

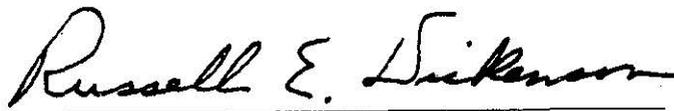
FINAL  
GENERAL MANAGEMENT PLAN  
ENVIRONMENTAL IMPACT STATEMENT  
WILDERNESS RECOMMENDATION

DEVELOPMENT CONCEPT PLAN  
Horseshoe Bend  
Hough Creek  
Barry's Landing  
Ok-A-Beh  
Afterbay

BIGHORN CANYON NATIONAL RECREATION AREA  
MONTANA-WYOMING

Prepared by

United States Department of the Interior  
National Park Service  
Denver Service Center

  
Director, National Park Service

# C O N T E N T S

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**PART:1 THE PLAN**

## I. INTRODUCTION

### A. Setting and Resource Significance

Bighorn Canyon National Recreation Area is in southeastern Montana and north-central Wyoming (see Vicinity map). It encompasses about 120,000 acres, including the 12,700 acres of Bighorn Lake. The lake is created by the Yellowtail Dam, which was constructed on the Bighorn River in 1965 as a part of the Missouri River Basin Project.

Bighorn Canyon offers a diversified landscape of forest and mountains, upland prairies, deep canyons, broad valleys, and Bighorn Lake. To the north and south lie broad, relatively flat valleys bordered by low grassy hills; east and west the land rises to the Bighorn and Pryor Mountains, respectively.

The Bighorn River is the major stream in this region. It flows northward through the Bighorn Basin in Wyoming, entering the Bighorn Canyon north of Lovell, Wyoming. The canyon was formed by a combination of accelerated stream erosion and gradual regional uplift. Much of it is narrow and confined within sheer walls as high as 335 m (1,000 ft), interrupted by similarly deep side canyons.

Through time, Bighorn Canyon has hosted several waves of human immigrants; the Bighorn Basin has been continuously occupied for over 10,000 years. The earliest occupants of the Bighorn Basin moved throughout this region in response to the changing seasons and resultant variations in available plants and animals. This succession of hunters and gatherers was followed by the Crow Indians who migrated to the area because of pressure from tribes in the East. In the 19th century, trappers, explorers, and traders used the area lightly, as most of their activity was concentrated on the Yellowstone River. Range cattle first arrived in the Bighorn Basin in 1879, setting the stage for permanent settlement represented by ranches scattered in and close to the recreation area.

Bighorn Canyon in its regional setting well illustrates the interpretive theme of the recreation area--"Man and the Bighorn Environment." This theme includes how past human occupants were directly dependent on the land and how this dependence has changed with respect to technological achievements such as hydroelectric power generation, coal extraction, and farming.

Learning of the natural and cultural heritage of Bighorn Canyon is becoming an increasingly important experience to the visitor. Not only can interpretation explain the origin of interesting landscapes and wildlife, but it also gives visitors insight to the basics of human existence.

### B. Purpose and Administrative History

Bighorn Canyon National Recreation Area was established by Public Law 89-664, dated October 15, 1966, "to provide for recreation use and enjoyment of Bighorn Lake and adjacent lands, and to preserve the scenic, scientific, and historic resources." The law also provides for utilizing renewable natural resources and for entering into cooperative agreements with other federal and state agencies for the joint

administration and use of various land and water areas within and adjoining the recreation area. Another provision in the enabling legislation added the authority to change the boundaries of Bighorn Canyon National Recreation Area through inclusion of Crow tribal lands.

Specifically, section 2(b) of this act states the following:

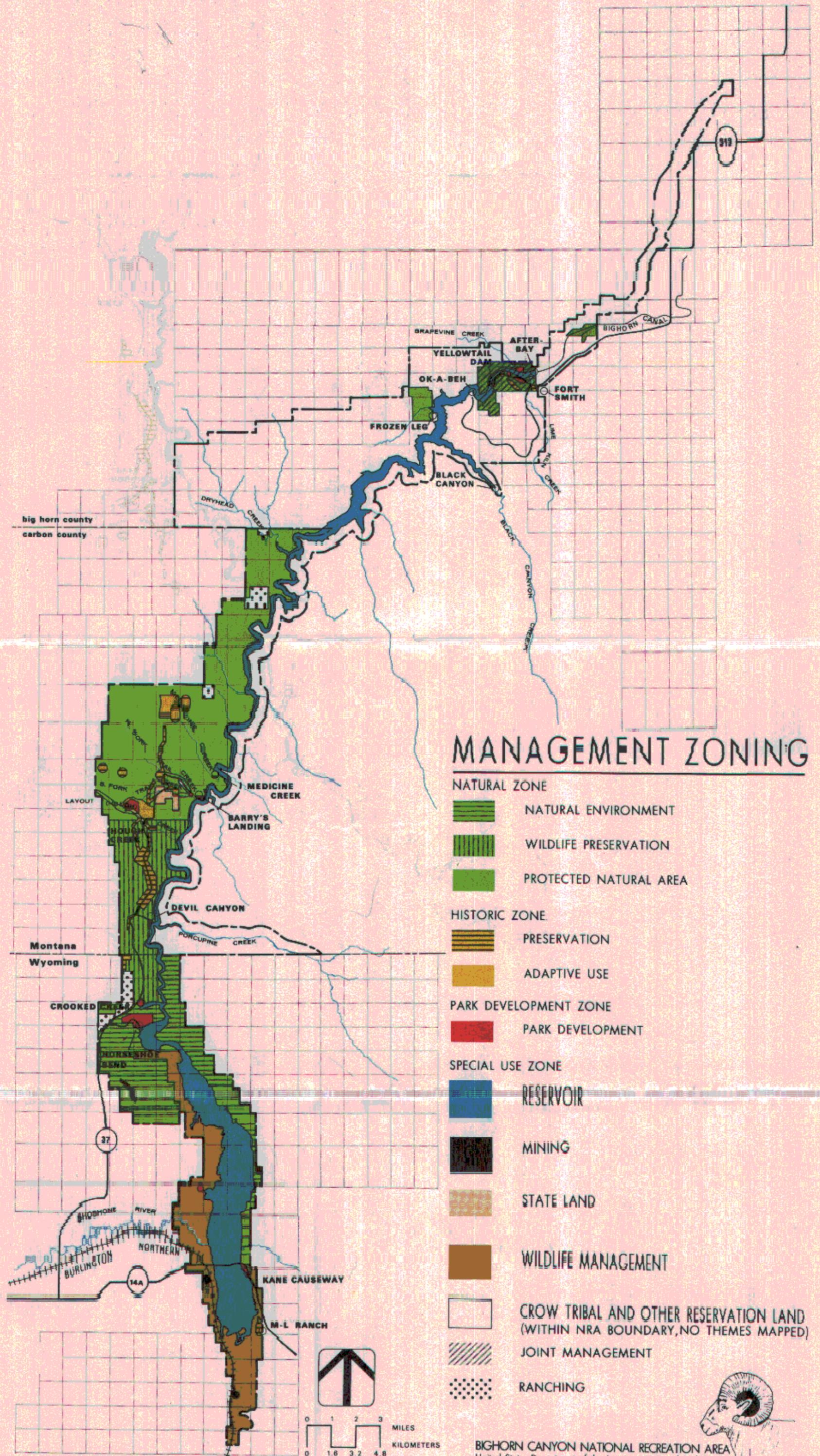
No part of the tribal mountain lands or any other lands of the Crow Tribe of Montana shall be included within the recreation area unless requested by the council of the tribe. The Indian areas so included may be developed and administered in accordance with the laws and rules applicable to the recreation area, subject to any limitation specified by the tribal council and approved by the Secretary.

Following the establishing legislation and negotiations between the Crow and the National Park Service, the Crow Tribal Council passed Resolution 67-59 on May 20, 1967, approving a draft Memorandum of Agreement for the inclusion of 55,947 acres of reservation lands within the exterior boundaries of the recreation area. The draft was sent to Washington, D.C., where it was given further consideration and modification and then signed by Tribal Chairman Edison Real Bird, Director George Hartzog of the National Park Service, and Secretary of the Interior Stewart Udall on December 1, 1967. On October 2, 1968, under the authority granted in P.L. 89-664, the secretary adjusted the boundaries to include these reservation lands by publication of a boundary description in the Federal Register.

Based on recommendations made by the Crow Cultural Committee, a resolution recognizing the importance of archeological sites was passed in June 1970. The resolution further called for the National Park Service to aid the Crow in ". . . preserving, protecting, and defining the antiquities which exist both within and without the boundaries of Bighorn Canyon National Recreation Area."

The Crow Tribal Council passed Resolution 71-12 on September 1, 1971, which specifically called for the preservation of the archeological resources of the Grapevine and Dryhead drainages, development of these resources as part of a Crow Indian Heritage and Cultural Area, and inclusion of this area as a National Indian Cultural and Ceremonial Shrine. Resolution 71-12 also allowed the tribe to zone tribal lands within the recreation area by granting the authority to the Tribal Recreation Committee.

A key part of development planning since the establishment of Bighorn Canyon National Recreation Area has been the proposal for construction of a transpark road. The primary purpose of the transpark road was to facilitate access, connect major developments, and provide for scenic touring. A Master Plan for the recreation area, approved in 1971, included the concept of a transpark road in the proposed development. The road as planned extended from the end of Wyoming State Highway 37 near Horseshoe Bend, Wyoming, northward on the west side of Bighorn Canyon 50 miles to Fort Smith, Montana.



# MANAGEMENT ZONING

## NATURAL ZONE

-  NATURAL ENVIRONMENT
-  WILDLIFE PRESERVATION
-  PROTECTED NATURAL AREA

## HISTORIC ZONE

-  PRESERVATION
-  ADAPTIVE USE

## PARK DEVELOPMENT ZONE

-  PARK DEVELOPMENT

## SPECIAL USE ZONE

-  RESERVOIR
-  MINING
-  STATE LAND
-  WILDLIFE MANAGEMENT
-  CROW TRIBAL AND OTHER RESERVATION LAND (WITHIN NRA BOUNDARY, NO THEMES MAPPED)
-  JOINT MANAGEMENT
-  RANCHING

BIGHORN CANYON NATIONAL RECREATION AREA  
United States Department of the Interior - National Park Service



A Draft Environmental Statement for the transpark road was released to the public in March 1973. In April 1973, Wirth Associates of Billings, Montana, was granted a contract to produce a general development plan for the National Park Service based on the transpark road concept.

In October 1973, the Crow Tribal Council passed Resolution 73-06, which called for the renegotiation of the 1967 Memorandum of Agreement and approval of the agreement by the entire tribal council before granting approval for the transpark road.

The Final Environmental Statement for the transpark road was approved and released on April 23, 1974. Objections to the road were again made by the Crow.

On September 23, 1974, suit was filed against the National Park Service by the Montana Wildlife Federation and the Montana Wilderness Association, seeking to bar construction of the transpark road. On October 9, 1974, the United States District Court for the District of Montana, Billings Division, granted the injunction sought by the Montana Wildlife Federation and the Montana Wilderness Association, which prevented authorization of construction of the transpark road. A tribal resolution concerning the road and withdrawal of lands from the recreation area was tabled at the October 12, 1974, meeting of the Crow tribe.

The above injunction was lifted on January 20, 1976, and the case was appealed to the Ninth Circuit Court of Appeals. The court ruled in favor of the National Park Service, and construction was authorized for the second segment of the road. This segment, from Devil Canyon to Barry's Landing, was completed in November 1977. Bids for construction of the first segment of the transpark road had been opened in March 1971. Construction of this segment, running from Horseshoe Bend to Devil Canyon, had begun in the summer of 1971.

On April 10, 1976, the Crow Tribal Council passed Resolution 76-32, which called for withdrawal of all tribal lands formerly included in the recreation area, denial/rejection for the construction of roads across tribal lands, and invalidation of the 1967 Memorandum of Agreement.

The Draft Master Plan begun in 1973 by Wirth Associates was released to the public in July 1977. The plan was based on completion of the transpark road, which is now known as Bad Pass Road, and also included developments on tribal lands.

On December 5, 1977, the secretary of the interior indicated in a letter to the Crow Tribal Council that Interior Department acceptance of Resolution 76-32 would leave an operational void at Bighorn Canyon, and that renegotiation of the 1967 Memorandum of Agreement should occur at the field level. Further, the secretary responded that until such time as the 1967 memorandum is renegotiated, the original Memorandum of Agreement will be considered legally binding by the Department of the Interior. Until this issue is resolved, however, the National Park Service has been instructed to place a moratorium on any further development of Crow lands within the recreation area.

Recognizing the existing differences between the National Park Service and the Crow over the 1967 Memorandum of Agreement, the future development included in this planning effort is confined to the area within the boundaries of Bighorn Canyon National Recreation Area by Congress in P.L. 89-664 on October 15, 1966. Crow Reservation lands within the recreation area are not included in this plan and will not be subject to NPS planning without permission of the Crow Tribal Council and the secretary of the interior.

#### C. Management Strategy

This strategy for the recreation area takes into account three elements: (1) regional setting--the centralized position of the recreation area in the Bighorn Basin, surrounded by lands and resources administered by other agencies or owned by the Crow; (2) opportunities for water-based recreation and interpretation within the recreation area; and (3) a unique collection of interrelated natural and cultural resources in and near the recreation area.

This General Management Plan sets the stage for the following actions through the remainder of the century: Facilities for water recreation, camping, picnicking, and hiking will be developed in phases on a scale agreeing with numerical projections of visitor use. Representative scenic, natural, and cultural resources will be interpreted onsite within their capacity to withstand visitor impact. Exhibits, audiovisual programs, and publications will be used to interpret resources that are fragile or difficult-of-access.

Sensitive resources will be conserved and studied rather than immediately used for onsite interpretation to the public as follows: Historic, archeological, and paleontologic resources will be ranked as to significance and susceptibility to damage by public use. Selected resources that are not NPS administered lands (both inside and outside the recreation area boundary) will be interpreted cooperatively as the National Park Service, the administering agencies, and the Crow tribe are able to plan for their protection and use.

In summary, most initial development at Bighorn Canyon will be in support of camping, water-based recreation, and interpretation. Interpretation of land-based resources will increase commensurately with advances in research, cooperative planning with other agencies and interests, and availability of NPS funds and staffing for interpretive programs. It is recognized that onsite interpretation of certain cultural resources that are highly fragile, difficult to protect, or religiously significant may never be practicable.

#### D. Suitability Analysis

The proposed development sites in the recreation area have been chosen as a result of recommendations by previous planning efforts and/or by in-field investigations and analyses. In either case, the sites have been carefully reviewed for both development suitability and potential environmental constraints.

Marinas and campgrounds are the two most intensive developments proposed for the recreation area. As a result, the siting of

marinas and campgrounds received the greatest degree of planning and analysis.

There was a marina operating at Frozen Leg in the northern portion of the recreation area in the past. This operation was owned by a private concern and operated on a yearly permit issued by the National Park Service. In the past few years, the marina had deteriorated to the point that it was an aesthetic as well as a structural problem. In addition, the facility required a shuttle system from the Ok-A-Beh boat launch to the marina for those owners mooring their boats. Frozen Leg marina was not reopened after the 1978 season.

The marina in the south district at Horseshoe Bend is in better physical condition, but it lacks the size and overnight slips necessary to make it a viable economic enterprise for the concession operators. With these existing problems in mind, criteria were established for choosing permanent marina sites.

Economic, physical, and environmental factors were strong determinants in reviewing marina sites. Economically, it was advantageous to select locations close to existing utilities, visitor use facilities, and existing roads capable of handling projected visitation. From a physical siting standpoint, it was important to have an area that would withstand anticipated wind and wave actions and would provide sufficient depth even during maximum drawdown of the reservoir. The site also needed to be relatively free of siltation problems and required gradual slopes to accommodate shoreline development. The most important environmental considerations were protection of archeological, historical, and wilderness values; avoidance of sensitive vegetation and wildlife areas; and minimization of development on highly erosive soils or soils with a high shrink/swell potential.

Several areas of the park were immediately eliminated from consideration because of serious limitations in at least one of these criteria. The Bull Elk Basin and Black Canyon areas in the north district are reasonably good areas for marinas but are some distance from existing developments; in the case of Bull Elk Basin, there are also several limitations due to land slumping. The latter problem also eliminated a site near the Yellowtail Dam. Frozen Leg and Box Canyon were eliminated because each would require ferrying in order to transport users to moored boats. In the south district, the entire area south of the Narrows was eliminated due to high siltation rates and extensive mudflats. The Dryhead area has excellent mooring potential but is some distance from any road and has extremely steep slopes on the shoreline.

The areas that proved to be most suitable for marina development were Ok-A-Beh in the north district and Barry's Landing and Horseshoe Bend in the south. Strong determinants in each case were the developments already established in these areas, particularly boat launch ramps. There were serious questions initially as to the feasibility of marina anchorage at Ok-A-Beh and Barry's Landing; however, these sites were reviewed by a marina consultant, and it was determined that there would be no problem.

The need to develop campgrounds results from the inadequacy of present facilities to accommodate expected increases in visitation. There are currently three campgrounds in the recreation area: One is a large 126-unit site at Horseshoe Bend, and the second is a small informal area of about 25 sites at Afterbay. The third consists of 15 sites dispersed along North Fork Trail Creek near Barry's Landing. The former meets anticipated visitor needs in terms of size, but is harsh aesthetically, as there are no trees or shade shelters to relieve the intense summer sun. The Afterbay site is a gravel parking lot, which offers the visitor few, if any, amenities. In addition, it is much too small to meet projected visitation increases.

The criteria established to determine suitable camping areas were similar to those developed for marinas. Again the important criteria were economic, physical, and environmental factors. The important economic criteria included proximity to existing roads and utilities. Desirable physical criteria were deep and permeable soils; slopes adequate for drainage but not so steep as to be inaccessible or costly to build on; and vegetation that was aesthetically pleasing but not so dense as to require extensive cutting. The most important environmental criteria included protection of historical, archeological, and wilderness values; avoidance of sensitive wildlife and vegetative communities; and relatively erosion-free soils.

Locating sites in the north district was difficult because of the scarcity of federally owned lands. The decision to plan no new facilities on Crow Reservation lands effectively eliminated all other sites. One potential site northeast of Afterbay was the parcel of land situated on the Bighorn River that is currently owned by the National Park Service (see Landownership map). However, this site was determined inappropriate due to the strong possibility of conflicts between campers and the Crow over fishing access to the Bighorn River, and because the area is on reservation-added land. Campground development was restricted to the Afterbay area. The only site in this area that met most of the criteria and was of adequate size was a parcel of land on the north side of Afterbay near the airstrip. This site was therefore chosen as the north district campground.

Most camping requirements in the south district can be satisfied at the existing Horseshoe Bend campground with the planned addition of sun shelters and major modifications in landscaping. With these additions, the site will easily meet most criteria.

There was an additional need in the south district for camping near the Barry's Landing area. The criteria were applied to the surrounding areas, and two sites proved particularly suitable. The first site, near Hillsboro, provides an extensive area suitable for camping but intrudes on the historic setting of the Hillsboro site and lacks tree cover. The second site at Hough Creek near the Sorenson Ranch lacked these constraints and met most other criteria. Therefore, the Hough Creek site was chosen for a small campground to serve both the Barry's Landing boaters and nonboaters visiting the south district.

## II. GENERAL MANAGEMENT PLAN

### A. Management Zoning Proposals

Management zoning, an expression of management strategy, is the method by which the National Park Service categorizes land and water within a park. It represents the proposed management of park resources upon full implementation of a plan. Four zones into which a park may be divided are as follows: natural zone, historic zone, park development zone, and special use zone. The first three zones are used for lands and waters for which the National Park Service has sole or primary jurisdiction. The special use zone is used where other agencies or interests control land or water use. Each zone can be divided into smaller subzones in order to focus management on particular activities or developments.

All four management zones have been used to subdivide the land and water base of Bighorn Canyon National Recreation Area. In addition, a number of subzones have been identified to protect or manage special areas within the park. The Management Zoning map depicts the generalized spatial extent of each zone or subzone. The utility and transportation subzones have not been mapped because of their extremely narrow and linear aspects. However, a detailed Management Zoning map has been prepared on USGS 1:24,000 quadrangles (1 in. equals 2,000 ft) and can be examined at the recreation area. This map is the official Management Zoning map. Table 1 includes the acreages and percentages of the total park included in each zone and subzone as delineated on the official map.

The management zones and subzones for the recreation area are as follows:

#### 1. Natural Zone

The natural zone identifies those lands and waters that are managed to conserve natural resource values and processes. Uses that do not adversely affect these values and processes are permitted.

##### a. Natural Environment Subzone

The natural environment subzone includes undeveloped areas in the park that are managed to preserve the natural character of the landscape. Included in this category are several large areas of land. The first is a parcel on the east side of the lake north of U.S. 14A. This parcel includes the old Kane Bridge development, which is being abandoned and allowed to return to a natural state. Two other large parcels are found on the west side of the lake. The first area is near Horseshoe Bend; the second is near Hough Creek. The latter includes the Dryhead Common Grazing Allotment--a Bureau of Land Management cattle-grazing area. Cattle grazing and ranching are established land uses in this area (see section II.B.1.b.(2)).

*This appears to be inconsistent w/ intent*

##### b. Wildlife Preservation Subzone

The wildlife preservation subzone delineates that portion of the Pryor Mountain Wild Horse Range within the recreation area boundaries (see section II.B.1.b.(2)).

