member will have a copy of the amended plan in a loose-leaf binder for ease of updating.

GOAL: Achieve healthy, well distributed bighorn sheep populations throughout suitable habitat on public lands administered by the Arizona Strip BLM.

Objectives

BS1 - Enhance and maintain forage, water, and cover conditions on 585 square miles of bighorn sheep habitat so that watersheds are in proper functioning condition, ecological processes are maintained, water quality standards are met, and T/E species habitat is conserved. Manage this habitat to support an average density of no more than four sheep per square mile within each habitat area by the year 2010 (Table 1).

Planned Actions

BS1a - BLM and AGFD will identify and map key use areas for bighorn sheep on the Arizona Strip. Additional key areas will be identified and mapped as bighorn populations expand into suitable habitat.

BS1b - BLM and AGFD will incorporate key forage species and cover components for bighorn into desired plant community prescriptions within applicable planning documents for the Arizona Strip.

BS1c - AGFD will conduct habitat assessments in each Habitat Area to refine bighorn sheep population density objectives. Conduct other habitat studies as necessary.

BS1d - BLM and AGFD will identify annually developments in bighorn habitat which do not provide reliable water or which pose hazards to safe access by bighorn sheep. BLM and/or AGFD will modify, repair or reconstruct existing developments to increase reliability and provide safe access for wildlife (Appendix A).

BS1e - AGFD and/or BLM will construct new water developments for bighorn sheep (Appendix B) where necessary to provide water where none is available to make otherwise suitable, but unoccupied, habitat available.

Evaluation & Monitoring

BS1a - BLM and AGFD will monitor bighorn key use areas as opportunities arise and evaluate their importance to local populations. Evaluate resource damage on a case by case basis.

BS1b - BLM and AGFD will establish forage utilization transects in bighorn habitat to be read every 3 years as population densities approach their maxima. Vegetation impacts will be assessed when use exceeds 50% of current years' growth.

BS1c - The Core Team will refine bighorn population density objectives upon completion of the habitat assessments and make appropriate adjustments.

BS1d - BLM and/or AGFD will monitor the operating condition of bighorn sheep waters using project inspection / maintenance report forms. The Core Team will prioritize repair and reconstruction of projects at annual meetings and summarize in annual HMP evaluations.

BS1e - The Core Team will evaluate the need for and prioritize new habitat developments for bighorn at annual meetings and summarize in annual HMP evaluations.

Objectives

BS2 - Increase populations of desert bighorn sheep to fully occupy 585 square miles of suitable habitat on the Arizona Strip at an average density of no more than four bighorn per square mile by the year 2010. Maximum populations for the four desert bighorn habitat areas would be 886 for the Virgin and Beaver Dam Mountains, 700 for the Grand Wash Cliffs, 340 for Kanab Creek, and 432 for the Paria - Vermillion Cliffs area. The maximum population for the Arizona Strip would be 2352 desert bighorn.

Planned Actions

BS2a - AGFD, in coordination with BLM, will conduct supplemental releases of desert bighorn sheep at sites identified by the Core Team (Appendix C). Additional sites may be added to the list at the discretion of the team if necessary to meet bighorn sheep management objectives.

BS2b - In the event that either populations exceed herd management upper limits or resource damage is attributed to bighorn sheep, AGFD, in coordination with BLM, will take action(s) to mitigate the problem. Such actions include, but are not limited to, fencing, removal, relocation, regulated hunting, vegetative treatments, or water developments.

Evaluation & Monitoring

BS2 - AGFD will monitor bighorn population trends by conducting biennial aerial surveys and population estimates. New releases will be prioritized by the Core Team. AGFD will radio-collar a significant percentage of released desert bighorn sheep and monitor to determine distribution, mortality, and key use areas.

TABLE 1. Desert Bighorn Sheep Habitat Areas on the Arizona Strip With 1996 and Potential Maximum Populations Based upon Four Sheep per Square Mile

Habitat Area	Area		Population	
	Square Miles	Acres	1996	Potential Maximum
Virgin and Beaver Dam Mountains	220	141,770	120	880
Grand Wash Cliffs	175	113,360	90	700
Kanab Creek	85	54,495	200	340
Paria - Vermillion Cliffs	105	62,030	140	420
Hurricane Cliffs	15	9,600	0	60
TOTAL for Arizona Strip	585	371,655	550	2400

Implementation Schedules

APPENDIX A. Desert Bighorn Sheep Developments Requiring Maintenance or Reconstruction on the Arizona Strip (April 2001)

Project Name	Location	Problem Description	Date Reported	Date Completed
Virgin and Beaver Dam Mountains Habitat Area				
Hedricks Spring SPD	T.40N., R.14W., Sec 19 NWSW	Repair float box, replace drinker	June 1995	
Virgin Mountain WLC <i>Eng⁴</i>	T.40N., R.14W., Sec 07 NENE	Repair float box & holding tank	June 1995	
Buck Springs Redevelopment	T.38N., R.16W., Sec 12 NESW	Redevelop spring source	April 1993	
Virgin Mountain WLC	T.40N., R.14W., Sec 07 NENE	Does not hold water	April 2001	
Mirage WLC	T.40N., R.14W., Sec 19 NWSW	Tanks do not fill	April 2001	
Hedricks Spring SPD	T.40N., R.14W., Sec 19 NWSW	Float valve failure	April 2001	
Grand Wash Cliffs Habitat Area				
~~Squaw Canyon~~ <i>NAX</i> WLC	T.35N., R.14W., Sec 28 SWSE	Repair torn liner	June 1994	
Overlook WLC	T.34N., R.14W., Sec 31 NENE	Apron not secured	April 2001	
Pick Point WLC	T.33N., R.14W., Sec 04 SWSW	3" pipe broken	April 2001	
Ferguson Pockets North WLC	T.36N., R.14W., Sec 22 NWSE	Does not hold water	April 2001	
<i>Eng Pockets S</i>				