Table 1  
MANAGEMENT ZONES

<u>ZONE</u>	<u>SUBZONE</u>	<u>ACREAGE</u>	<u>PERCENTAGE OF PARK</u>
Natural	Natural environment	39,552	32.8%
	Wildlife preservation	7,874	6.5%
	Protected natural area	<u>675</u>	<u>0.6%</u>
	Total	48,101	39.9%
Historic	Preservation	1,514	1.3%
	Adaptive use	<u>408</u>	<u>0.3%</u>
	Total	1,922	1.6%
Park Development		<u>791</u>	<u>0.7%</u>
	Total	791	0.7%
Special Use	Reservoir	16,289	13.5%
	Mining	82	0.1%
	State lands	394	0.3%
	Wildlife management	5,739	4.8%
	Crow tribal and other reservation lands	45,193	37.6%
	Utilities	186	0.2%
	Transportation	182	0.2%
	Ranching	1,405	1.1%
	Joint management*	<u>1,745</u>	<u>1.4%</u>
	Total	69,470	57.8%
	PARK TOTAL	120,284	100.0%

\*Not included in totals



H.B.  
maint.  
Gard

c. Protected Natural Area Subzone

The protected natural area subzone indicates land and water areas set aside because of their fragility and ecological significance. The areas shown on the Management Zoning map represent the riparian vegetation zones of the recreation area and are important resources because of their ecological diversity and relatively limited distribution. These areas occur along streams primarily in the central and northern portion of the recreation area.

2. Historic Zone

The historic zone identifies those cultural resources managed for preservation, protection, or interpretation.

a. Preservation Subzone

The preservation subzone contains those areas that are important because of their association with personages, events, or periods of human history. Pursuant to the determination of historians and archeologists, these areas are managed in varying stages of repair from fully restored to no maintenance at all. Included within this subzone are the archeological sites on or eligible for nomination to the National Register of Historic Places, and significant historic sites such as the Bighorn Canal (Ditch) Headgate, the M-L (Mason-Lovell) Ranch, Hillsboro (Cedarvale), and the Wood Road near Fort C.F. Smith (see section III.B.2.c.).

b. Adaptive Use Subzone

The adaptive use subzone represents the historic sites that are not only preserved but also adapted to modern uses. The Sorenson (Ewing-Snell) Ranch is currently managed under the adaptive use policy. The Lockhart Ranch will possibly be adapted for use as a ranger residence, as well as preserved as a historic structure. Selected buildings and surrounding environs will also be managed to preserve the historic setting.

3. Park Development Zone

The park development zone includes all NPS-controlled development in the recreation area. All developed areas are included within this zone with the exception of Black Canyon, which falls within the reservoir subzone, and Ok-A-Beh, which is too small to be accurately shown on the map. In addition, all park roads, residential areas (nonhistoric), and associated developments are included.

4. Special Use Zone

The special use zone delineates those areas that are wholly or partially outside the jurisdiction of the National Park Service yet within the boundaries of the recreation area.

a. Reservoir Subzone

The reservoir subzone includes the maximum pool area of Bighorn Lake. This area is managed for flood control, power generation, and irrigation by the Water and Power Resources Service. The National Park Service manages water-oriented recreation and cooperates with the states of Montana and Wyoming in the management of fishery resources.

b. Mining Subzone

The mining subzone shows lands used for active mining purposes. These lands are controlled by NPS permits, but the underlying minerals are owned by other interests. Two sites are found south of U.S. 14A, and a third is near the western boundary by Horseshoe Bend.

c. State Lands Subzone

The state lands subzone represents the lands near Hough Creek, which are owned and managed by the state of Montana.

d. Wildlife Management Subzone

The wildlife management subzone delineates the lands managed for wildlife habitat and sporting use. These lands are part of the Yellowtail Wildlife Habitat Area and are found in the extreme southern end of the recreation area. In addition to the lands shown on the Management Zoning map, there are vast acreages of mudflats that are covered by the high pool of the reservoir but are used as wildlife habitat when the water level is lower (see section II.F.5.).

e. Crow Tribal and Other Reservation Lands Subzone

The Crow tribal and other reservation lands subzone is the largest single category and represents the portion of the recreation area situated within the boundaries of the Crow Reservation. It includes all nonfederal recreation area lands in Big Horn County, Montana. Crow Reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to NPS planning without permission of the Crow Tribal Council and the secretary of the interior.

f. Utilities Subzone

The utilities subzone includes lands used for overhead power line corridors. These lands are generally Water and Power Resources Service controlled rights-of-way under special use permits covered in the "Statement for Management."

g. Transportation Subzone

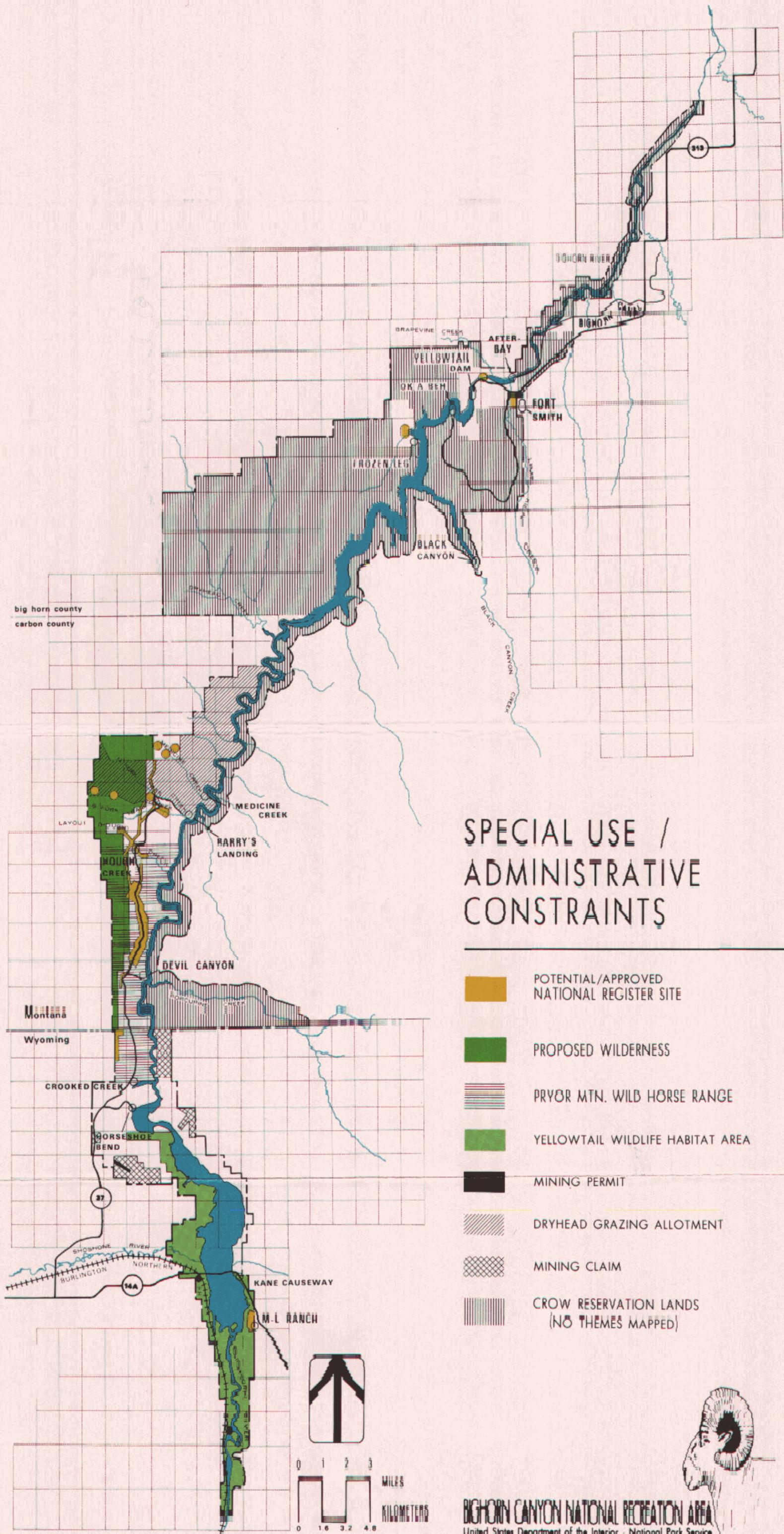
The transportation subzone represents roads that are primarily used for nonpark uses. The Burlington Northern railroad tracks in the southern portion of the recreation area are also included within this subzone.

h. Ranching Subzone

The ranching subzone delineates those private lands that are used for ranching purposes.

i. Joint Management Subzone

The joint management subzone includes those lands around the Afterbay/Ft. Smith area, which are in federal ownership and jointly managed by the Water and Power Resources Service and the National Park Service. This zone is a combination or overlay zone that does not affect the use or the management of the land. It merely indicates that there are two groups working together to decide land use.



## SPECIAL USE / ADMINISTRATIVE CONSTRAINTS

-  POTENTIAL/APPROVED NATIONAL REGISTER SITE
-  PROPOSED WILDERNESS
-  PRYOR MTN. WILD HORSE RANGE
-  YELLOWTAIL WILDLIFE HABITAT AREA
-  MINING PERMIT
-  DRYHEAD GRAZING ALLOTMENT
-  MINING CLAIM
-  CROW RESERVATION LANDS (NO THEMES MAPPED)



**BIGHORN CANYON NATIONAL RECREATION AREA**  
 United States Department of the Interior - National Park Service

## B. Resource Management Plans

### 1. Natural Resource Management Plan

The policies, rules, and regulations established by the National Park Service for natural areas will be followed in the administration and management of natural resources for Bighorn Canyon National Recreation Area. The preservation of the natural environment for the enjoyment of the recreation area visitors and for the integrity of the ecosystems is the major objective of this natural resource management plan. These policies will be implemented in cooperation with other governmental agencies including the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Water and Power Resources Service, and the states of Wyoming and Montana. The "Natural Resource Management Plan" was approved in 1979 and a summary follows.

The National Park Service did not acquire a complete ecological entity free from man-made influences in the recreation area. Grazing and mining activities have affected the composition of the natural resources, and the man-made Bighorn Lake has become an important part of the environment. These elements will continue to be incorporated in land use decisions, which provide for the special use of natural resources without detracting from NPS management objectives.

Grazing  
mining

#### a. Basic Management Strategies

##### (1) Vegetation

The predominant vegetative communities in the recreation area are desert shrubland in the south, juniper/ shrub in the middle, and grassland in the north. Impacts of grazing and other human activities are still evident in the present day vegetative composition. The goal of National Park Service management is to restore or maintain the landscape in a pristine condition and to minimize the impact of human activities. Research in the form of monitoring vegetation is essential to this goal.

Areas under continual utilization (grazing allotments, visitor use areas, and mining sites) will be monitored to establish trends in the ecosystem and to identify early warning signs of significant deterioration. Every effort will be made to allow the restoration of areas that were once subject to intensive disturbance. Special attention will be given to preserving habitats that contain uncommon species and habitats that are unique or of special interest, such as riparian communities and pockets of pine forests along the canyon wall. Exotic species will be monitored and controlled. There are no known threatened or endangered plants in the recreation area, although a thorough inventory has not yet been performed.

##### (2) Wildlife

Black bear have been seen at the Black Canyon boat-in camp/picnic area and occasionally near Ft. Smith, presenting potentially hazardous conditions. The problem is probably precipitated by improper food storage, deliberate feeding of bears, and inadequate garbage collection. These conditions will be corrected as much as possible, and a study will be performed when the scope of work is defined.

In the Wyoming portion of the recreation area there are 11,600 acres of land managed as part of the 28,000-acre Yellowtail Wildlife Habitat Area. This land is managed by the Wyoming Game and Fish Department (see section II.G.5). The area is primarily established to promote waterfowl and upland game habitat, and hunting is allowed in accordance with state regulations.

The American peregrine falcon and the bald eagle are endangered species that have been reported in the recreation area in recent years. These species and their habitats will be protected in accordance with the requirements of the Endangered Species Act of 1973. The peregrine falcon may be potentially affected by visitor use and development. A survey of the entire recreation area will be undertaken to determine occurrence and document potential habitat of the peregrine falcon. Coordination with the U.S. Fish and Wildlife Service was performed as specified in Section 7 of the Endangered Species Act.

(3) Fisheries

Fishery restocking and statistical information on success ratios are researched and maintained by the respective state agencies. State fishing licenses are required, and the recreation area staff assists with enforcement of state regulations.

(4) Water Resources

Surface streams in Bighorn Canyon National Recreation Area are maintained in their natural state. Treated sewage from the Yellowtail Dam visitor center is discharged into Bighorn Lake under an EPA permit. The amount of discharge is estimated at a maximum of 3,000 gallons daily from June 15 to September 15 and is an instantaneous discharge. The water quality of Bighorn Lake has been monitored by the Environmental Protection Agency and the U.S. Geological Survey. The Bighorn and Shoshone rivers carry the major portion of influent water to the lake. Concentrations of nutrients, sediments, and total dissolved solids are high in these rivers, due primarily to agricultural runoff. The concentration of sulfates is higher than the recommended level for a freshwater supply; however, the level is safe and these rivers can be tapped if other sources of water are unavailable. The amount of sediments and nutrients in the water decreases significantly from the southern end to the north, and the phytoplankton productivity decreases correspondingly.

b. Special Uses

(1) Mining

There are 77 unpatented mining claims on park land in the Wyoming portion of the recreation area. Sixty-seven are for uranium, four are for glass sand, and six are for bentonite. The validity of these claims has yet to be determined, and bentonite and high grade sand and gravel mining are the only active operations in the recreation area. Before any mining claims are activated, a plan of operation and an environmental assessment must be approved by the regional director of the National Park Service.

Several thousand acres of land at the southern end of the lake were purchased without the acquisition of mineral rights.

High-grade sand and gravel exist in abundance in this area, and there are currently two outstanding special use permits. In order to maintain the integrity of the land surface, all permits define the conditions under which excavation is permitted and are approved by the regional director.

(2) Grazing

The National Park Service and the Bureau of Land Management have entered into a cooperative agreement to manage 9,815 acres of land referred to as the Dryhead Common Grazing Allotment. The agreement specifies public recreation as the primary use to be made of the resources. The National Park Service determines what lands may be used for grazing, and the Bureau of Land Management administers the operation. Details of the plan are outlined in the "Dryhead Common Allotment Management Plan" (May 10, 1975). A rest-rotation policy has been established for the Dryhead allotment, and improvements in range conditions are anticipated. A research monitoring program will be established to determine the effects of grazing on this rangeland.

Grazing

The Pryor Mountain Wild Horse Range (9,100 acres are within the recreation area boundaries) has been severely overgrazed in the past. An interagency study was conducted on this area, and the results appear in the Pryor Mountain Complex Land Use Decisions (May 23, 1974).

(3) Farming

There is relatively little farming within the recreation area. Two farming permits (approximately 1,200 acres) and 4 grazing permits (approximately 4,500 acres) are managed by the Wyoming Game and Fish Department. Of the crops harvested, one-fourth of the grain goes to the state for sale or replanting as wildlife feed. There are private farming developments within the Crow section of the recreation area. There are no unique farmlands within the recreation area, but the area downstream from the Afterbay Dam would be considered prime under the requirements of prime and unique farmlands guidelines (516 DM 2.6). This land is irrigated, and flooding is controlled by the dam. There are no NPS developments planned for this area. The Water and Power Resources Service has an expanded irrigation plan that would add several thousand acres of reservation lands adjacent to the recreation area to the irrigation system.

(4) Offroad Vehicle Use

There will be no ORV use in the recreation area except on designated routes. The recreation area staff is currently seeking special regulations for designation of snowmobile trails in the Yellowtail Wildlife Habitat Area in accordance with requirements of Executive Order 11989 and NPS Management Policies. Trails would be approximately 8½ miles in length and would provide winter access to Bighorn Lake. These proposals are being coordinated with the Bureau of Land Management and the Wyoming Game and Fish Department.

c. Development Constraints

(1) Soils

The accumulation of sediments in the Horseshoe Bend area is a concern because of the proposed developments; a study of the situation is a top priority.

Land slumping has occurred in the Bull Elk area. Movement occurs at an average rate of 2 feet per year, and the condition is monitored by the Water and Power Resources Section (see section III.B.3.a.(3)).

(2) Floodplain

There are no clearly defined floodplains in the recreation area. Attempts have been made in the planning process to avoid potential floodplain areas. Due to the steep cliffs and limited lake access points in the recreation area, it has been necessary to place some facilities in floodplain areas. Management of floodplains must comply with the requirements of Executive Orders 11988 and 11990 of May 24, 1977.

The water level in Bighorn Lake is controlled by the Water and Power Resources Service for flood control, power generation, and water storage. Any potential floodplain areas controlled by Yellowtail Dam would be classified as "Standing Water Floodplain Environments" under Executive Orders 11988 and 11990. Attainment of maximum pool in Bighorn Lake could result in inundation of Kane Causeway picnic/rest area and Black Canyon and Frozen Leg boat-in camp/picnic areas. There is only low potential hazard in these areas because the lake level is controlled. All facilities (picnic tables, trash cans, fire grills) have been or will be designed for portability or to withstand inundation. Unusually severe rainfall could result in extensive flooding downstream of the Yellowtail Dam.

Unusually high runoff from streams due to locally heavy rain or snow melt could flood the Hough Creek, Frozen Leg, and North Fork Trail Creek areas. There is no specific data available for these areas to determine floodplain zones, but there has been no evidence of severe flooding for 50 years in the Hough Creek area. Facilities that could be affected include the picnic area along North Fork Trail Creek, the ranger residence in the Sorenson Ranch, the day use area at Hough Creek, and the camp/picnic area at Frozen Leg. Day use areas are not prohibited uses in a floodplain zone, and the Sorenson Ranch is an adaptively used historic structure. The floodplain will be delineated before the comprehensive design plans for the comfort station and leach field at Hough Creek are drawn up. Construction or operation of waste disposal plants is prohibited in a floodplain area.

(3) Energy

All proposed facilities will be constructed using energy-efficient design in compliance with Executive Order 12003. The superintendent will also manage the area in an energy-efficient manner.

d. Research Needs

Implementation of the resource management plan will require the following research projects:

Construction

#### Sedimentation

Determine the amount of sedimentation occurring near the proposed Horseshoe Bend development

Define the limits and lifetime of development in that area

#### Vegetation

Perform a comprehensive taxonomic study to identify plant species in the recreation area, including rare, threatened, or endangered species

Monitor the effect of continued grazing, other farming activities, and visitor use on vegetative species composition and productivity

Survey resource problems and initiate any necessary rehabilitation or site restoration projects

#### Wildlife

Study the range and feeding habits of black bears

Investigate methods for management of black bears

Monitor the breeding success of the endangered peregrine falcon and the occurrence of golden and bald eagles

Survey the entire recreation area to determine occurrence and document potential habitat of the peregrine falcon.

#### Water Quality

Monitor the overall productivity of the lake and related water quality parameters

Monitor the Horseshoe Bend swimming beach for fecal coliforms

Identify the sources of nutrients, pesticides, and herbicides that enter the lake

#### Air Quality

Identify those plant and animal species in the recreation area that are known indicators of air quality and monitor (record) the changes if any

Establish air pollution monitoring devices to collect and maintain continuous records in critical areas within the park

#### Noise

Measure sound levels and correlate those levels with average visitor exposure and wildlife impact

#### 2. Cultural Resource Management Plan

The National Park Service will provide for the preservation, restoration, protection, interpretation, study, management, and use of all significant cultural resources through adequate research

and programming. All actions taken will be in full compliance with the requirements of the Historic Sites Act of 1935; National Historic Preservation Act of 1966; Executive Order 11593 "Protection and Enhancement of the Cultural Environment;" Regulations, "Protection of Historic and Cultural Properties" (36 CFR 800); "Protection of the Environment" (40 CFR 1500); Uniform Rules Prescribed to Carry Out Provisions of the Act for the Preservation of American Antiquities; and National Park Service Management Policies.

A planning document dealing with cultural resources management will be prepared in the immediate future and implemented to fulfill the objectives of this plan. The plan will contain a detailed inventory of the appropriate resources, a description of management problems, and a recommendation of solutions to these problems.

All proposals and activities affecting or relating to cultural resources will be developed and executed with the active participation of professional specialists in history, archeology, and historic architecture or curatorship in accordance with National Park Service Management Policies and NPS-28 Cultural Resources Management Guidelines.

Undertakings in which the alteration or loss of cultural resources is necessary to achieve management goals will be mitigated. These measures will include professional salvage of information and remains and an accompanying report; proper curatorial care of excavated material and field records; and deposit and preservation of data and artifacts in the recreation area's museum, library/archives collections, or other designated repository.

Cultural resources will be vigilantly maintained and protected to prevent alteration or loss during the interim period prior to the development of a cultural resource management plan.

### C. Visitor Use and Interpretation Proposals

#### 1. General

##### a. Interpretive Objectives

The purpose of interpretation for Bighorn Canyon National Recreation Area can be defined by the following objectives:

To provide timely and accurate information to visitors and prospective visitors regarding opportunities in Bighorn Canyon and the region

To foster public understanding and appreciation of the archeological, historic, and natural features of Bighorn Canyon

To foster public understanding and appreciation of the interaction of humans, past and present, with the Bighorn Canyon environment

To enhance the understanding and appreciation of Crow Indian culture through innovative and outreaching interpretive activities

To develop energy conservation and awareness through interpretive programs and media applications

To foster public understanding and support of park policies and practices, which preserve and protect the cultural and natural features and provide for the safety of visitors

b. Interpretive Themes

The interpretive significance of the recreation area is its story of a harsh environment and how humans have used and adapted to that environment. The themes used to interpret this story are cultural history, natural history, recreation, and information and orientation. These themes have been further divided into subthemes. The important elements of cultural history include Early Prehistoric period (10,000 to 4000 B.C.), Middle Prehistoric period (4000 B.C. to A.D. 500), Late Prehistoric period (A.D. 500 to 1650), Crow settlement, early explorers, military, homesteaders, open-range cattle industry, sheep industry, mining, dude ranching, and energy.

Natural history is an integral part of cultural history; thus, an understanding of natural history is critical to a complete understanding of man's relationship to Bighorn Canyon. The major subthemes of natural history include tectonics and erosion of the Bighorn region, the ecosystems of Bighorn Canyon, and Bighorn fisheries.

Recreation is also part of man's use of the land and as such is an important theme. Some of the major subthemes include sightseeing, hiking, camping, hunting, picnicking, water skiing, boating, swimming, and fishing.

Information and orientation is another interpretive theme. Components of this theme include such interests as: location of major facilities, agenda for interpretive programs, identification of significance wildlife species, location and significance of cultural resources, and surrounding (non-park) attractions.

c. Visitor Experience

Visitors should come away from Bighorn Canyon with an understanding and appreciation of the relationship of humans with Bighorn Canyon from prehistoric times to the present recreational/technological period.

At each area, a particular part of the story will be emphasized, but with enough of the total story presented to provide a broad perspective of the continuity. Hopefully, this approach will encourage visitors to explore other areas of the park for a more in-depth understanding of all the parts of the entire story.

d. Safety

The major safety hazards at Bighorn Canyon are floating debris, submerged objects, lakeshore slumping, and rotten rock overhangs in the canyon. Other safety considerations include swimming and boating accidents, weather (as it affects boaters), bears, and rattlesnakes.

The major existing safety program is comprehensive and will continue to be implemented. Brochures, personal contact, and

signs are utilized to provide information about the hazards. In addition, specific programs are implemented to deal with certain problems. There is a yearly program of collection and disposal of floating debris. Approximately 80 percent of all boaters are contacted and given a safety inspection. Launch ramps have or will have safety messages. Bear-proof garbage cans have been installed at the Black Canyon boat-in camp/picnic area and problem bears are trapped and removed to remote areas. A study will be initiated to learn more about bear/human conflicts (see section II.B.1.d.3).

The informal swimming area at Ok-A-Beh is currently roped off to prevent boater/swimmer conflicts. Because this area is too close to the launch area, it is proposed to eliminate this use and provide swimming facilities at Afterbay. At Horseshoe Bend, the beach will be realigned to further separate swimmers from marina users.

Foot traffic over the Bighorn Canal Headgate will be eliminated and a foot bridge constructed. Hillsboro will be allowed to decay naturally (see section III.B.2.c.). To assure visitor safety frequent inspections will be held, and access will be controlled. The trail into the Pryors is potentially hazardous. Safety information will be provided at the trailhead in an exhibit or brochure.

The Kane Causeway day use area access road intersection with U.S. 14A will be realigned to eliminate the poor visibility that now exists. The road into the M-L Ranch will also be improved to bring it up to standard and improve safety.

## 2. Development Areas

### a. Kane/Lovell

This area will serve as a day use area providing picnicking, fishing, and rest stop facilities for recreation area visitors and cross-country travelers.

The Bighorn visitor center at Lovell currently provides information and orientation to south district attractions and the surrounding region. Exhibits include a small display on the mechanics and application of solar energy, a topographical relief map, a series of photographs, and routed wood panels depicting the scenic and recreational attractions of Bighorn Canyon. Two films are shown--a general overview of the recreation area and a description of the wild horses. The solar energy exhibit will be revised and improved.

A new free-standing exhibit will be added that will tell the story of 20,000 years of natural and human history, including the Natural Trap Cave and the seasonal transhumance cycle. Orientation exhibits will be upgraded.

Guided walks are currently given at the M-L Ranch on a request basis only. There is no directional signing; visitors unfamiliar with the route must receive directions at the visitor center. Two or three waysides telling the story of open-range cattle ranching are proposed.

An exhibit to be constructed and maintained by the Water and Power Resources Service at Kane Bridge will explain the purpose and benefits of this major reservoir.

b. Horseshoe Bend

The Horseshoe Bend area will serve as the major focal point for recreation in the southern end of the recreation area. A broad range of visitor experiences will be available to visitors interested in both water-based and land-oriented activities ranging from boating and camping to picnicking, swimming, hiking, and fishing. Concessioner-operated boat tours originating from the marina will make Bighorn Lake accessible to those visitors without boats. All facilities and activities will be in a location convenient to the majority of south district visitors. Crooked Creek will provide picnicking and fishing opportunities for those traveling by car and those who have walked from Horseshoe Bend.

Guided auto caravans provide onsite interpretation of the historic and archeological resources in the south district. These caravans will continue pending an evaluation of the energy consumption involved. Guided walks will continue to be given to interpret the fossil resources on Sykes Mountain at Horseshoe Bend.

Orientation and recreation information will be provided at the Horseshoe Bend boat launch area. Geologic processes and formations will be interpreted at the Red Cliffs viewpoint. At the Sykes Ridge overlook, the pioneer experience will be interpreted.

Interpretation of wild horses will be provided along that section of the Bad Pass Road passing through the Pryor Mountain Wild Horse Range. The message content will be coordinated with the Bureau of Land Management. At the Bad Pass Trail pullout and along the Bad Pass Road, the theories of the origin and purpose of the ancient trail and its rock cairns will be interpreted. The tipi rings at Crooked Creek will be interpreted for their cultural and archeological significance.

c. Hough Creek

The Hough Creek/Sorenson Ranch visitor experience is unique within the recreation area. Away from the lake and in a primarily riparian habitat, this area will offer different day use and overnight opportunities. The campground, although convenient to Barry's Landing users, will be removed from the general recreation area activities and offer more primitive camping opportunities at the walk-in sites.

Campers and day users will be able to take advantage of extensive hiking trails into the Pryor Mountains and Layout Canyon. Picnickers will find the facilities at Hough Creek cool and refreshing and different from the majority of picnic sites in the recreation area.

The basic story to be interpreted in this area is the continuity of land use -- its patterns and products. Aspects of this story that are evident in this area include seasonal transhumance activities, historic Crow occupation, gold exploration, fenced farming, and ranching. Another important theme to be interpreted is the riparian

habitat. The processes and products of regional tectonics will be interpreted at the Devil Canyon overlook.

d. Barry's Landing

Similar to Horseshoe Bend, Barry's Landing will provide opportunities for visitors interested in both land- and water-oriented activities. Barry's Landing will cater more to day users by providing picnic and comfort facilities, but more importantly, the area will offer lake service for boaters launching here as well as arriving from other parts of the lake.

The drive into Barry's Landing is highlighted by North Fork Trail Creek, which will offer picnic facilities in one of the few heavily vegetated riparian areas in the entire park available to the general park visitor. Picnicking will also be available in the scenic location of the point at the confluence of North and South Fork Trail creeks overlooking the lake.

Hiking will be available to Hillsboro and Chain Canyon Cove. Boaters seeking a more primitive experience will find overnight and day use opportunities available in Medicine Creek, accessible by boat or trail.

Hillsboro will be allowed to decay but will be interpreted through guided walks as a dude ranch in the area. In addition to recreation, Barry's Landing offers evidence of transhumance occupation, gold mining, and outlawry.

e. Ok-A-Beh

The north end of Bighorn Lake, including Black Canyon and Ok-A-Beh, will provide experiences almost exclusively for boaters. Similar to Medicine Creek, Black Canyon and Frozen Leg will offer primitive overnight and day use opportunities in a pleasing natural setting accessible only by boat. These facilities will be available to Ok-A-Beh boaters as well as those traveling from the south district facilities.

Ok-A-Beh will provide the north district visitor access to Bighorn Lake. A small marina, set deep within the canyon, will offer launch and marina services, and also fishing, information, orientation, and concession services. Boat rentals will be available.

Interpretation of recreational opportunities, safety, wildlife, and fisheries will be provided at Ok-A-Beh. The story of the legend of the Bighorn will be presented here. The Om-Ne-A trail will be self-guided with interpretation of natural history and energy.

f. Afterbay

More than any other area in the north district this area, comprised of the Yellowtail Dam and Afterbay, will serve the general visitor, sightseer, and day user. The Yellowtail Dam visitor center will offer an introduction to the dam, canyon, and surrounding lands. Guided boat tours interpreting the geologic uplift and erosional processes (Bull Elk Basin), vegetative adaptation to a canyon environment

(Black Canyon), and an example of a riparian habitat (Cabin Creek) have been conducted. These boat tours, once operated by the National Park Service, have been phased out and will be replaced by concessioner-operated tours. Boat tours originating from the dam are needed to allow visitors without boats to see the canyon and experience its scenery and grandeur.

Afterbay will provide a broad range of facilities and opportunities, serving nearly the entire north district visitor population. Those seeking overnight accommodations, both exclusive Afterbay visitors and Ok-A-Beh boaters, will find improved camping facilities convenient to Ft. Smith services. Those visitors seeking group facilities will find a separate picnic area available for their use. Day users and sightseers will be able to take advantage of a broad range of activities including picnicking, swimming, and bank and boat fishing.

Interpretation at the Yellowtail Dam visitor center currently deals primarily with hydroelectric generation but also includes aspects of the Crow Indian culture and geology of Bighorn Canyon. The Water and Power Resources Service and the National Park Service are jointly planning both exhibit rehabilitation and new exhibits.

A wayside exhibit will be provided for the Bighorn Canal Headgate to tell the story of this major technological achievement by the Crow tribe.

Environmental education discovery walks for children will continue to be given in the vicinity of Afterbay.

Information and orientation to the north district will be provided near the entrance to Bighorn Canyon National Recreation Area on Montana 313. In the same vicinity, there will be interpretation of Fort C.F. Smith and its role in the protection of the Bozeman Trail, and also of the Hayfield fight between the U.S. Army and a large war party of Sioux and Cheyenne.

g. Parkwide

Evening programs have been and will continue to be offered at all campgrounds on a variety of topics designed to increase the understanding and appreciation of the many stories and outstanding resources of the Bighorn country. Particular emphasis is given to information that is generally unavailable elsewhere.

Demonstrations of Crow beadwork, cooking, and costume making will continue to be given at the north district visitor center and campground.

Offsite programs covering energy conservation, Crow cultural achievements, natural and human history, recreational opportunities, paleontological discoveries, environmental issues, and general visitor opportunities at Bighorn Canyon are presented in numerous towns throughout the region at schools, urban centers, and retirement homes.

There are currently no publications specific to the recreation area. Because the majority of archeological features are outside the jurisdiction of the National Park Service and are inaccessible to the general public, it is proposed that a publication be prepared to tell the story of man in the Bighorn Canyon area.

3. Levels of Activities

Most interpretive programs currently offered are not at full capacity (see appendix D for carrying capacities of interpretive programs). Assuming the composition and interest of park visitors remains essentially the same (which is the current trend), visitation would have to reach 1,500,000 before other interpretive programs would be at full capacity. However, should the composition of park visitors change significantly (more cross-country travelers), the proportional attendance at interpretive programs would probably increase.

The composition of park visitors would also influence peak use periods, which currently occur on weekends. Greater representation from cross-country travelers would increase weekday use, resulting in a more even distribution of use throughout the season. This would in turn increase the need for daily interpretive activities.

Careful monitoring of use and visitor trends will provide the means of determining future interpretive needs. Interpretive development is of high priority and will be implemented by 1990, even though other development might not be completed.

4. Concessions and Fees

Concession facilities in Bighorn Canyon National Recreation Area are currently limited to the Horseshoe Bend area, where boat rentals, fuel services, small tackle store, and snack bar are provided. A concessioner-operated boat tour began in the summer of 1979.

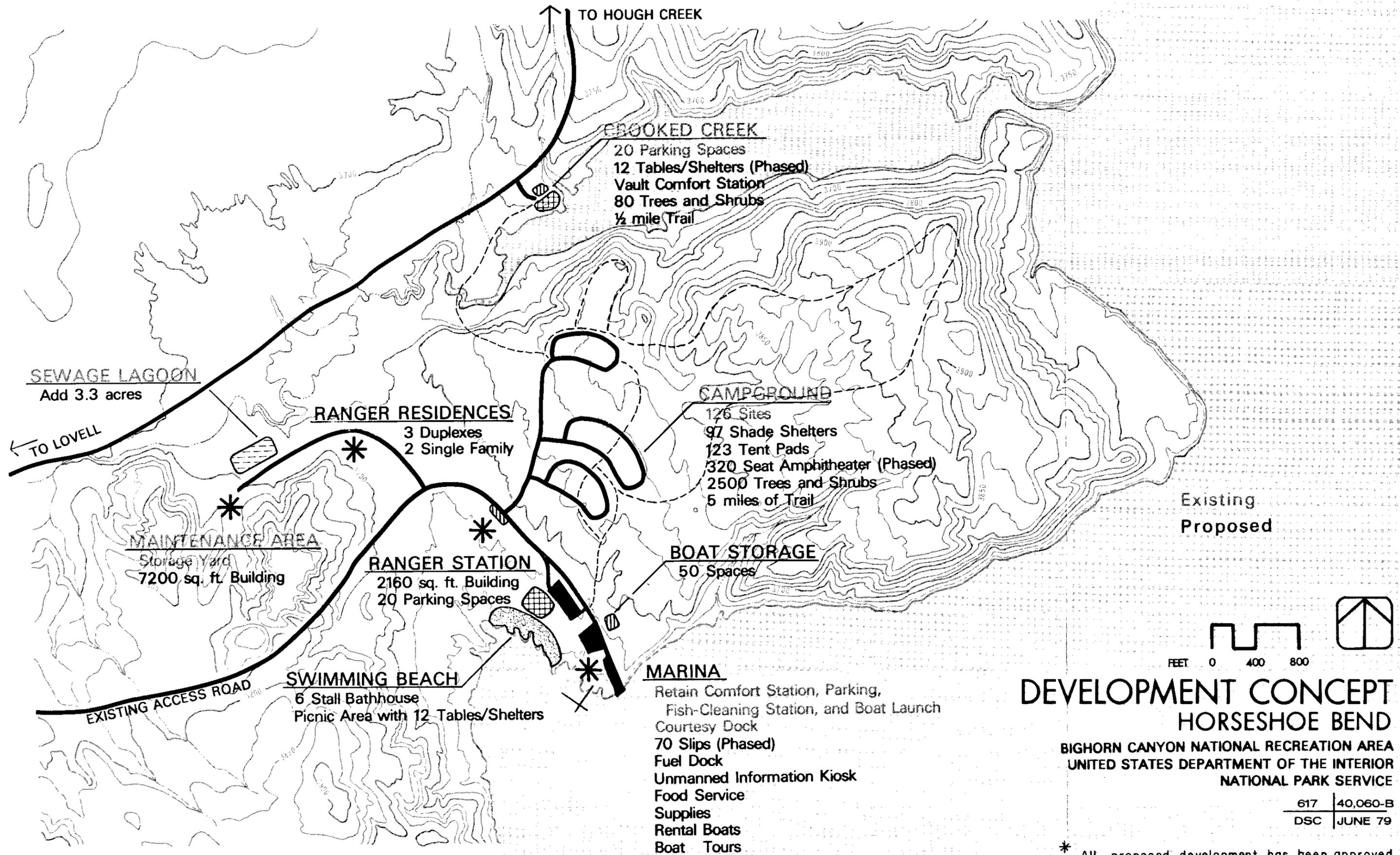
The plan proposes concession operations at Horseshoe Bend to be expanded and upgraded. A marina and dry boat storage will be provided in addition to upgrading the present developments. A fuel facility, small docking area, and marine and tackle sales are planned for Barry's Landing. A marina, fuel dock, marine tackle and food sales will be developed at Ok-A-Beh. A concession-operated boat tour is proposed from the Yellowtail Dam. The Crow tribe has the first right of refusal on the concessions within the Montana portion of the recreation area.

NPS fees are currently charged at the Horseshoe Bend campground. It is anticipated that the Afterbay and Hough Creek campgrounds will become fee areas upon completion. No entrance fees are proposed for the recreation area.

D. General Development Proposals

1. Access and Circulation

Bighorn Canyon lies in a physically remote area of north-central Wyoming and south-central Montana. Development of permanent access roads suitable for modern vehicular needs has been slow because of the rugged geographic setting and the generally sparse settlement pattern in this region.



# DEVELOPMENT CONCEPT HORSESHOE BEND

BIGHORN CANYON NATIONAL RECREATION AREA  
UNITED STATES DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE

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\* All proposed development has been approved  
(4/4/78)

Access to the major development sites of the south district was achieved in 1977 with the completion of the Bad Pass Road. Prior to this date, access was achieved via lower quality improved and unimproved roads. The Bad Pass Road intersects with U.S. 14A near Lovell, WY. U.S. 14A connects with the interstate highway system (I-90) near Sheridan, Wyoming, and serves as the major means of access to the south district.

The north district of the recreation area is accessible via Montana 313, a two-lane paved road that connects Ft. Smith and Hardin. I-90 passes through Hardin providing access to the area.

Access to the north side of the Afterbay developed area is via a gravel road, which passes over the Afterbay Dam past the proposed

bridge, which has been removed. The south side of Afterbay can be reached via a paved road off Montana 313.

The Ok-A-Beh developed area is accessible via a two-lane paved road from Ft. Smith.

The proposed development in the recreation area calls for improved access to several developed areas. No major road projects are proposed.

In the south district, realignment of the dirt access road to the Kane Causeway day use area is proposed. The existing access road has limited visibility and consequently poses a potential safety hazard.

At Horseshoe Bend a 300-foot asphalt road is proposed to connect the boat storage yard and the main access road. The existing road from the Horseshoe Bend access road to the maintenance yard will be upgraded to asphalt. The access road to Crooked Creek will be upgraded slightly at its intersection with the Bad Pass Road. A 7,200-foot asphalt road will be built from the proposed campground at Hough Creek to the Bad Pass Road. The rough dirt access roads to the picnic area on North Fork Trail Creek and to Chain Canyon Cove will be upgraded to light duty gravel. The existing road to Hillsboro will be retained as a foot trail/service road.

In the north district the only new development will be paved roads for the campground area at Afterbay. All other roads will remain in their current states.

## 2. Development Areas

Existing development at Bighorn Canyon National Recreation Area has been heavily oriented toward providing opportunities for water-based recreation. The existing major development sites at Ok-A-Beh, Barry's Landing, and Horseshoe Bend have been constructed to serve this use. Existing minor developed areas at Yellowtail Dam, Afterbay, Black Canyon, Medicine Creek Cove, North Fork Trail Creek, Devil Canyon, Crooked Creek, Kane Bridge, and M-L Ranch provide

picnicking, fishing, and sight-seeing opportunities that are ancillary to water-based recreation.

The proposed development plan for the park (see General Development Plan map) will expand three existing major development sites and create two new major sites. The new sites will be at Afterbay and Hough Creek; each will provide opportunities for land-oriented recreation. In addition to these large developments, some of the smaller areas will be expanded in size or function, and new minor development sites will be constructed.

Table 13 is a summary of all development in the recreation area (see appendix B: "Cost/Benefit Analysis").

a. Kane/Lovell

Existing development in this area includes a visitor center near the town of Lovell, a boat launch and primitive camp area at Kane Bridge, and interpretive facilities at M-L Ranch.

The development proposal calls for continuation of these uses with the exception of removal of all facilities at Kane Bridge. The M-L Ranch will be preserved in its current condition, and better parking and pedestrian access will be provided. A new development (Kane Causeway) at the east end of the U.S. 14A bridge will accommodate fishing access and picnicking. A vault comfort station and landscaping will also be installed.

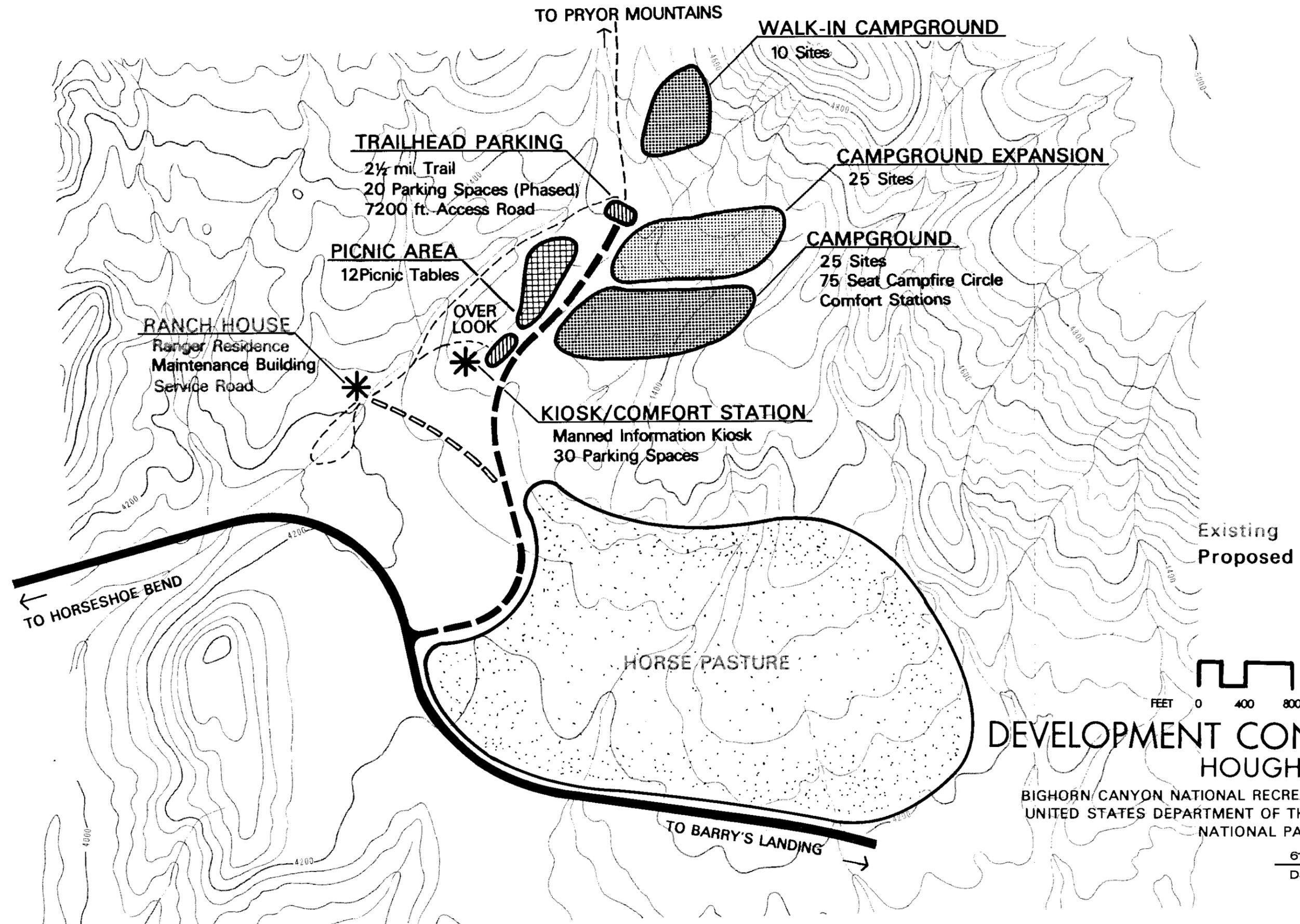
b. Horseshoe Bend

Horseshoe Bend is currently the major boat launch and visitor use area in the southern end of the recreation area. Existing facilities include a boat ramp, comfort station, fish-cleaning station, ranger trailer, parking, campground, maintenance yard, seasonal housing, and swimming beach.