Project Name	Location	Problem Description	Date Reported	Date Completed
Kanab Creek Habitat Area (All bighorn sheep water developments were in good working condition as of 2000)				
Paria Canyon - Vermillion Cliffs Habitat Area (All bighorn sheep water developments were in good working condition as of 2000)				
Hurricane Cliffs Habitat Area (There are no bighorn sheep water developments in this habitat area as of 2001)				

WLC = Wildlife Catchment
SPD = Spring Development

APPENDIX B. Proposed Desert Bighorn Sheep Water Developments On the Arizona Strip in Priority Order (April 2001)

Project Name	Approximate Location	Located In Wilderness or Monument	AGFD Game Unit
Virgin and Beaver Dam Mountains Habitat Area			
Lost Spring Re-development	T.40N., R.14W., Sec 15	Yes	13B
Grand Wash Cliffs Habitat Area			
Cave Canyon WLC	T.36N., R.14W., Sec 34	Yes	13B
Kanab Creek Habitat Area			
Grama Canyon #1 WLC	T.37N., R.4W., Sec 14	No	13A
Grama Canyon #2 WLC	T.37N., R.3W., Sec 19	No	13A
~~Bulrush Point WLC~~ Coop instead	T.38N., R.3W., Sec 32	No	13A
Clearwater Point WLC	T.38N., R.3W., Sec 08	No	13A
~~Hack WLC~~	T.37N., R.5W., Sec 23	No	13A
Paria Canyon - Vermillion Cliffs Habitat Area			
Thousand Pockets Rim WLC	T.41N., R.7E., Sec 21	Yes	12B
Benali Rim WLC	T.39N., R.4E., Sec 22	Yes	12B
Narrows Slick Rock WLC	T.41N., R.5E., Sec 10	Yes	12B
Cedar Mountain WLC	T.41N., R.6E., Sec 11	Yes	12B
Bridger Point WLC	T.42N., R.5E., Sec 35	Yes	12B
Hurricane Cliffs Habitat Area			
(None identified)			

WLC = Wildlife Catchment

**APPENDIX C. Proposed Desert Bighorn Sheep Supplemental Releases
On the Arizona Strip in Priority Order (April 2001)**

Proposed Release Site	Proposed Related Action	Habitat Area	Approximate Location	Located In Wilderness or Monument	ACFD GMU
Cottonwood/Rock Canyon	None	Hurricane Cliffs	T.41N., R.09W., Sec 25	No	13A/B
Ridgeline WLC	Only need water in WLC	Virgin and Beaver Dam	T.38N., R.16W. Sec 13	Yes	13B
Thousand Pockets	Build Thousand Pockets WLC	Paria - Vermillion Cliffs	T.41N., R.07E. Sec 21	Yes	12B
Hedricks Spring	Repair spring development	Virgin and Beaver Dam	T.40N., R.14W. Sec 19	Yes	13B
Willow Springs	Repair and re-align fence	Virgin and Beaver Dam	T.37N., R.04W. Sec 14	Yes	13B
N/A	Repair Virgin Mtns. WLC	Virgin and Beaver Dam	T.40N., R.14W. Sec 07	Yes	13B
N/A	Repair Buck Springs development	Virgin and Beaver Dam	T.38N., R.16W. Sec 12	Yes	13B
Squaw Canyon WLC	Repair WLC	Grand Wash Cliffs	T.35N., R.14W. Sec 28	Yes	13B
Ferguson Pockets N WLC	none	Grand Wash Cliffs	T.36N., R.14W. Sec 22	Yes	13B
Hancock Springs	none	Paria - Vermillion Cliffs	T.39N., R.05E. Sec 31	Yes	12B
Benali Rim	Build Benali Rim WLC	Paria - Vermillion Cliffs	T.39N., R.04E. Sec 22	Yes	12B
Rock Canyon	none	Hurricane Cliffs	T.41N., R.09W. Sec 08	No	13B
Cave Canyon WLC	Build Cave Canyon WLC	Grand Wash Cliffs	T.36N., R.14E. Sec 34	Yes	13B
Grama Canyon	none	Kanab Creek	T.37N., R.03W. Sec 19	No	13A
Paria Narrows	Build Narrows Slick Rock WLC	Paria - Vermillion Cliffs	T.41N., R.05E. Sec 10	Yes	12B
Bridger Point WLC	Build Bridger Point WLC	Paria - Vermillion Cliffs	T.42N., R.05E. Sec 35	Yes	12B
Bulrush Point	none	Kanab Creek	T.38N., R.03W. Sec 32	No	13A
Cedar Pockets	none	Virgin and Beaver Dam	T.41N., R.14W. Sec 10	Yes	13B
N/A	Build Cedar Mountain WLC	Paria - Vermillion Cliffs	T.41N., R.06E. Sec 11	Yes	12B
N/A	Build Clearwater Point WLC	Kanab Creek	T.38N., R.03W. Sec 08	No	13A
N/A	Build Hack WLC	Kanab Creek	T.37N., R.05W. Sec 23	No	13A

N/A = Not Applicable: No release planned
WLC = Wildlife Catchment