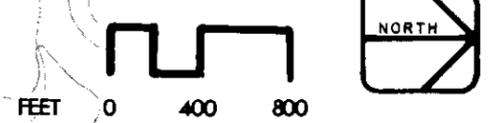
A large marina is proposed to provide permanent mooring space. Dry boat storage will be provided near the existing boat ramp. Construction will be phased to develop the new facility in proportion with visitation increases. Marine and fishing supplies will be provided in a new structure between the existing parking area and the proposed marina.

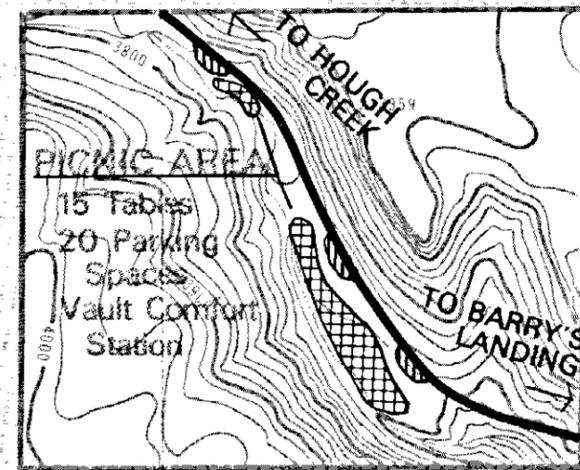
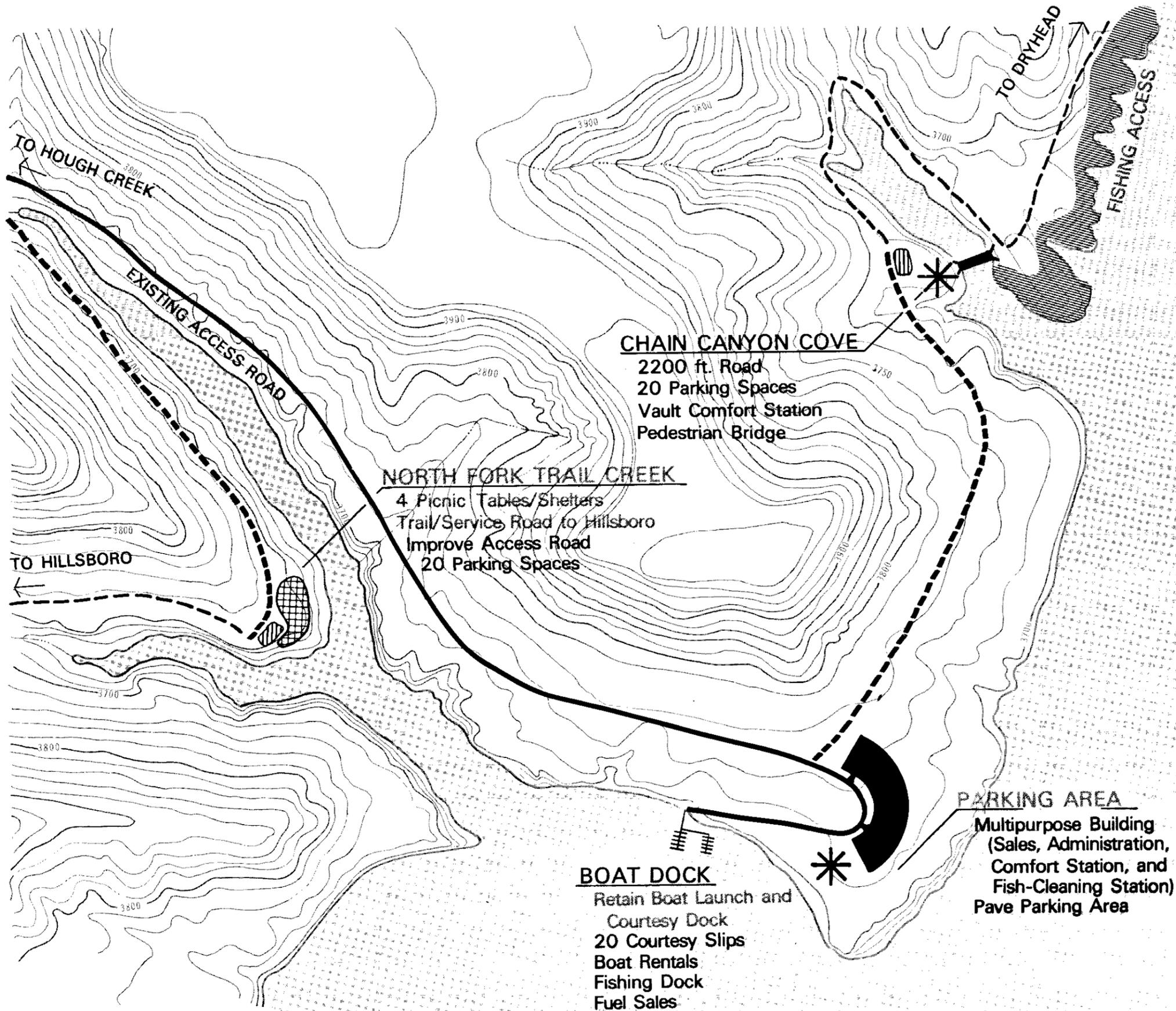
Major regrading of the shoreline will be necessary to accommodate and separate the marina and swimming beach. The latter will be moved slightly west of its current location. A small bathhouse and comfort station will be built between the beach and existing parking area. In addition, space for picnicking will be provided in this area.

A new ranger station will be built to replace the existing trailer. The trailers that are currently used for seasonal housing will also be replaced with permanent residential facilities. The existing maintenance yard will be expanded to include a permanent warehouse/maintenance building.



**DEVELOPMENT CONCEPT**  
**HOUGH CREEK**  
 BIGHORN CANYON NATIONAL RECREATION AREA  
 UNITED STATES DEPARTMENT OF THE INTERIOR  
 NATIONAL PARK SERVICE





Existing  
Proposed



**DEVELOPMENT CONCEPT**  
**BARRY'S LANDING**  
 BIGHORN CANYON NATIONAL RECREATION AREA  
 UNITED STATES DEPARTMENT OF THE INTERIOR  
 NATIONAL PARK SERVICE

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Extensive landscaping will be undertaken, and shade shelters and tent pads constructed, in order to improve the aesthetic quality and livability of the existing campground. An amphitheater will also be added.

The Crooked Creek developed area is near the Horseshoe Bend site and will serve in close conjunction with it. Day use activities will be emphasized. Picnicking and fishing access will be provided in the area adjacent to the existing parking lot.

c. Hough Creek

Existing development in the Hough Creek area is limited to an interpretive overlook at Devil Canyon and a ranger residence at Hough Creek.

Under the proposed development plan, this area will become the major recreation site for land-oriented activities in the southern end of the recreation area. Camping, picnicking, hiking, and interpretation will be the major activities.

The existing access road and parking lot at Devil Canyon will be retained. Asphalt trails will be provided from the parking lot to the rim to improve access.

A small campground, to be built in two phases, is proposed for the juniper-filled valley just west of the existing ranger residence. Trails will be provided from the campground to the picnic area, from the ranger residence through the picnic area, and eventually into the Pryor Mountains. Primitive walk-in campsites will be provided near the Pryor Mountain trail.

The picnic area is proposed for the base of the hill that physically separates the ranger residence from the campground. This area will be the central focus for visitors entering the Hough Creek developed area and will serve as a "jumping off" point for many activities. Parking will be available near the picnic area to serve most day use facilities. An interpretive kiosk will be constructed in this area to provide information and visitor orientation.

The Sorenson Ranch will remain a ranger residence under the adaptive use policy. A small maintenance building will be constructed behind the ranch house for vehicles, fire cache, and storage.

d. Barry's Landing

The major existing facilities in the Barry's Landing area include a boat ramp and parking facility at Barry's Landing; camping sites along North Fork Trail Creek; primitive boat-in camp/picnic sites at Medicine Creek Cove; and picnic sites at the confluence of North and South Fork Trail creeks.

At Barry's Landing, the proposed action calls for hard surfacing of the existing parking area and construction of a multipurpose building adjacent to this parking lot. The latter will incorporate space for a concession-operated marine and fishing supply

store, fish-cleaning and comfort stations, and storage and interpretive functions. Courtesy slips will be added to provide space for extended day and overnight use. Fuel and oil service will be available.

The boat-in camp/picnic sites at Medicine Creek Cove will be improved with the addition of tables and grills for each site. A floating comfort station/courtesy dock will be added.

Picnic sites at the confluence of North and South Fork Trail creeks will be made more accessible with the improvement of the access road to high-grade gravel surfacing. Permanent parking spaces will be added and the trail/service road to Hillsboro will be retained.

A new facility will be constructed at Chain Canyon Cove just east of Barry's Landing. The existing primitive cattle road will be improved to gravel. Hiking and fishing will be the primary uses of the area. A vault comfort station and pedestrian bridge will be constructed, as well as trails to provide access along the lakeshore and canyon rim to Medicine Creek and Dryhead.

e. Ok-A-Beh

Existing developments in this area are intended almost entirely for boat users. At Ok-A-Beh there is a boat ramp, courtesy dock, parking, comfort stations, and a temporary visitor contact station. Frozen Leg was the only marina site in the northern portion of the lake and was operated by inholder owners but did not reopen after the 1978 season.

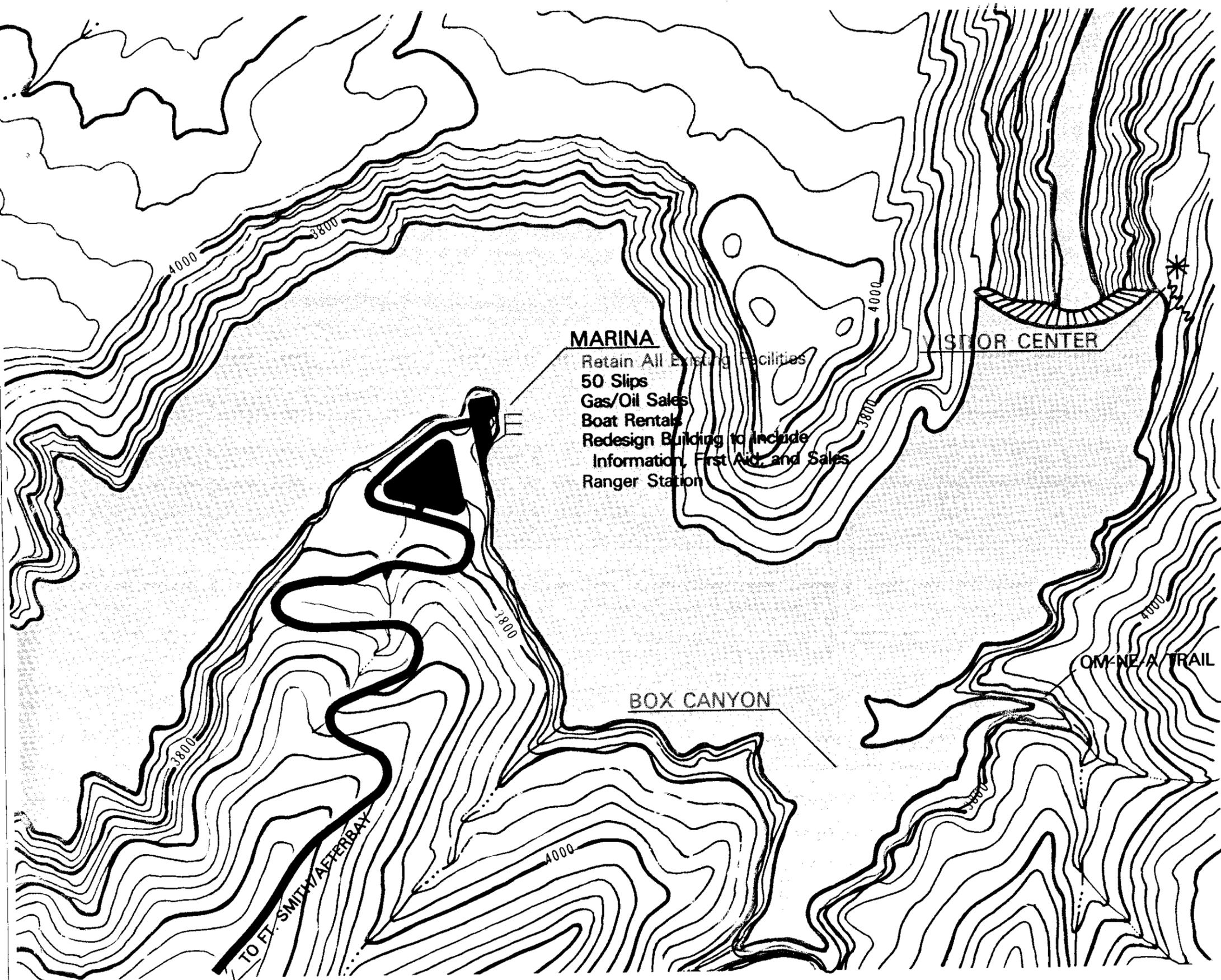
Ok-A-Beh will be expanded to be the major visitor use area in the northern portion of the lake. All existing functions will remain, with the visitor contact function being incorporated into the existing restroom/overlook building. This action will require expansion of the existing building. At the same time, a concessioner-operated supply store will be added.

The Frozen Leg marina was purchased by the National Park Service. All marina services, including docking facilities and fuel sales, have been removed. All future marina services will be provided at Ok-A-Beh. Frozen Leg will be converted to a boat-in camp/picnic area. The existing docks and superstructure will be removed, and the pit toilets will be retained. Six campsites (tables, fire grills, trash cans), a small overnight dock, and a 6-site picnic area will be provided. The existing road will be retained as a hiking trail.

Boat-in camping and picnicking, as well as all other facilities, will be retained at Black Canyon.

f. Afterbay

The Afterbay area is currently used as a fishing and camping area. The Yellowtail Dam visitor center offers interpretation of National Park Service and Water and Power Resources Service functions in the recreation area. It will remain the primary visitor orientation facility in the northern end of the recreation area. Concessioner-operated boat



**MARINA**  
 Retain All Existing Facilities  
 50 Slips  
 Gas/Oil Sales  
 Boat Rentals  
 Redesign Building to include  
 Information, First Aid, and Sales  
 Ranger Station

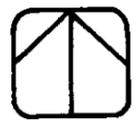
**VISITOR CENTER**

**BOX CANYON**

**OM-NE-A TRAIL**

TO FT. SMITH WATERBAY

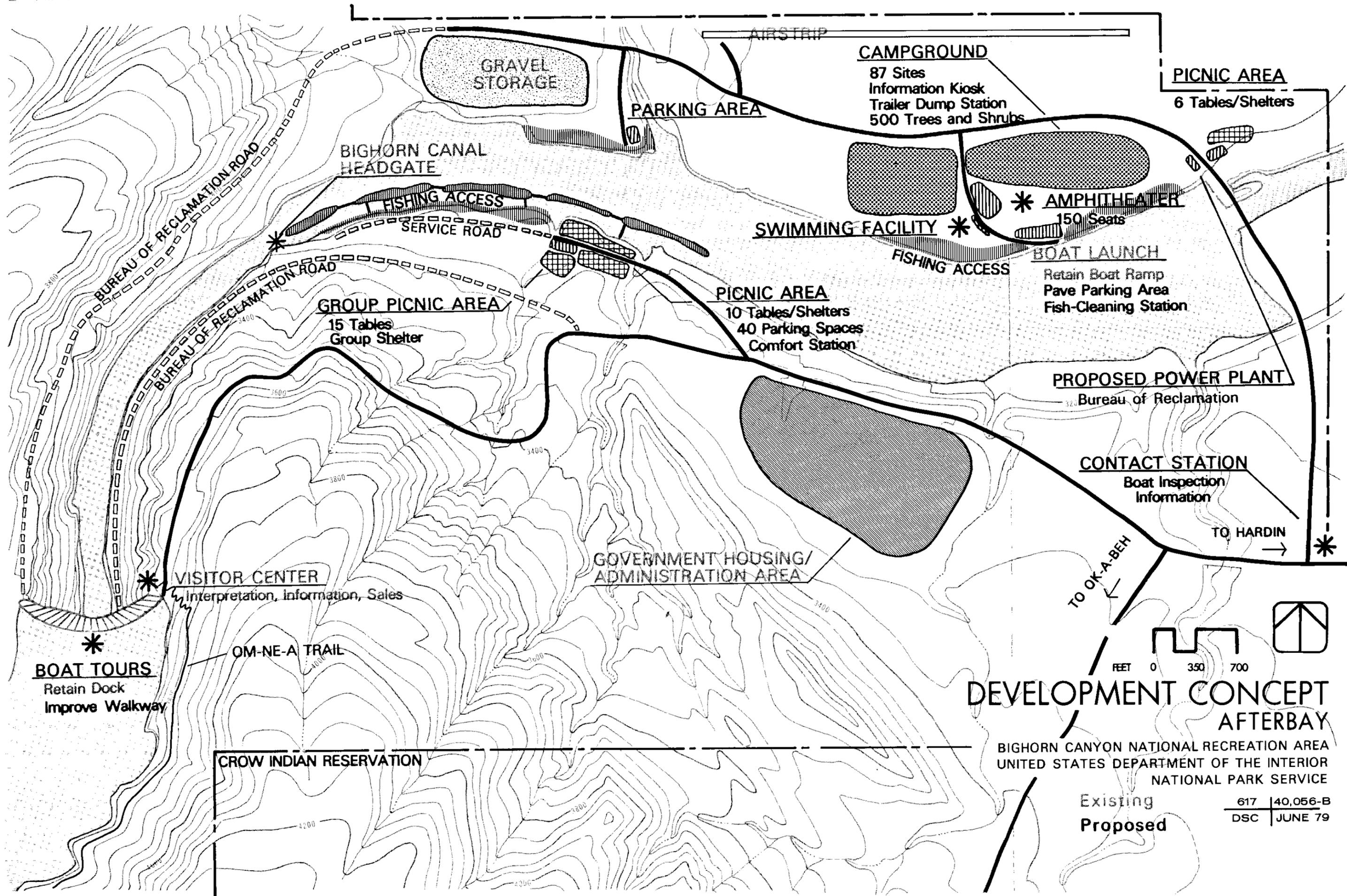
Existing  
 Proposed



**DEVELOPMENT CONCEPT  
 OK-A-BEH**

BIGHORN CANYON NATIONAL RECREATION AREA  
 UNITED STATES DEPARTMENT OF THE INTERIOR  
 NATIONAL PARK SERVICE

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GRAVEL STORAGE

AIRSTRIP

CAMPGROUND

87 Sites  
Information Kiosk  
Trailer Dump Station  
500 Trees and Shrubs

PICNIC AREA

6 Tables/Shelters

PARKING AREA

BIGHORN CANAL HEADGATE

FISHING ACCESS

SERVICE ROAD

SWIMMING FACILITY

\* AMPHITHEATER

150 Seats

BOAT LAUNCH

Retain Boat Ramp  
Pave Parking Area  
Fish-Cleaning Station

GROUP PICNIC AREA

15 Tables  
Group Shelter

PICNIC AREA

10 Tables/Shelters  
40 Parking Spaces  
Comfort Station

PROPOSED POWER PLANT

Bureau of Reclamation

CONTACT STATION

Boat Inspection  
Information

TO HARDIN

GOVERNMENT HOUSING/  
ADMINISTRATION AREA

\* VISITOR CENTER

Interpretation, Information, Sales

\* BOAT TOURS

Retain Dock  
Improve Walkway

OM-NE-A TRAIL

CROW INDIAN RESERVATION

TO OK-A-BEH

DEVELOPMENT CONCEPT  
AFTERBAY

BIGHORN CANYON NATIONAL RECREATION AREA  
UNITED STATES DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE

Existing  
Proposed

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tours on Bighorn Lake will be provided from the boat dock on the Yellowtail Dam. These boat tours will comply with NPS Management Policies and OMB requirements. The existing gangway will be replaced with a new, safer version.

As a part of the proposal, increased opportunities for recreation will be available in the Afterbay area. Camping will be expanded and moved from the south side of Afterbay to a new site on the north side below the existing airstrip. The old campground will be renovated and converted to a group/individual picnic area. A swimming facility will be provided near the proposed campground. The existing airstrip will continue to be maintained and used for recreational and administrative purposes.

The Bighorn Canal Headgate will be allowed to deteriorate and public access across the top of the structure will be eliminated. Remaining sections of the old canal will be bridged together and will also be connected to the shoreline. This will open considerable shoreline to fishing and hiking.

A visitor contact/boat inspection station will be constructed at the intersection of Montana 313 and the road to the north side of Afterbay. Also along this latter road will be a small picnic area and a fishing access/parking area.

### 3. Full Spectrum Use

Full spectrum use addresses the needs of disabled persons, including persons both with ambulatory and sensory disabilities. Many existing facilities in Bighorn Canyon National Recreation Area will be modified, and any new facilities constructed in the future will provide appropriate access for disabled visitors. The following changes are proposed to ensure full spectrum use of the recreation area:

M-L Ranch -- Hard-surfaced parking and paths will be provided, as well as a new entrance gate, allowing easy access to disabled visitors.

Horseshoe Bend -- Existing comfort stations will be modified, and a port-a-lift will be installed at the boat dock. Pathways to picnic sites will be designed for the disabled.

Devil Canyon Overlook -- Ramps and asphalt trails to the rim from the north and south ends of the parking area will be provided.

Hough Creek -- Several sites in the walk-in campground will be made accessible to visitors in wheelchairs.

Barry's Landing -- A port-a-lift will be provided at the boat ramp.

North Fork Trail Creek -- Most of the picnic sites will be made accessible to disabled visitors.

Chain Canyon Cove -- The pedestrian bridge will be designed for full spectrum accessibility.

Medicine Creek Cove -- The floating comfort station will be made accessible to the handicapped.

Ok-A-Beh -- A port-a-lift will be provided at the boat dock and the comfort stations modified to accommodate wheelchairs.

Yellowtail Dam Visitor Center -- The restrooms will be modified to accept wheelchairs by the Water and Power Resources Service.

Afterbay -- All buildings at proposed development sites will be constructed to be accessible to disabled visitors.

E. Wilderness

1. Preliminary Wilderness Proposal

A "Wilderness Study" was prepared in July 1977 by the National Park Service to evaluate the wilderness potential of the recreation area. The following three roadless areas were identified in this study:

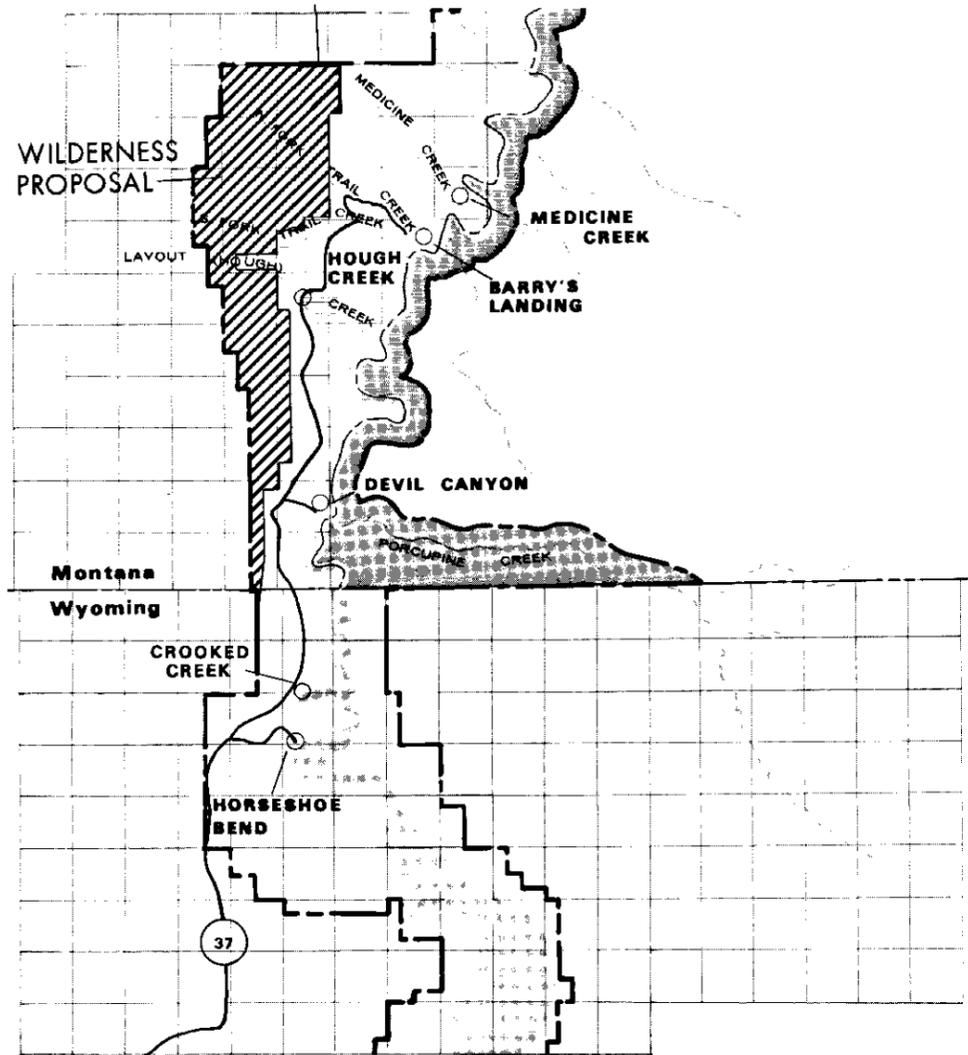
A -- Pryor Mountains west of the Bad Pass Road

B -- East of the Bad Pass Road between Dryhead and Barry's Landing

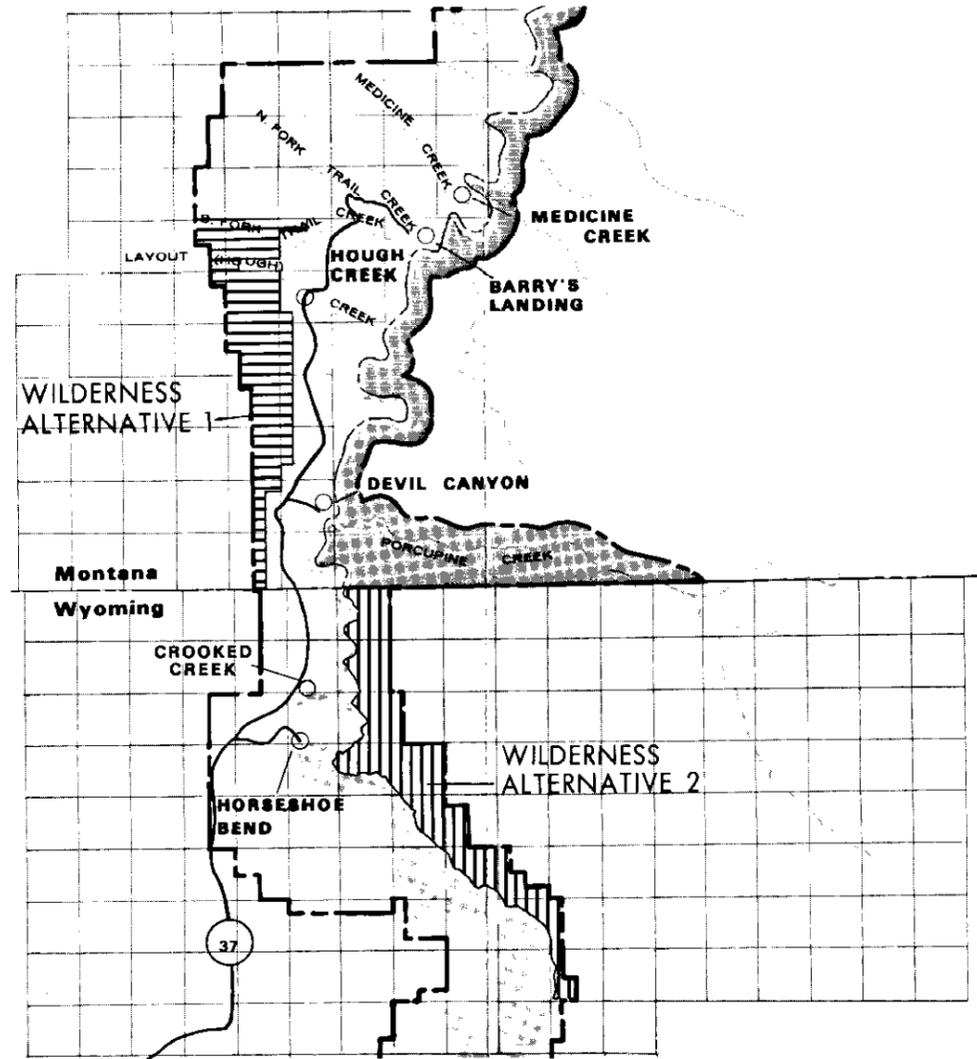
C -- Southeast shoreline in Wyoming between the Montana and Wyoming state lines and Kane Bridge

Crow lands were excluded from the roadless area study. Although there are roadless areas within the reservation lands that are a part of the recreation area under the 1967 Memorandum of Agreement, consideration for their inclusion into the wilderness system can be made only at the request of the tribe. Crow reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to National Park Service planning without permission of the Crow Tribal Council and the secretary of the interior. Roadless area B was deleted as a potential wilderness area due to planned improvements in the Dryhead Common Grazing Allotment and legislative and administrative agreements between the Bureau of Land Management and the National Park Service.

The proposal identifies approximately 8,108 acres of roadless area A as eligible for wilderness designation (see Wilderness Proposal and Alternatives map). Wilderness alternatives were devised from roadless areas A and C. The area proposed for wilderness includes one portion of the Dryhead Common Grazing Allotment and a portion of the Pryor Mountains Wild Horse Range. Since there is only one small improvement tentatively proposed within the grazing allotment, a determination was made that the subject improvement would not be substantially noticeable. The improvement would involve installing an underground pipe to a watering trough to facilitate cattle grazing. The proposal to establish wilderness will not alter the present grazing operations or management of wilderness.



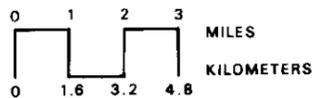
PROPOSAL



ALTERNATIVES



CROW RESERVATION LAND (NO THEMES MAPPED)



# WILDERNESS PROPOSAL AND ALTERNATIVES



BIGHORN CANYON NATIONAL RECREATION AREA  
United States Department of the Interior - National Park Service

There was a parcel of private land (approximately 463 acres) identified as potential wilderness in the preliminary wilderness proposal. This private land has been acquired by the federal government and is now included in the wilderness recommendation.

Except for the inclusion of some lands in the historic preservation zone, the lands in the wilderness proposal have been included in the natural zone of the management zoning proposal. They consist of areas of the same character--relatively undisturbed, without permanent improvement or human habitation, bordering on lands with complementary land use practices, and scenically outstanding. The wilderness proposal will not involve the removal of any existing services or preclude the development of needed services at sites suitable for such development.

## 2. Wilderness Recommendation

In accordance with provisions in the 1964 Wilderness Act, a wilderness review of all roadless areas over 5,000 acres must be performed. The wilderness study for Bighorn Canyon National Recreation Area was expanded to include all roadless areas in the park, regardless of acreage. This environmental statement contains a National Park Service wilderness recommendation that is subject to revision. Wilderness Act procedures require a subsequent recommendation by the secretary of the interior to the president concerning wilderness and provide that the president shall advise Congress of his recommendation with respect to the wilderness designation. Wilderness can be designated only by an act of Congress.

The National Park Service carefully considered the suggestions in oral and written statements received as a result of the public hearings. This study, which included consideration of management requirements, has resulted in no change in the preliminary wilderness proposal.

### F. Land Acquisition Plan

NPS policy provides for the acquisition of lands and waters in fee simple or less-than-fee interest (consistent with enabling legislation) to protect resources and provide for visitor use. The "Revised Land Acquisition Policy" published in the Federal Register on April 26, 1979, required areas within the National Park System to have a land acquisition plan. Bighorn Canyon National Recreation Area will follow the procedures outlined in the above policy for newly authorized areas. Acquisition of lands and interests in lands within the recreation area will also be conducted in accordance with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646).

The land acquisition plan for Bighorn Canyon National Recreation Area will be developed by the superintendent, approved by the regional director, and subjected to public participation procedures at a future date. The purpose of the plan will be to inform the recreation area staff, land acquisition personnel, the affected landowners, and the general public of the land acquisition plan for this area. Acquisition

priorities, definitions of compatible and incompatible uses, and the reservation of use and occupancy rights will also be included in the plan.

G. Interrelationships with Other Projects

1. Water and Power Resources Service

The Water and Power Resources Service and the National Park Service entered into a cooperative agreement in 1964 (amended in 1972), specifying the management responsibilities of the respective agencies concerning reclamation, recreation, and maintenance activities within the recreation area. Included in the agreement is a provision whereby the Water and Power Resources Service monitors water releases from Yellowtail Dam with "full consideration of public recreation and fish and wildlife purposes." The Water and Power Resources Service is currently undertaking site improvements in the Afterbay area and is coordinating its activities with the current NPS development concept plans for the area. The Water and Power Resources Service is studying installation of a generator in the Afterbay Dam. No changes are contemplated in the operation of the afterbay. Intermittent extraction of aggregate by the Water and Power Resources Service will continue in the Afterbay area, and such activities will be coordinated with the National Park Service as provided for under the cooperative agreement.

2. Bureau of Land Management

In 1969 the National Park Service and the Bureau of Land Management entered into a cooperative agreement concerning management of lands within the recreation area. This agreement establishes public outdoor recreation as the primary use to be made of the resources within the recreation area. The Bureau of Land Management agreed to manage lands outside the recreation area in a manner that recognizes the potential environmental effects on the recreation area. Under the provisions of this agreement, the National Park Service determines which public lands within the recreation area will be made available for grazing, and the Bureau of Land Management administers these activities. The Dryhead Common Grazing Allotment, which includes 9,815 acres of recreation area land, is also managed by the Bureau of Land Management. The Pryor Mountain Wild Horse Range, 9,100 acres of which are within the recreation area boundaries, is managed by the Bureau of Land Management, but in cases where such management affects land use options, recreational use has priority. All mineral leases on BLM-administered lands within the recreation area will be referred to the National Park Service, where they will be handled on a case-by-case basis.

The Bureau of Land Management is just beginning a roadless area inventory and review for possible inclusion of BLM lands into the wilderness system. Three tracts in the Pryor Mountains will be included in this study. These areas tie in directly to the proposed wilderness in the recreation area and the Lost Water Canyon area in Custer National Forest. An interpretive road and overlook site to interpret the wild horse range has been proposed by the Bureau of Land Management to be built in one of the roadless areas. This road would connect with the Bad Pass Road near Horseshoe Bend. However, due to its location within a roadless study area, no final decisions concerning the interpretive overlook have been made by the bureau.

3. U.S. Forest Service

The U.S. Forest Service recently completed its RARE II, Roadless Area Review and Evaluation, for Custer National Forest in the Pryor Mountains and has recommended a 9,000-acre wilderness area at Lost Water Canyon. The tract is west of the Hough Creek area and is separated from the recreation area by the Burnt Timber Ridge road corridor. As discussed above, inclusion of BLM wilderness study areas could tie this area to NPS wilderness and create a large contiguous wilderness area.

4. Interagency Agreements

During the early 1970s, the National Park Service, the Bureau of Land Management, and the U.S. Forest Service entered into an interagency study of management options for the Bighorn Canyon/Pryor Mountain complex. Land Use Recommendations for the Pryor Mountain Complex, released in 1973, and Pryor Mountain Complex Land Use Decisions, dated May 23, 1974, set up the management framework for oil and gas leasing on the Pryor Mountain Wild Horse Range and established a rest-rotation grazing plan for the Dryhead Common Grazing Allotment. Additional decisions are included in these documents.

5. State Game and Fish Agencies

The National Park Service and the Wyoming Game and Fish Department entered into a cooperative agreement in which 11,600 acres of NPS land were included in the Yellowtail Wildlife Habitat Area. The area is managed by the state primarily for fish and wildlife benefits. Hunting is allowed in the habitat area and is controlled by applicable state regulations.

The states of Montana and Wyoming are responsible for fish-stocking programs within the recreation area. Fishing within the recreation area is governed by the respective state regulations, with NPS staff assisting in enforcement.

Several additional agreements, special use permits, and similar land use stipulations affect the management of Bighorn Canyon. The approved "Statement for Management" includes a complete listing and description of these agreements.

### III. DESCRIPTION OF THE ENVIRONMENT

#### A. Region

##### 1. Landownership and Use

The regional landownership pattern of the Bighorn Canyon area is a diverse mixture of federal, state, and private owners.

The Crow own a major portion of the landbase of the recreation area. In addition their lands (Crow Indian Reservation) extend north and east of the recreation area to cover a vast territory. Close to 50 percent of this land, although within the reservation, is held by non-Indians. Primary uses on both Indian and non-Indian lands are grazing, irrigated and nonirrigated agriculture, and timber production.

The Bureau of Land Management administers much of the lands adjacent to the southern end of the recreation area. These lands are managed for a variety of uses, with grazing being the most prevalent. Important resources on BLM lands include the non-NPS portion of the Pryor Mountain Wild Horse Range, several caves, archeological sites, and several roadless areas currently being evaluated for possible inclusion into the National Wilderness Preservation System.

The U.S. Forest Service has landholdings immediately west (Custer National Forest) and east (Bighorn National Forest) of the recreation area. These lands are managed for multiple uses including grazing, timber harvesting, recreation, and wilderness.

The Yellowtail Wildlife Habitat Area occupies NPS, BLM, Water and Power Resources Service, and state of Wyoming lands. It is situated in and adjacent to the southern end of the recreation area and is managed for hunting and fishing by the Wyoming Game and Fish Department.

Private holdings are present throughout the Bighorn Canyon area. They appear in a scattered pattern often interspersed within the major blocks of land previously described. These lands are principally used for agriculture and grazing.

Several communities lie close to the recreation area. Of these, Billings, Montana, is the largest and best known. It serves as a regional service center providing varied opportunities in the commercial, industrial, and residential sectors of the economy.

##### 2. Socioeconomic Environment

The recreation area covers parts of Big Horn County in Wyoming and Big Horn and Carbon counties in Montana. Socioeconomically, it is most closely tied with the Wyoming and Montana Big Horn counties because they provide all of the highway access to the recreation area and contain travel routes, such as I-90 and U.S. 310, which carry large numbers of cross-country travelers. Montana 313 brings visitors from I-90 through the towns of Hardin, St. Xavier, and Ft. Smith; U.S. 14A and 310 serve the southern end of the recreation area and route many visitors through the town of Lovell, Wyoming. These communities receive the greatest impact from recreation area visitor travel and provide many of the services, such as food, lodging, and auto services.

Carbon County, Montana, although within the recreation area, is not included in this analysis. The county is little affected by the recreation area and does not warrant discussion.

a. Big Horn County, Wyoming

Similar to the entire surrounding region, Big Horn County's most important basic industry is agriculture. Agriculture and agricultural services account for 14 percent of the county's employment and 12 percent of its personal income (see table 4). The population is primarily white and rural. As indicated by agriculture's location quotient,\* agriculture is more than three times as important, in terms of employment and to a greater extent personal income, to Big Horn County's economy than it is to the Wyoming state economy as a whole (see table 5).

Manufacturing, primarily sugar processing, also accounts for a large portion of county employment and income (10 percent) and is somewhat more important to the county than the state.

Mining, although slightly less important in Big Horn County than elsewhere in the state, supplies nearly 20 percent of the county's personal income. Most of this is the mining of bentonite, and growth in this industry has produced an increase in mining industry personal income of over 200 percent between 1971 and 1976. However, lack of corresponding employment increases indicate that income benefits have gone to existing firms without equally contributing to county employment opportunities.

Between 1950 and 1970, the population of Big Horn County steadily decreased from 13,000 inhabitants to just over 10,000. In this decade, however, the population has grown to 11,600 (see table 2), increasing 10.5 percent between 1971 and 1976. This increase is primarily attributed to the increase in the bentonite industry and a stabilization in the agricultural sector.

Growth in the county has been somewhat slower than in Wyoming, which has experienced large-scale growth in energy resource development. Big Horn county has increased its population faster than the rest of the Bighorn Canyon region and Montana. Over 50 percent of the county's population resides in the communities of Lovell, Greybull, and Basin. Similarly, economic growth, expressed as total employment and per capita income, has been slower than in Wyoming and Montana (see table 2). This supports the expectation of slower population growth of only 6.8 percent for Big Horn County between 1976 and 1995, resulting in a total expected population of 12,383.

While Big Horn County, Wyoming, enjoys some benefits from tourism, it is not a major economic or social force in the

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\*The location quotient compares the percent contribution of the industry to the county's economy with the percent contribution of the industry to the state's economy. A value of 1.0 means they are equally important.

county. The presence of Bighorn Canyon, as well as the hunting and fishing opportunities in the Yellowtail Wildlife Habitat Area, does attract some recreationists to the county. The state of Wyoming depends quite heavily on its tourist industry (the second largest industry in the state), but those economic sectors that receive the largest impact from tourism, principally the retail trade and service sectors, are far less important to the county's economy than they are to the state's (see tables 4 and 5). This indicates that these sectors primarily operate out of the needs of the county's population rather than from tourist input. Likely changes in the future, such as increased development and visitation to the recreation area and the improvement of U.S. 14A, could increase the role of tourism in Big Horn County, Wyoming.

b. Big Horn County, Montana

As in Big Horn County, Wyoming, the principal economic base in Big Horn County, Montana, has been agriculture. Involving primarily grazing, irrigated row cropping, and small grain and hay production, agriculture plays a somewhat smaller relative role than it does in the Wyoming county, but it is a three times more important employer in Big Horn County than in the state of Montana (see table 5). In recent years, however, its relative role has decreased, primarily because of large-scale energy resource development occurring in the county.

Present mining activity and the racial composition of the county are two factors that distinguish the county most from Big Horn County, Wyoming; and are producing some of the most dynamic changes. Between 1971 and 1976, mining employment and personal income increased 483 percent and 1,052 percent, respectively--increasing dramatically the importance of this industry to the local economy. Currently, five major coal companies are extracting in excess of 13 million tons of coal annually, and future mining is expected to play a major role in county growth. The effect of this in the past can also be seen in the growth in per capita income and total employment above what occurred in Big Horn County, Wyoming, during the same time period (see table 2). By 1995, this is expected to cause an 88 percent increase in the county's population, resulting in a total of nearly 20,000 people. Growth of this magnitude will likely produce greater demand for recreational services in Bighorn Canyon National Recreation Area (see appendix B for visitation analysis).

Because Big Horn County contains most of the Crow Reservation and a large area of the Northern Cheyenne Reservation, an extremely high percentage of the county population is Native American. The Native American population in Big Horn County has increased steadily since 1960 to where in 1973 Native Americans accounted for over 68 percent of the county's population.

Table 2

POPULATION, EMPLOYMENT, AND INCOME  
Wyoming-Montana

<u>Population</u>	<u>1971</u>	<u>1976</u>	<u>Change</u>
Big Horn, Wyoming	10,500	11,600	10.5%
Big Horn, Montana	10,109	10,590	4.8%
Wyoming	340,300	390,400	14.7%
Montana	709,749	752,717	6.1%
<u>Employment</u>			
Big Horn, Wyoming	4,343	4,851	11.7%
Big Horn, Montana	3,749	4,300	14.7%
Wyoming	155,290	194,352	25.2%
Montana	289,887	327,251	12.9%
<u>Per Capita Income</u>			
Big Horn, Wyoming	3,109	4,833	55.5%
Big Horn, Montana	2,683	4,577	70.6%
Wyoming	3,847	6,634	72.5%
Montana	3,502	5,691	62.5%
U.S.	4,132	6,396	54.8%

Table 3

COMPARATIVE POPULATION TRENDS  
Big Horn County, Montana

	<u>1960</u>	<u>1970</u>	<u>Change</u>	<u>1973</u>	<u>Change</u>
Big Horn County	10,007	10,057	+ 0.4%	10,360	+ 3.0%
Crow	2,789	3,356	+23.3%	4,334	+29.1%
Percent of county	27.8%	33.3%	----	41.8%	----
Northern Cheyenne	1,922	2,439	+26.8%	2,926	+19.9%
Percent of county	19.2%	24.2%	----	26.6%	----

Reasons for this trend probably lie in the higher birth rates for the Indians and corresponding lower and declining birth rates for the non-Indian population; improved Indian health services, which provide longer life spans and lower infant mortality; and increased economic opportunity and Indian awareness, which have caused more Indians to remain at or return to the reservation.

Table 4  
MAJOR SOURCES OF PERSONAL INCOME

<u>Industry</u>	<u>Big Horn County, Wyoming</u>			<u>Big Horn County, Montana</u>		
	<u>Total Earnings</u>	<u>Change 1971-1976</u>	<u>State Location Quotient</u>	<u>Total Earnings</u>	<u>Change 1971-1976</u>	<u>State Location Quotient</u>
Farm	7.7%	-35%	3.26	3.9%	-82%	.91
Nonfarm						
Private						
Ag. Services, Forest, Fisheries	4.0%	559%	12.28	0.8%	17%	2.32
Mining	19.4%	236%	1.01	30.8%	1,052%	7.80
Construction	8.3%	136%	.70	8.6%	56%	.98
Manufacturing	10.3%	58%	1.73	0.9%	-65%	.08
Nondurable Goods	6.7%	64%	1.76	0.4%	-83%	.11
Durable Goods	3.5%	48%	1.67	0.5%	141%	.06
Transportation and Public Utilities	9.5%	23%	.91	3.8%	76%	.36
Wholesale Trade	2.1%	81%	.54	2.5%	328%	.38
Retail Trade	8.6%	59%	.77	9.1%	30%	.74
Finance, Insurance, Real Estate	2.8%	(D)	.89	2.5%	72%	.57
Services	6.3%	(D)	.55	12.1%	107%	.80
Government and Gov't Enterprises						
Federal, Civilian	2.6%	57%	.50	12.7%	35%	2.19
Federal, Military	0.6%	13%	.22	0.4%	28%	.18
State and Local	18.1%	65%	1.43	12.0%	76%	.82

(D) Not shown to avoid disclosure of confidential information

SOURCE: U.S. Bureau of Economic Analysis, Regional Economics Information System July, 1978

Table 5  
EMPLOYMENT AND INDUSTRIAL SOURCES

Industry	Big Horn County, Wyoming			Big Horn County, Montana		
	Total Employment	Change 1971-1976	State Location Quotient	Total Employment	Change 1971-1976	State Location Quotient
Farm	10.3%	4%	2.96	9.8	-30%	3.31
Nonfarm						
Private						
Ag. Services, Forest, Fisheries	3.6%	338%	7.84	1.0%	21%	1.86
Mining	11.5%	66%	.97	13.4%	483%	6.35
Construction	5.3%	81%	.61	6.9%	27%	1.26
Manufacturing	10.0%	1%	2.00	0.9%	-78%	.10
Nondurable Goods	6.8%	5%	2.28	0.5%	-88%	.15
Durable Goods	3.2%	-6%	1.59	0.5%	60%	.08
Transportation and Public Utilities	5.8%	-16%	.79	3.1%	21%	.43
Wholesale Trade	2.5%	43%	.73	2.9%	240%	.53
Retail Trade	11.8%	16%	.70	12.2%	3%	.68
Finance, Insurance, Real Estate	2.3%	(D)	.75	2.4%	33%	.59
Services	7.5%	(D)	.53	17.6%	42%	.93
Government and Gov't Enterprises						
Federal, Civilian	2.6%	10%	.59	10.9%	5%	2.37
Federal, Military	2.7%	-30%	.62	2.1%	-19%	.55
State and Local	24.3%	11%	1.42	16.9%	18%	.91

(D) Not shown to avoid disclosure of confidential information

SOURCE: U.S. Bureau of Economic Analysis, Regional Economics Information System July, 1978

Of particular importance to the recreation area is the Crow Reservation, which surrounds much of and includes portions of the north district of the recreation area. Therefore, interaction between recreation area administrators, visitors, and reservation residents is a continual phenomenon. Of the estimated 4,500 Crow residing in Big Horn County, approximately 3,500 (81 percent) live on the reservation (Bureau of Indian Affairs 1979).

One important factor of contemporary Indian life is an increasing awareness of Indianess. This has resulted in the increased use of significant religious and cultural sites throughout the Crow lands, including the recreation area (see section III.B.2. of the Final Environmental Statement). As the Crow population increases and the significance of these sites grows in the daily lives of the Crow people, increasing demands will be placed on recreation area lands.

The Crow are also interested in recreational aspects of Bighorn Canyon National Recreation Area. Discussions with the park staff indicated that the Crow visit the recreation area in tightly knit family and multifamily groups, and that visits by Crow members are most likely to occur on Sunday. These two factors are quite important when considering how the recreation area will serve Crow visitors.

Similar to Big Horn County, Wyoming, the tourist industry is present in Big Horn County, Montana, but at a very low level. The contributions of the county's retail trade and service sectors to the economy indicate that these sectors operate primarily out of the needs of the local population with little input from tourism (see table 5).

c. Recreational Opportunities

The region surrounding Bighorn Canyon National Recreation Area serves both regional inhabitants and cross-country travelers with a variety of wildland recreational opportunities.

Water-oriented recreational activities, including boating, fishing, and waterskiing, primarily attract visitors from the regional population. In addition to Bighorn Canyon, residents of Billings, Montana, and the surrounding area can go to Cooney Reservoir, Deadman's Basin, and Rosebud state recreation areas. Each offers water-based recreation on a smaller scale than Bighorn Canyon. Recreationists willing to travel a little further can enjoy the greater opportunities offered at Buffalo Bill Reservoir (121 road-miles from Billings) or Boysen State Park (211 road-miles from Billings). Excellent fishing is also available in the Yellowstone and Bighorn rivers, as well as in numerous small streams flowing through the region.

Within a 100-mile radius of Billings, there are over 2,000 campsites in more than 70 campgrounds. Of the available campsites, about 52 percent are in private campgrounds, 26 percent are in Forest Service campgrounds, and the remainder are divided between the National Park Service, state, county and Crow Reservation. Backcountry camping is available regionally in the north Absaroka, Beartooth, Cloud Peak, and Washakie wilderness areas.

The region surrounding Bighorn Canyon is also rich in history. It is best known for the events memorialized by Custer Battlefield National Monument. Other moments of history are preserved in Chief Plenty Coups Memorial State Monument, Pictograph Cave State Monument, and Pompeys Pillar (along the Lewis and Clark expedition route). Knowledge of the region's cultural and archeological value is still growing. The Plains Indians' medicine wheels and buffalo jumps are already nationally known, and other aspects of the Indian heritage may become better known as their importance becomes better understood.

Other recreational opportunities are available in the nearby Bighorn, Custer, Gallatin, and Shoshone national forests and the Hailstone, Lake Mason, and Half Breed national wildlife refuges. Yellowstone and Grand Teton national parks are also popular with the region's inhabitants. Two ski areas and at least three designated snowmobile trails encourage winter recreation in the vicinity of Red Lodge, Montana. Hunting for deer, game birds, and other animals is also a popular activity on both public and private lands.

The 1973 Montana Statewide Outdoor Recreation Plan indicated that the region surrounding Billings and Bighorn Canyon (designated as region 7 in the statewide plan) received relatively light nonresident use. Seventy-five percent of visitation to the region's recreational facilities originated within the region, and 82 percent of the regional visitation originated in Yellowstone County, where Billings is located. Driving and walking for pleasure, sight-seeing, fishing, and picnicking were the region's five most popular activities. Four-wheeling, camping, hunting, and hiking were also quite popular. Swimming and motorboating were less popular, with each accounting for less than 3 percent of the regional residents' recreation time.

B. Recreation Area

1. Socioeconomic Environment

a. Visitor Use

Reported visitation to Bighorn Canyon National Recreation Area rose 58 percent from 1973 to 1977. In 1977 visitation to the north district was 102,039; visitation to the south district was 150,304. Most of the visitors are from the immediate five-county area (65 percent in 1977). About 12 percent of the visitors are Wyoming or Montana residents from outside the local area, and cross-country visitors account for about 23 percent of total visitation. This distribution does not seem to be changing, based on 1968 and 1978 surveys. Responding to population trends in the Montana-Wyoming region, visitation is expected to rise at a continued rapid rate through the 1980 decade and then slow. Visitation in the year 2000 will be about 58 percent higher than the 1977 levels.

Although the emphasis at Bighorn Canyon is on active water-based recreation, in 1977 boaters accounted for only 12 percent of total visitation. Camping accounted for about 8 percent of the total reported visitation. Taking into account the probable overlap between camping and boating, 15-16 percent of total visitation is campers and boaters. Little information exists to document what the remainder of the visitors are doing at Bighorn Canyon, but day use activities such as

sightseeing, photography, etc., are probably important activities. An ongoing study is underway to evaluate the visitor use.

Because most visitors reside nearby, boating and camping use peaks markedly on weekends and is comparatively low during the week. The June to August peak use season is typical of recreation areas in the region, with late June and early July being the usual peak period at Bighorn Canyon.

Based on current trends, projected use of active recreational opportunities during the peak period at Bighorn Canyon is summarized as follows:

	1980		2000	
	<u>North District</u>	<u>South District</u>	<u>North District</u>	<u>South District</u>
Average number of campsites occupied				
Weekday	7	25	11	37
Weekend	46	61	82	93
Average number of boats launched				
Weekday	17	29	29	49
Weekend	68	72	116	124

For a more detailed description of visitation characteristics, trends, projections, and demand analysis, see appendix B.

b. Landownership and Use

The 120,284 acres of the recreation area are under several different ownerships, including federal, state, private, and Crow interests (see Landownership map). The predominant use of nonrecreation area lands outside NPS jurisdiction is grazing; about 66,000 acres of recreation area land are currently being grazed. Mining is allowed within the recreation area subject to specific regulations (see section II.B.1.b.(1)).

(1) Federal Interests

Federal ownership within the recreation area includes 68,108 acres of land and water. The Water and Power Resources Service controls lands in the Bighorn Canyon below the 3,675-foot elevation line. Lands used for grazing include the Dryhead Common Grazing Allotment, managed by the Bureau of Land Management. Lands utilized for wildlife benefits in the recreation area include 9,100 acres in the 31,000-acre Pryor Mountain Wild Horse Range.

(2) State Interests

The state of Montana owns 394 acres of school lands within the recreation area, which are currently managed by the National Park Service. The Wyoming Game and Fish Department manages 11,600 acres in the Yellowtail Wildlife Habitat Area in the southern end of the recreation area for wildlife benefits.

### (3) Private Interests

Private landownership accounts for about 6,590 acres. The majority of private inholdings outside the reservation area are being acquired by the National Park Service. Bentonite deposits on 50 acres of federal land in the southern end of the recreation area are currently being strip-mined under a special permit. Two sand and gravel operations along the Bighorn River in Wyoming are also operating under special use permits (see section II.B.1.b.(1)). Several additional bentonite, glass sand, and uranium claims currently exist in the Wyoming portion of the recreation area but have not been evaluated for validity at this time.

### (4) Crow Interests

Crow Reservation lands within the recreation area boundary include common tribal lands and individually allotted lands, in addition to the private lands noted previously. Tribal lands (common and individual allotment holdings) total 45,193 acres, utilized primarily for grazing. Crow Reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to NPS planning without permission of the Crow Tribal Council and the secretary of the interior.

## 2. Cultural Environment

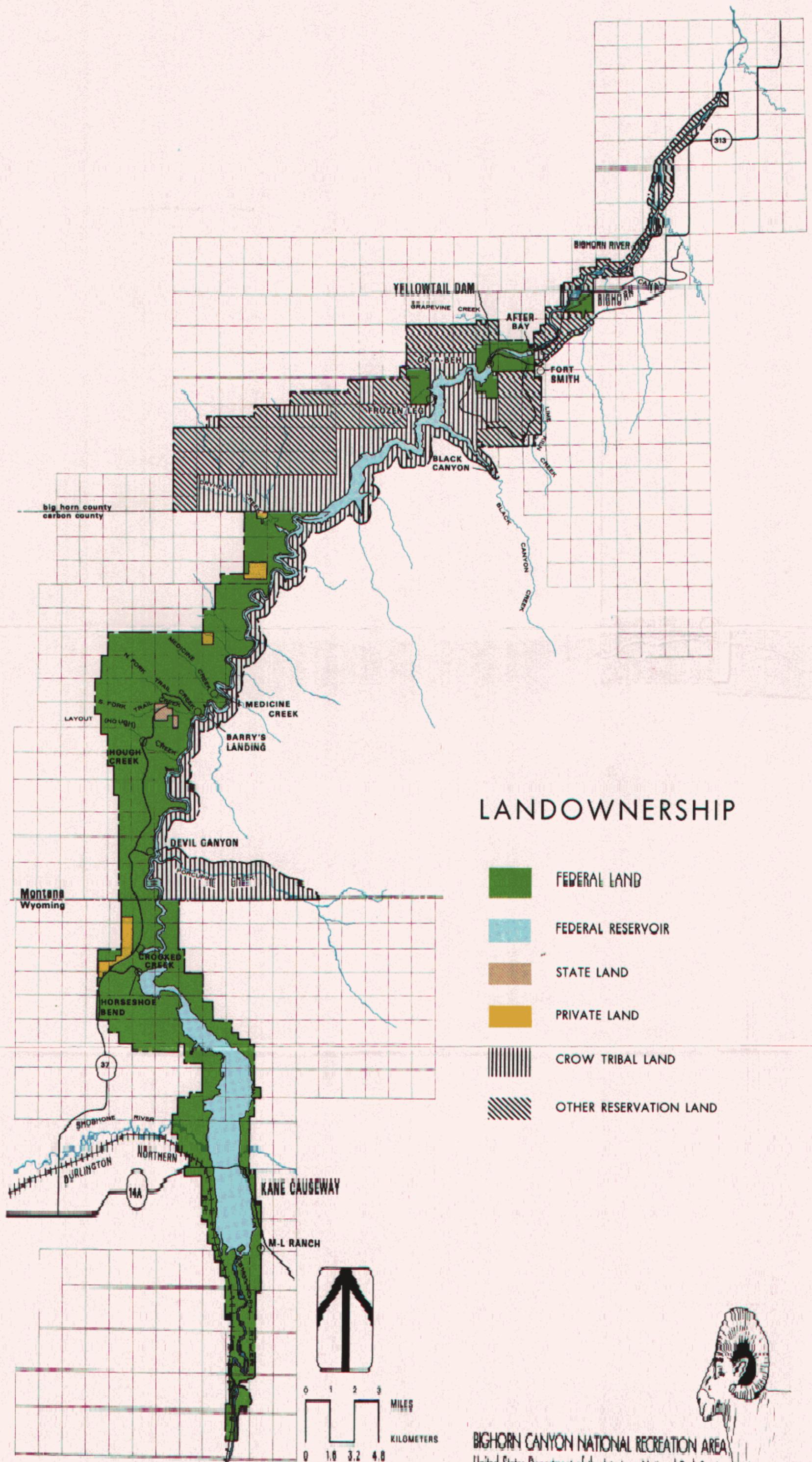
### a. Archeological Resources

The earliest evidence of human occupation and use of the Bighorn Canyon/Pryor Mountain area is from the end of the Pleistocene (10 thousand years ago). According to the scheme devised by Mulloy (1958), on the Northwest Plains this period is called the Early Prehistoric period. Later periods, the Middle Prehistoric, the Late Prehistoric, the Proto-historic, and the Historic, are represented in the Bighorn canyon vicinity. Appendix C: "Cultural Resources Basic Data" contains a brief description of these periods and the occupants' lifeways.

By the end of the Early Prehistoric period, Paleo-Indians were utilizing the Bighorn Canyon area. Some of their distinctive stone projectile points have been collected from the surface of archeological sites, and others have been recovered in controlled archeological excavations such as those at the Pretty Creek site, Sorenson Cave, and Mangus Cave.

Frequently, Middle Prehistoric period hunters and gatherers inhabited relatively small territories with a diversity of environmental zones in close proximity within which they could exploit a variety of resources on a seasonal and annual basis. The Bighorn Canyon area was ideally suited for this adaptation, as it crosscuts five distinct environmental zones and offers all the basic resources required for this lifeway. It is likely that many occupation sites, caves and rock-shelters, tipi rings, jump sites, and quarries in the Bighorn Canyon area will date from this Middle Prehistoric period.

Archeological evidence for the Late Prehistoric period in the Bighorn Canyon/Pryor Mountain area indicates that some of the inhabitants may have been immigrants from the Great Basin, possibly related to the Shoshone. It is also possible, but as yet unproven, that



**BIGHORN CANYON NATIONAL RECREATION AREA**  
 United States Department of the Interior - National Park Service

bands of Native Americans that we now know as the Crow arrived in this portion of Montana sometime during this period. Oral traditions, legends, and linguistic data seem to point to a Late Prehistoric arrival for the Crow people, while archeological and ethnohistorical evidence seem to indicate a Proto-historic arrival (see section III.B.2.b.).

The Proto-historic period and the early part of the Historic period were the times of the classic, equestrian nomadic Plains Indian cultures, well known from oral traditional, ethnohistorical, and archival accounts.

The Historic period has been classified as that period of time from A.D. 1800 to present. The history of Native American occupancy of Bighorn Canyon is almost exclusively that of the Crow Indians. Other Native American tribes moved through and hunted in the area, but they were trespassing on land controlled by the Crow. Undoubtedly some of the bison jump features, vision quest sites, burials, fortified sites, wooden structures, medicine wheel sites, and occupation sites can be directly attributed to this period of occupancy by the Crow.

#### (1) Archeological Sites

Over the past 40 years, approximately 612 archeological sites have been located in the Bighorn Canyon/Pryor Mountain area by amateur and professional archeologists (see appendix C, table 19). One hundred and eighty-seven of these are found within the present boundaries of the recreation area, and the majority of the remainder are on adjacent Bureau of Land Management, U.S. Forest Service, and Crow tribal lands.

Of the 187 sites within the recreation area, 53 have been inundated by the reservoir waters of Bighorn Lake, 70 are extant on NPS lands to the south, and 64 are extant on Crow lands to the north (see table 6).

Professor Lawrence L. Loendorf of the University of North Dakota was the principal archeological researcher in the Bighorn Canyon/Pryor Mountain area between 1968-1976 and remains the leading authority on the prehistoric and early historic archeology of the area. According to Loendorf, the variety and distribution of some 12 basic archeological sites over five distinct environmental zones can best be understood from a cultural-ecological perspective. The varied physiographic and biotic communities in the area offer an opportunity for a cultural adaptation or survival strategy known as seasonal transhumance (see appendix C for a description of this theory).

Essentially, seasonal transhumance is the deliberate movement of people and their possessions within a defined territory that is "scheduled" to exploit seasonally available plant, animal, geologic, and social (other human groups) resources. Generally this lifeway is carried on by small bands, who, most of the year, move in response to hunting ranges of animals or the availability of plants. At an appointed time in the year, generally late summer or fall, these bands of people come together and integrate for social, political, economical, and ideological reasons and operate as a larger group.

During his nine years of work, Loendorf identified several hundred archeological sites in the following five major environmental zones present in the Bighorn Canyon/Pryor Mountain area: the subalpine, coniferous forest, juniper breaks, grassland, and dryland. Throughout these zones, 12 basic configurations of archeological sites were located and classified as occupation sites, tipi ring sites, wooden structures, caves and rock-shelters, buffalo jumps, burials, fortified caves, quarries, rock art sites, vision quest sites, a medicine wheel site, and cairns/rock alignments. These different archeological sites seem to represent different kinds of economic, residence, religious/ ceremonial, warfare, or otherwise social behaviors carried on by prehistoric or early prehistoric people who practiced a seasonal type of subsistence economy (see appendix C).

In summary, the importance of the archeology of the Bighorn Canyon/Pryor Mountain area lies not in the individual significance of bison jumps, a prehistoric trail, or even in the verified 8,000 years of history at a single occupation area, but rather in the overall proof and reconstruction of a hunting and gathering lifeway that successfully supported generations of Native Americans for some 10,000-12,000 years on the Northwest Plains.

(2) National Register Sites

(a) Bad Pass Trail ✓

The Bad Pass Trail (24CB853) was an extremely significant route of transportation and trade connecting the grasslands and plains to the north and east with the Wyoming Basin and Great Basin country to the south and west. Its deep travois ruts and hundreds of rock cairns attest to its long use and high visibility. The narrow strip of upland prairie between East Pryor Mountain and Bighorn Canyon was the most practical connection between the two regions. Prehistorically, it is hypothesized that this trail was used for the trade of agricultural products, hides, meats, and other perishables and probably was also used for the trade of other highly desirable items like obsidian and steatite. Historically, the trail is known to be important for the trade of European items such as beads, metal objects, guns, and horses.

✓ (b) Pretty Creek

The Pretty Creek archeological site (24CB4&5) is a series of different activity areas, which were occupied for different lengths of time by different people intermittently throughout its 8,000-year history. The separate activity areas include hearths, tipi rings, sweat lodge locations, vision quest locations, and occupational lithic debris. Ten-foot-deep test pits have revealed early artifacts stylistically similar to both Great Basin and Northwest Plains cultures. The site is approximately 1½ miles long on either side of Hough or Layout Creek and would appear to be in an ideal locale for the following reasons: (1) proximity to the Bad Pass Trail; (2) proximity to permanent water in Hough Creek and the Bighorn River at Barry's Landing; and (3) ecotonal location. The Pretty Creek site is within the juniper/grass and riparian woodland vegetative communities. Those occupants who chose the Hough Creek area for a campsite and/or work area were in an advantageous spot with access to a variety of small animals and larger game animals and made these environmental life zones their home and wandering place.

Table 6  
 ARCHEOLOGICAL SITES AND RANKINGS

Bighorn Canyon National Recreation Area

<u>Site Type</u>	<u>NPS</u>	<u>Crow</u>	<u>Total</u>
Occupation	46	31	77
Wooden structures	4	0	4
Tipi rings	33	11	44
Medicine wheel	0	1	1
Petroglyph/pictograph	1	5	6
Cave/rock-shelter	13	2	15
Rockpiles/cairns	3	0	3
Quarry	6	1	7
Buffalo jump	0	5	5
Burials	2	3	5
Fortified site	0	2	2
Vision quest	2	2	4
Other	2	0	2
Unknown	<u>11</u>	<u>1</u>	<u>12</u>
TOTAL	123 <sup>1</sup>	64	187

Rankings of Sites<sup>2</sup>

1--Critical scientific value	5	10	15
2--Major scientific value	5	11	16
3--Moderate scientific value	45	34	79
4--Minor scientific value	12	8	20
5--Trivial scientific value	<u>56</u>	<u>1</u>	<u>57</u>
TOTAL	123	64	187

<sup>1</sup>53 of these sites were inundated by construction of the Yellowtail Dam; this results in a total of 134 sites extant within the recreation area.

<sup>2</sup>Loendorf, personal communication, December 14, 1978

Archeologically, this site has produced evidence of great antiquity, interregional exchange and contact, and significant intersite associations with the Bad Pass Trail.

b. Crow Resources

Native American occupation of the Northwest Plains began some 12,000 years ago with big game hunting Paleo-Indians and has been continuous ever since. Sites such as bison-procurement sites, fortified caves, wooden structures, and tipi rings are consistent with a seasonal transhumance pattern, which may have begun as early as 4,000 years ago.

There is some uncertainty as to which Native American tribes first occupied the Bighorn Canyon area and the dates of their occupancy. Dates for Crow arrival to this area range from A.D. 700-1777 and a discussion follows. There are also suggestions that the Shoshone once occupied this area as well. A large portion of southeastern Montana was controlled at one time by the Shoshone. Teit (1930) comments:

. . . Shoshonean tribes occupied the Upper Yellowstone country, including the National Park, and they are said to have extended east to the Bighorn Mountains or beyond. . . . How far east and down the Yellowstone they extended is not known; but they are thought to have at one time held the country around Billings, and most, if not all, of the country where the Crow Indians now have a reservation.

Hewes (1948) says that the Blackfoot, and to some extent the Crow, had driven the Shoshone west of the Rockies after 1750 to 1780. Hyde (1959) in a description of the Atsina states: "They had helped drive the Snakes [Shoshone] out of the Yellowstone and Bighorn country prior to 1790."

The Crow are a Siouan-speaking people who originated in the Lake Winnepeg area of Canada (McGinnis and Sharrock 1972) or farther south in what is now Minnesota (Medicine Crow 1939). The Crow call themselves Apsaalooke, or children of the large-beaked bird (USDI, NPS 1979f). The Crow were once part of the Hidatsa tribe, then living along the banks of the Mississippi River (Denig 1856). There is much dispute over the exact dates of the Crow-Hidatsa separation and the subsequent arrival of the Crow to the Bighorn Canyon area. Linguistic (glottochronological) evidence seems to point to at least a 500-year separation between the Crow and the Hidatsa (Wood and Downer 1977). Historical accounts offer several dates for the Crow split from the Hidatsa and their arrival to the Bighorn Mountains, ranging from 1677-1777 (Matthews 1877), about 1750 (Bradley 1896), to 1776 (Denig 1856). Hanson (1979) states that evaluation of the accounts of Denig, Bradley, and Matthews is difficult because of the lack of justification for the dates given. Wood and Downer (1979) comment: "Ethnohistorical data suggest that the Crow separation dates from the mid 1700s. Rather than dating the initial separation of the two groups, the ethnohistorical data probably reflect the final severing of ties with the Hidatsa--a separation made final by the adoption of the horse."

Crow oral traditions point to an arrival in the Bighorn Canyon area 16 generations ago. According to some Crow tribal historians (USDI, NPS 1979f), assuming an average of 80 years per generation, this would indicate an arrival around 700 A.D. Another estimate (assuming an average of 27 years per generation) would indicate an arrival around 1550 A.D. (Medicine Crow 1979). No substantive conclusions can be drawn at this time, and various types of evidence provide a range of dates from A.D. 700-1777 for the separation of the Crow from the Hidatsa and their arrival at the Bighorn area.

Crow traditional culture is part of the plains horse complex, the peak of which ranged from 1800 to the late 1880s (Ewers 1955). Traits of this complex included bison hunting as well as intertribal warfare and raiding. "[The Plains Indians were] equipped with stout ash bows, three feet or less long, so effective that a warrior could drive deadly barbed arrows clear through a buffalo while racing along at top speed. . . . The Indians of the Great Plains were dangerous antagonists in any war." (Billington 1974).

The Crow became a fine example of the classic nomadic horsemen of the northern Great Plains. The Crow raided and

centered around the pursuit and utilization of bison; meat and many items of their material culture came from the bison. Further description of the Crow way of life and their history can be found in appendix C.

c. Historic Resources

The largest volume of historical activity in the Bighorn Basin region tended to flow around the margins of Bighorn Canyon National Recreation Area and seldom penetrated the tract encompassed by the present boundaries. A brief account of the history of the Bighorn Canyon area can be found in appendix C.

Since the establishment of the recreation area, detailed historic studies of many sites have been performed (see Archeologic/Historic Sites map for locations of these sites). As a result of recommendations from these studies, the following sites have been placed on the National Register of Historic Places: Hillsboro (Cedarvale), listed 8/19/75; the Sorenson (Ewing-Snell) Ranch, listed 5/12/77; the Bighorn Canal (Ditch) Headgate, listed 12/12/76; and the Fort C.F. Smith Historic District, listed 10/10/75. Following are descriptions of these and other historic sites within the recreation area. All National Register sites have been placed in the historic zone on the Management Zoning map.

The M-L (Mason-Lovell) Ranch, consisting of a log bunkhouse, outbuildings, orchard, and ranch lane, was stabilized and preserved in 1977. This ranch has been nominated to the National Register and has been placed in the historic preservation zone.

The Kane Cemetery in the southern end of the recreation area served the town of Kane, which was inundated by the

reservoir waters of Bighorn Lake. The cemetery is ineligible for the National Register but has been placed in the historic preservation zone.

The Sorenson Ranch consists of one of the longest occupied sets of historic buildings in the recreation area. The ranch house has been informally restored on the exterior and maintained; it currently serves under the adaptive use policy as a permanent ranger station. The ranch house, four log buildings, and corral are within view and within relatively easy access of the present road alignment near Barry's Landing.

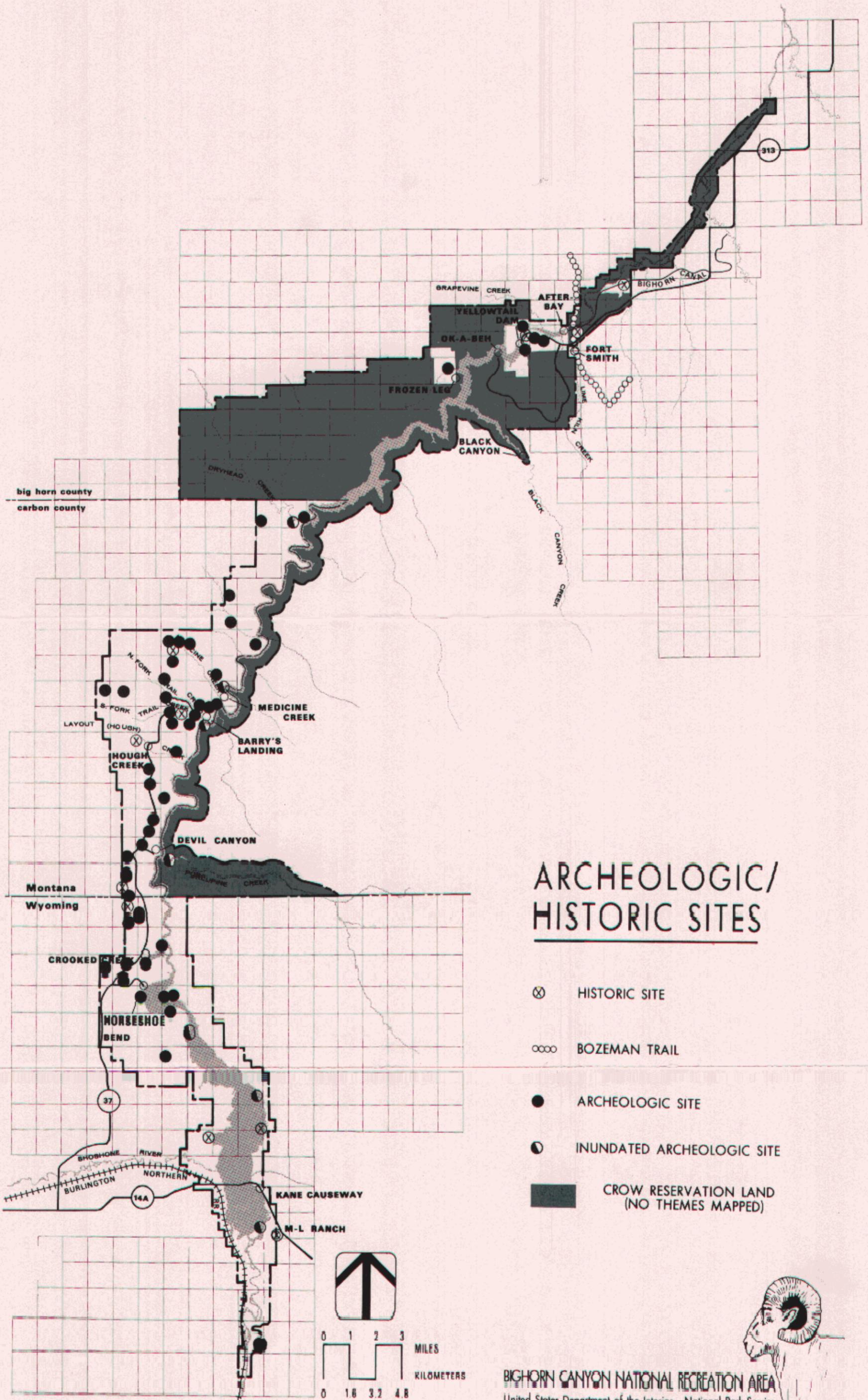
The Hillsboro site settled by G. William Barry consists of a tract developed for farming and dude ranching from 1910 to the 1920s. A number of structures, ruins, and foundations remain. The National Park Service made a decision to allow Hillsboro to deteriorate naturally. In accordance with the Historic Preservation Act of 1966, the Montana State Historic Preservation Officer and the Advisory Council on Historic Preservation reviewed this proposal and a memorandum of agreement was signed by the concerned parties.

The Lockhart Ranch consists of a private inholding that includes 16 log and 2 wood frame buildings, bridge, corral, and fences. The property was developed and intermittently occupied by the regionally and nationally known journalist, Caroline Lockhart. This site is currently being acquired by the National Park Service and will not be nominated to the National Register.

The Ruth-Aldrich (Foust) Ranch is a small deteriorating homestead that was built around 1897-1906. It is ineligible for the National Register, and a policy of neglect has been recommended. All actions taken will comply with the appropriate requirements (see section II.B.2).

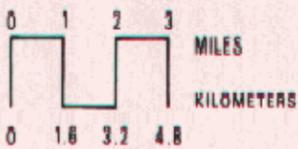
The only visible remains of the Bighorn Canal Headgate within the recreation area are the headgate and the overgrown ditch extending down the Bighorn River. The headgate is replaced by the Afterbay Dam. The headgate is partially submerged by the varying level of the river backed up behind Afterbay Dam. A policy of neglect has been recommended by the National Park Service and concurred with by the Advisory Council on Historic Preservation in accordance with section 106 of the National Historic Preservation Act of 1966 (36 CFR 800) and National Park Service Special Directive 78-3 "Removal, Major Alteration, or Neglect of Structures" (see Appendix H). The Bighorn Canal Headgate will be recorded to the Historic American Engineering Standards.

None of the walls or structures are standing at this time at the site of Fort C.F. Smith. Outlines of walls and foundations remain, and the ruts of the Bozeman Trail can still be seen in the vicinity of the fort. The post cemetery is now overgrown with grass, and nothing remains to mark the site. Stretches of the Old Wood Road can still be seen from the fort site and all the way up the switchbacks of the Ok-A-Beh Road and beyond toward the Bighorn Mountains. The lime



## ARCHEOLOGIC/ HISTORIC SITES

- ⊗ HISTORIC SITE
- BOZEMAN TRAIL
- ARCHEOLOGIC SITE
- ⦿ INUNDATED ARCHEOLOGIC SITE
- CROW RESERVATION LAND (NO THEMES MAPPED)



BIGHORN CANYON NATIONAL RECREATION AREA  
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quarry is still very evident, although the lime kiln is just a heap of rubble (see appendix C).

A house on the former Lind property, west of the Hayfield fight site along the Bighorn River, is rumored to have been the officers' quarters of Fort Custer, which was near Hardin. The structure is purported to have been moved around 1900 from the fort to its present site, a distance of about 40 miles. This information must be validated before any actions can be taken by the National Park Service.

### 3. Natural Environment

#### a. Geology

##### (1) Geomorphology

Bighorn Canyon National Recreation Area is in Wyoming and Montana about 120 km (75 mi) east of Yellowstone National Park. The canyon cuts through the northern end of the Bighorn Mountains anticline that extends southeastward into Wyoming. The Pryor Mountains rise immediately to the west and north of the recreation area. These mountains are the easternmost extension of the Rocky Mountains in this region.

Most of the topographic relief of the region is an expression of uplift of the Rocky Mountains that began about 70 million years ago. Prior to this time seas covered most of this area, resulting in the many layers of marine and sedimentary rock that are so common at Bighorn Canyon.

The Bighorn River has cut a canyon up to 670 m (2,200 ft) deep through the northern tip of the Bighorn Mountains. Except for this major canyon and its tributaries, the topography is a gently rolling plain, which gradually increases in elevation from about 1,200 m (3,600 ft) in the south to 1,500 m (4,500 ft) in the north. The mild relief is occasionally broken by local rock outcrops.

Bighorn Canyon is a dramatic erosional feature that provides evidence of considerable regional uplift. The sharp bends in the canyon today are the incised meanders of the Bighorn River of the past, which flowed over a mildly sloping plain that was folded into the Bighorn Mountains.

About 50 to 70 million years ago, local uplift beneath essentially horizontal beds of sedimentary rock created the numerous anticlines, synclines, and domes in the Bighorn Canyon area. A 90 degree fold in sedimentary rock is graphically displayed on the canyon wall near Big Bull Elk basin. The Bighorn Mountains are a large anticlinal uplift, and Sheep Mountain south of Lovell is an outstanding example of a double plunging anticline.

Hogbacks, landforms associated with these uplifts, are ridges of more resistant sedimentary rock along the flanks of the anticlinal uplifts. Hogbacks are common around the northern end of the recreation area in the vicinity of Fort Smith.

The Pryor Mountains are an example of an entirely different mountain-building process, fault-block. The sheer cliff face of these mountains east of the recreation area is the first in a series of major faults that were part of the uplift of the Pryor Mountains. In this case, the sedimentary rocks were broken along nearly vertical planes instead of being folded.

The Sykes Spring fault zone extends 8 km (5 mi) along the foothills east of the Pryor Mountains and west of the Horseshoe Bend and Hough Creek development sites. These faults account for the series of springs along the Pryors.

There are many geologic landforms associated with erosional processes that followed uplift of the region. Slow-moving mudslides occurred during the moister glacial period, but much of this debris has been eroded away. Floods have deposited alluvium in major tributaries and along the sides of the Bighorn River, and uplift and/or downcutting of the Bighorn River have eroded these deposits into terraces that are still visible below the dam.

## (2) Stratigraphy

Sedimentary rock exposed in the recreation area, dating back to the Mississippian and Devonian periods (235-400 million years ago), is of marine origin.

A loosely cemented undifferentiated formation called the Jefferson limestone and Three Forks shale forms the talus slopes at the base of the canyon walls. This rock is overlain by the Madison limestone, the predominant white cliff that forms Bighorn Canyon. The formation is a major aquifer in the region and is characterized by caves.

The Madison limestone is capped by the red Amsden Formation, consisting of interbedded sandstone, siltstone, limestone, and red shale. The red color is very distinctive, and the white cliffs of Madison limestone are frequently stained as a result of the Amsden washing down. The Amsden Formation is one of the dominant parent bedrocks along the upper plain above the canyon and occurs at both Barry's Landing and Horseshoe Bend.

The Tensleep Formation is an irregular band of sandstone along the plain between the canyon and the Pryor Mountain foothills. The Embar and Chugwater formations are both mixtures of interbedded limestone, sandstone, siltstone, and clay. The Embar Formation is only found near Crooked Creek and south and is a common bedrock at Horseshoe Bend. The Chugwater Formation forms the distinctive red bluffs along the foothills of the Pryors, around Horseshoe Bend, and in the hogbacks around Ft. Smith.

## (3) Geologic Hazards

### (a) Earthflows

Earthflows along the base of the Pryor Mountains, which occurred during the glacial period, have stabilized and should not present any constraint for development.

(b) Flooding

Prehistoric and historic geologic records indicate infrequent flooding in the Hough Creek area well away from the proposed visitor use facility development.

(c) Rockfalls

Rockfalls are evident throughout the recreation area. The potential rockfall areas exist along the numerous cliffs of the canyon, side canyons, and outcrops. Rockfalls could occur at the Barry's Landing and Ok-A-Beh developed areas, although none have been observed since visitor use of these areas began. A potential rockfall area also exists along the east slope of the Pryor Mountains and presents possible hazards to hikers in the area.

(d) Faults and Earthquakes

Movement along known faults at Sykes Spring and Barry's Landing has not occurred in recent times, and the area has no history of major earthquakes.

(e) Slumping

Slumping areas associated with the inundation of the reservoir are evident in Bull Elk Basin. There are five major slides in the vicinity of Big Bull Elk Creek. Total estimated volume of the slides is 145,000,000 m<sup>3</sup> (175,000,000 cu yd) (Bureau of Reclamation 1978). Movement of the slides averages 2 feet a year, and public use of these areas is prohibited. Slumping of the lakeshore has also occurred on the west shore of Horseshoe Bend southwest of the boat launch ramp.

Several small slumps have developed along roadway excavations and fills near Yellowtail Dam since its construction (Bureau of Reclamation 1978). They generally occur in incompetent shale and limestone beds in the bottom half of the Amsden Formation. Most of the movement of these slides occurs each May and June after the spring rains. A slide in 1978 covered portions of the Bighorn Canal Headgate.

(4) Mineral Deposits

Bentonite, uranium, limestone, gravel, and glass sand are the significant mineral resources identified in the recreation area. Validated claims have been established only for bentonite.

Bentonite in shale of the Cretaceous period occurs in beds up to 5 meters thick. These deposits crop out intermittently along the eastern margin of Bighorn Basin (USDI, NPS 1978b).

The Pryor and Bighorn mountains were prospected for uranium in the 1950s. Secondary uranium deposits were found in Amsden and Madison formations. There are unvalidated uranium claims just north of Horseshoe Bend on the west side of the canyon.

Madison limestone is very common in the recreation area. Much of the limestone is interbedded with shale and

some dolomite. Limestone has been quarried in Lime Kiln Creek along the Ok-A-Beh road.

Unvalidated glass sand claims have been established just north of Horseshoe Bend on the west side of the canyon. High-grade sand and gravel outcrop in the southern tip of the recreation area. Mineral rights for these resources are retained by private interests.

Low-grade placer gold deposits were worked along the Bighorn River prior to inundation.

b. Soils

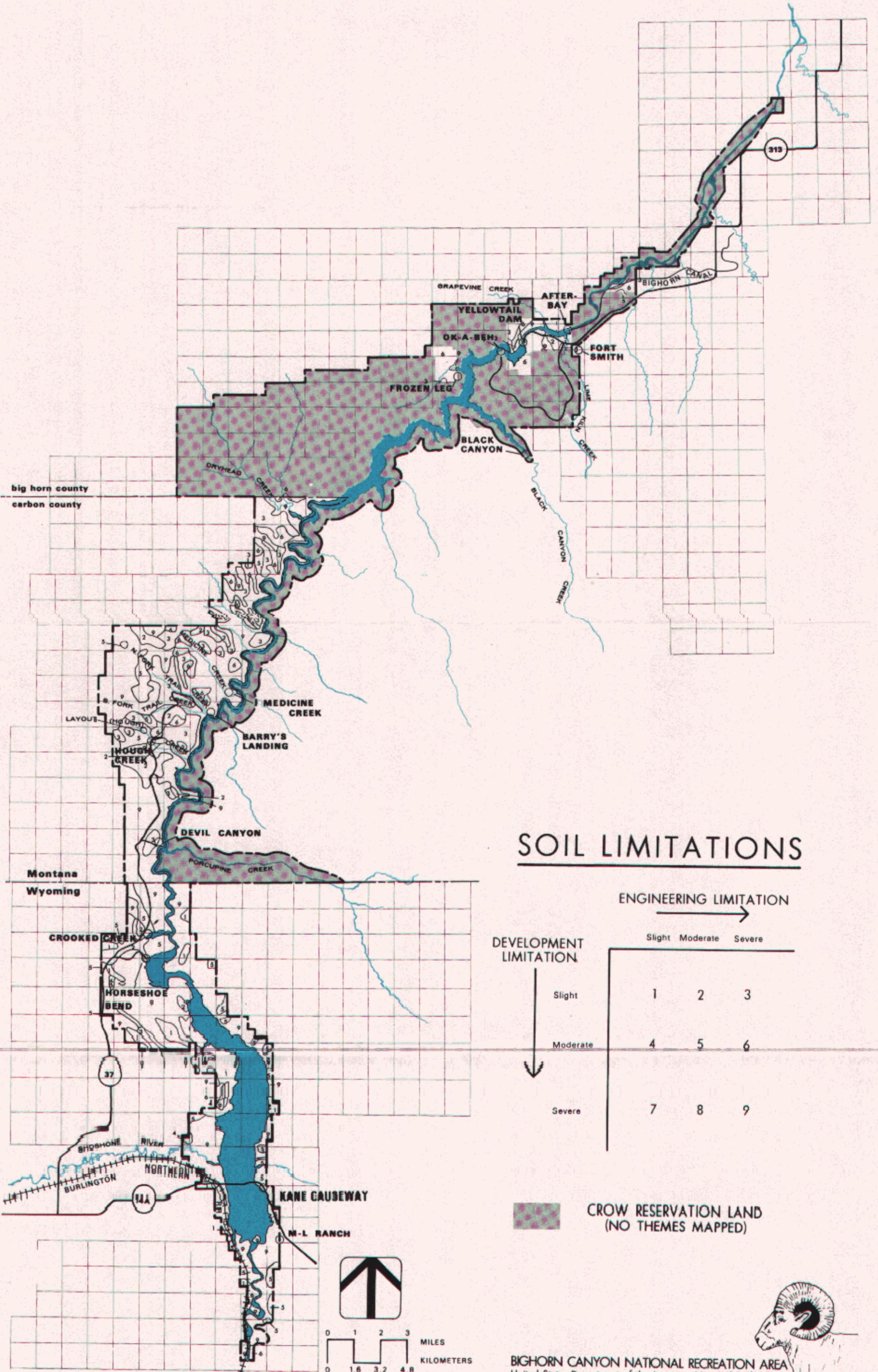
Most of the soils in the Bighorn Canyon area are formed in place and are derived from sandstone, siltstone, limestone, and shale bedrock. Soils deposited on alluvial terraces are generally derived from sandstone and shale. Sandy soils develop on sandstone, clayey soils are associated with shales, and silty soils develop from limestones. Variations in the texture of soils throughout the area are usually associated with the parent bedrock. These variations are very noticeable and often abrupt. All the soils are relatively rocky and gravelly, with depth to bedrock often less than 2 feet.

The organic content and amount of loam in the soil is fairly low, especially in the southern end of the recreation area. The surface organic layer is usually shallow and often not distinguished by any evident color change.

Alkalinity and salinity of the soil in the area are fairly high. The reaction pH ranges from 7.7-8.5. Salt and sodium are acquired from parent material, and soil developed from limestone is high in calcium carbonate. This soil condition limits the number and species of plants in the area.

Permeability of the soil by water runoff is moderate (1.5-5 cm/hr or 0.6-2 in/hr). Percolation through the soil is limited by the clay content of the soil, and layers of clay are interspersed throughout most of the parent bedrock formations. The shrink/swell potential for most soils is moderate to low except where there is bentonite. Frost action is moderate in general and high in some areas. The high seasonal groundwater table is less than 1.5 m (5 feet) except near streams.

Suitability for development is rated as severe for most areas (see Soil Limitations map) due to the shallow depth to bedrock. Parking lots, roads, paved trails, and building foundations will require special construction methods. Erosion potential in most areas is very high. Runoff is rapid, and the soil particles are readily carried away on slopes greater than 15 percent. Transplanted vegetation will require special site preparation to overcome the high alkalinity of the soil and shallow depth to bedrock.



# SOIL LIMITATIONS

ENGINEERING LIMITATION →

DEVELOPMENT LIMITATION ↓

	Slight	Moderate	Severe
Slight	1	2	3
Moderate	4	5	6
Severe	7	8	9

CROW RESERVATION LAND (NO THEMES MAPPED)



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c. Climate

Climate data for the recreation area are available from U.S. weather stations at Lovell and Ft. Smith. In general the southern end of the recreation area is drier than the northern end, with a corresponding gradual change in climate. Weather patterns are locally affected by the Bighorn and Pryor mountains, which receive a higher proportion of precipitation than the intervening lowlands. Temperature and precipitation within the canyon vary from the plains above due to the heat retention capacity of the lake and limited solar exposure.

Average annual temperatures at Lovell and Ft. Smith are about 10° C (50° F) and extremes range from over 38° C (100° F) to less than -26° C (-15° F) at both stations. January is typically the coldest month with mean daily temperatures averaging less than -12° C (10° F) and July or August is the hottest month with mean daily temperatures averaging about 27° C (80° F). Periods of extreme cold are not generally prolonged and are frequently broken by warm Chinook winds that melt the snow quickly, followed by lengthy periods of mild weather.

The average annual total precipitation ranges from 18 cm (7 in) at Lovell to 50 cm (20 in) at Ft. Smith. Usually one-third of the precipitation in the recreation area occurs as snow, with spring and early summer thundershowers accounting for most of the remaining portions of yearly precipitation. Evaporation is measured at Ft. Smith from May to September, and total evaporation during this season is usually between 115-127 cm (45-50 in).

The canyon acts as a trough, with warm winds rushing north from Lovell and pouring out to the flatlands north of the dam -- sometimes with extreme velocity. Higher elevation winds are generally westerly.

Wind data at Horseshoe Bend indicate that winds there are predominantly from the north and northwest. Ventilation appears generally excellent with wind averaging about 14.5 km/hr (9 mi/hr) during the summer months.

d. Vegetation

The most common plants at Bighorn Canyon National Recreation Area are low shrubs and grasses adapted to semiarid conditions. The vegetative communities are defined mainly by the availability of moisture as dictated by elevation, solar aspect, and drainage patterns. The Vegetation map shows six communities within the recreation area, as adapted from the 1974 Final Environmental Impact Statement, Proposed Transpark Road.

The dominant low shrub of the shrub/grass communities is either mountain mahogany or one of two species of juniper. Mountain mahogany generally predominates in drier habitats, which have a very shallow soil profile. Of the junipers, only Rocky Mountain juniper grows in the northern regions of the recreation area, and it is gradually replaced by Utah juniper to the south. The Utah juniper found at Frozen Leg is the northernmost extension of this species.

Variance in local slope, solar aspect, and availability of moisture causes extreme changes in vegetation. Douglas-fir and Ponderosa pine occur in a few locations high on the north-facing canyon rim walls that have a high soil moisture retention capacity. The relatively abundant availability of moisture in the major drainages leads to a dense, diverse cottonwood riparian habitat.

Other less common plant communities are found within the restrictive confines of the canyon wall and along the steep edges of the reservoir within the water fluctuation zone. Indian ricegrass, cheatgrass brome, and broom snakeweed are the notable invading species below the high-water line of the reservoir.

Grazing has occurred extensively in the recreation area, and about 10,000 acres will continue to be used for this purpose. This has significantly altered the relative abundance of various plants. Grazing tends to increase the proportion of junipers and shrubs in an area and reduces palatable species of grasses and forbs.

Natural fires in the recreation area are usually small brush fires involving less than 1 acre of land and are started by lightning. Only a few fires are observed during a season (see "Bighorn Canyon National Recreation Area--1978 Wildland Fire Control Plan").

Following is a general description of each community found on the Vegetation map. This description of vegetation represents the existing conditions and does not reflect the climax or naturally occurring state.

(1) Desert Shrubland

This community occupies the dry southern end of the recreation area. The flat landscape is frequently interrupted by rock outcrops, and the well-drained soils are poorly developed. The elevation ranges from 1,200 m (3,700 ft) in the south to 1,500 m (4,400 ft) at the northern end of this community's range.

The high evapotranspiration rate precludes the development of dense stands of grass, with a resultant domination of xeric shrub vegetation. Species diversity is low locally, although there is a noticeable change in dominant forms corresponding to the general decline of moisture availability southward. In order of dominance from south to north, the common shrubs in the community are as follows: shadscale saltbush, sagebrush, and broom snakeweed. Plains prickly pear cactus, bluebunch wheatgrass, blue grama, Fendler threeawn, inland saltgrass, and needle and thread grass occur throughout this community.

(2) Juniper/Grass

The range of this community lies within the middle of the recreation area at moderate elevations. The land is generally flat except for the frequent rock outcrops and washes. Soil types are extremely variable -- derived from limestone (sandy loams), hard shales (clay loams), and soft shales (silty clay loams). Annual precipitation ranges from 10-30 cm (8-12 in).

There is a gradual transition from the dry desert shrub community to the semiarid vegetation of the juniper/grass community. Juniper is often the dominant form of vegetation in the bottoms of washes, at higher elevations, and along north-facing slopes. When local solar aspect or gradual elevation changes dictate drier local conditions, mountain mahogany increases in abundance. Open grassy areas occur where there are rock outcrops, steep slopes, and shallow soils (less than 25 cm or 10 in). Although sagebrush is not as widespread in this community as in the southern end of the recreation area, several species are significant. Some of the common grasses and forbs are threadleaf sedge, prairie junegrass, Hood's phlox, goldenweed, small soapweed, bluebunch wheatgrass, and blue grama.

### (3) Foothills Grassland

The Bighorn Basin uplands receive the highest amount of annual precipitation in the recreation area (38-48 cm or 15-19 in). Within this grassland community, there is a broad transition zone from which sagebrush, juniper, and mountain mahogany blend into a homogeneous climax grassland. All varieties of soils are found, from sandy to clayey loams. Distinctive zones of grassland subtypes can be recognized with respect to local topographic and north-south geographic variances.

All of the medium and low shrubs found in the juniper/grass community are represented to some extent in the foothills grassland community. Grasses and forbs that occur in addition to those previously mentioned include little bluestem, bluegrass, rose pussytoes, milkvetch, Canadian and wavyleaf thistle, cheatgrass brome, sagebrush, and phlox species.

### (4) Canyon Wall

The canyon walls are mainly composed of limestone from elevations of 1,300-1,500 m (3,600-5,600 ft). Soils and vegetation vary locally with changes in solar aspect and width of ledges. The general north to south decrease in annual precipitation from 50-20 cm (20-8 in) affects vegetative components of canyon wall communities in the same manner as other communities beyond the canyon rim. A significant amount of increased moisture availability within the canyon may result from evaporation and from cold moisture-laden air trapped in the canyon.

Mountain mahogany is the most widely dispersed species; in many areas, it is the most abundant shrub on canyon walls because of its ability to grow in crevices with minimal amounts of soil. Moderately wide ledges of 1-5 m (3-15 ft) may contain either Rocky Mountain or Utah juniper. At the northern end of the recreation area, fairly wide northwest-facing ledges may support Douglas-fir and ponderosa pine. Ecotones are very sharp and complex. Low shrubs may include any of the sagebrush varieties and numerous combinations of other low shrubs, grasses, and forbs included in previous vegetative communities.

### (5) Riparian Woodland

A few permanent streams originating in the Pryor Mountains have cut limestone canyons and formed narrow floodplain

bottomlands. Because the alluvial soils are deep and rich in organic matter, stable deciduous woodlands have become established. Remnants of this mesic community extend up tributary streams and below the high-water mark along the reservoir. More extensive areas of riparian woodland are located below the high-water mark along the reservoir; specifically, below the Afterbay Dam and above Kane Bridge along the Bighorn River before it becomes the reservoir.

Cottonwood, willow, chokecherry, and skunkbush sumac are common trees and shrubs in this community. Kelseya moss (Kelseya uniflora) is an uncommon plant species that is found in this environment. Saltcedar, an invading exotic species, has been noted in some areas.

#### (6) Pine Savanna

Patches of pine vegetative communities occur northward from Dryhead overlook. Limber pine savannas mixed with Ponderosa pine adhere to isolated Tensleep sandstone knobs near the canyon rim in association with creeping juniper, prairie sandreed, Idaho fescue, chokecherry, and threadleaf sedge associations. Solid stands of climax Douglas-fir occur within Black Canyon and in scattered patches on north canyon slopes. Limber pine stands extend into the boundaries of the recreation area near Hough Creek from the forests of the Pryor Mountains. Moisture availability in the conifer communities is very high, usually due to solar aspect. Soils are either moderately or richly organic. The occurrence of associated low shrubs and graminoids is variable.

#### (7) Threatened and Endangered Species

A few plant species in the Bighorn Canyon region were originally on lists from which the endangered and threatened species list in the Federal Register was selected. Subsequently, none of them were determined to be so limited in distribution as to warrant legal protection and none were placed on proposed lists that designate protection by law. These plants will be observed and protected because they are uncommon locally.

Any plants which are listed or proposed for listing as threatened or endangered in the future will be afforded the conservation and protection required by the Endangered Species Act.

Erigeron allocotus grows in dry limestone rubble and was noted near Devil Canyon overlook. Penstemon caryi was found in the Pryor Mountains just outside of the recreation area boundary. Sullivantia hapemanii was noted on wet limestone walls near Barry's Landing along North Fork Trail Creek.

#### (8) Exotic Species

There are between 30-60 varieties of exotic plant species in the recreation area. Many exotic species are adapted to rapid development in disturbed areas. Most are annuals and have the ability to sustain growth in poorly developed soils. Overgrazing causes an increase in the occurrence of exotic species because many are not consumed by livestock. Also the exotic plants increase in areas where native vegetation has been trampled by people or livestock.

Cheatgrass brome and sweet clover are common early invaders of disturbed areas. Common Russian thistle and Canadian thistle are also dominant exotic invaders. Tamarix or saltcedar displaces native species in disturbed riparian habitats and around the reservoir below the high water line.

e. Wildlife

A great diversity of ecological zones exists in and adjacent to the recreation area, resulting in a corresponding diversity of wildlife utilizing the recreation area environs.

Large mammals generally utilize the habitats within the recreation area on a periodic basis. Mule deer winter in several locations along the east slope of the Pryor Mountains in the vicinity of Hough Creek and utilize the area in and around the Yellowtail Wildlife Habitat Area on a year-round basis. Elk have been reintroduced into the Bighorn Canyon area. Between 30 and 35 head winter in the canyon near Dryhead Creek, and another herd winters on the east side of the canyon near Bull Elk basin. Bighorn sheep have been reintroduced to the area around Devil Canyon, but the success of this reintroduced herd is still in doubt.

Black bears are common on tribal lands adjacent to the northern portion of the recreation area, and the bears frequently come into the Black Canyon campground to scavenge garbage and raid campers' food supplies. Bears occasionally come into the Ft. Smith area as well. Bobcats and mountain lions have been observed in the recreation area in recent years. Coyotes are common throughout the region.

A herd of feral horses is managed by the Bureau of Land Management on the 31,000-acre Pryor Mountain Wild Horse Range, 9,100 acres of which are within the recreation area boundaries between Hough Creek and Horseshoe Bend. The Bureau of Land Management maintains the herd at about 140 adult animals, based on analysis of the capacity of the available range.

Two birds falling under the authority of the Endangered Species Act of 1973 utilize habitats within the recreation area. The American peregrine falcon (Falco peregrinus), an endangered species, has been sighted in the recreation area in 1972, 1973, 1975, and observed nesting in 1978. The bald eagle (Haliaeetus leucocephalus) winters in significant numbers along the Bighorn River below the Yellowtail Dam, and some birds may be year-round residents.

Since the construction of the Yellowtail Dam, the respective state fish and game departments have undertaken intensive fish-stocking programs in Bighorn Lake. Fisheries production and angler success have been below average, due in part to the physical structure of the lake and fluctuation of the water level. Bighorn Lake is anticipated to eventually become a warm-water fishery dominated by walleye. Cold water species (trout and salmon) will continue to be present in the lake, supported by the cold water tributaries of Bighorn Lake. The tributary streams are the predominant spawning grounds for nearly all species of gamefish present in Bighorn Lake. It is notable that

while rainbow trout made up greater than 90 percent of reported catches in the Afterbay in recent years, random gill net samples and creel censuses taken by Montana Department of Fish and Game indicate that this species makes up less than 5 percent of the total fishery in Bighorn Lake.

f. Water Resources  
 (1) Hydrology

The Bighorn Basin watershed above the Yellowtail Dam, part of the Missouri River basin, has a drainage area of about 51,000 km<sup>2</sup> (20,000 mi<sup>2</sup>) (EPA 1977). The Bighorn River is controlled upstream by the Boysen Reservoir Dam south of Thermopolis, Wyoming, and flows north to the Yellowstone River in Montana.

As table 7 indicates, most of the water entering Bighorn Lake is from the Bighorn and Shoshone rivers (EPA 1977).

Table 7  
 HYDROLOGY OF BIGHORN LAKE

<u>Tributaries</u>	<u>Drainage area (km<sup>2</sup>)</u>	<u>Mean flow (m<sup>3</sup>/sec)</u>
Bighorn River	40,831.3	64.66
Shoshone River	6,086.5	29.48
Dryhead Creek	197.6	0.30
Crooked Creek	300.4	0.30
Minor tributaries & immediate drainage	<u>3,470.4</u>	<u>11.44</u>
Total	50,886.2	106.18

Several minor tributaries originate from the Pryor Mountains to the west and the Bighorn Mountains to the east. Peak runoff usually occurs in the spring coinciding with snow melt; however, the flows of the Shoshone and Bighorn rivers are controlled upstream by dams. Thundershowers in the summer may cause local flooding in tributaries of the Bighorn River.

The potential development areas in Bighorn Canyon National Recreation Area have all been surveyed for possible water supply sources. Madison limestone is the major water-bearing formation in the region, and alluvial deposits and Tensleep sandstone are possible local sources of underground water. Most wells in the area and many of the streams are high in sulfates, attributable to the gypsum content of the Chugwater Formation.

(a) Suspended Solids

About  $5 \times 10^9$  kg (5,800,000 tn) per year of suspended solids enters Bighorn Lake through the Bighorn and Shoshone rivers (Bureau of Reclamation 1960). Influent concentrations run from less than 11 mg/l to over 3,000 mg/l, and usually the higher concentrations occur during periods of peak flow (USGS 1964-1977).

The high suspended solid loads are a result of erosional runoff processes, with less than 9 percent of the total attributed to irrigation return flows (EPA 1978). Grazing has contributed to an increase in erosion by decreasing vegetative density and increasing the gullying process. The effect of grazing on increased sediment loading in rivers has not been quantified.

(b) Fecal Coliform

Bacteria levels, indicating the possible contamination of water from human or livestock wastes, are normally less than 100 colonies/100 ml in the Bighorn River (EPA 1978). The concentration of fecal coliforms may be high in the tributary drainages of Bighorn Lake if livestock wander into the streams.

(c) Dissolved Solids

The concentration of dissolved solids in the Bighorn and Shoshone rivers averages 600 mg/l (USGS 1964-1977), higher than the recommended USPHS standards of 500 mg/l for a municipal water supply intake. The natural hot springs at Thermopolis account for 20 percent of the total salinity in the Bighorn River, and runoff from saline deposits also contains high concentration of sulfur salts and sodium bicarbonate.

Water supply quality tests for Horseshoe Bend, Sorenson Ranch, Ok-A-Beh, and Kane Bridge all indicate safe levels of total dissolved solids (TDS), although some tests have had dissolved sulfate levels over 259 mg/l and TDS levels over 1000 mg/l.

(d) Nutrients

Nitrogen and phosphorus levels in the Bighorn and Shoshone rivers are higher than the maximum values for control of early eutrophication set by the National Eutrophication Survey Study (0.65 mg/l-N for nitrogen, 0.05 mg/l-P for phosphorus) (EPA 1978). The discharge-weighted average concentrations of nitrogen and phosphorus are 1.6 mg/l-N, 0.10 mg/l-P for the Bighorn River, and 1.9 mg/l-N and 0.08 mg/l-P for the Shoshone River (EPA 1978).

Phosphorus and nitrogen are either dissolved in water runoff or carried into streams attached to soil particles. Only 0.08 percent of the total nutrients entering rivers in the Bighorn Basin is attributed to sewage treatment plants.

Water supply sources at all of the development areas in the recreation area are well below the 10 mg/l-N state standard set for drinking water quality.

(e) Toxic Substances

Toxic substances in streams and reservoirs in the Bighorn Basin have always been either absent or found in very low concentrations.

Bighorn Lake is about 113 km (71 mi) long, and is generally narrow. The maximum usable capacity is  $170 \times 10^7 \text{ m}^3$  (1,400,000 ac-ft) and the surface area is about 70,000,000  $\text{m}^2$  (18,000 ac) (EPA 1973). The sides of the canyon filled by the impoundment are generally very steep, with the exception of the mudflats at the confluence of the Bighorn and Shoshone rivers.

The water level in the lake fluctuates about 20 m (60 ft), and the influent waterflow extremes are tempered by the controlled release at the Yellowtail Dam. Maximum discharge temperature at Ft. Smith is between  $13^\circ \text{ C}$  ( $55^\circ \text{ F}$ ) and  $18^\circ \text{ C}$  ( $64^\circ \text{ F}$ ). The lake is thermally stratified during the summer, although there is no evidence of a sharply defined thermocline (Soltero, Wright, and Horpestand 1974). The period of complete ice cover is variable.

(a) Suspended Solids

The high suspended solid concentrations entering the lake are greatly reduced due to impoundment. Turbidity of the effluent water is typically low (4-30 JTU) (EPA 1973), although influent water is extremely muddy at times. The Bureau of Reclamation (1960) estimates that it will take 86 years for the sediments to fill 20-30 percent of the total volume of the reservoir.

(b) Dissolved Solids

The high total dissolved solids of the influent lake water remains about the same throughout the lake. Deposits of calcium build up on boats left in the lake. The concentration of sulfates in water quality tests is high but within acceptable levels according to the requirements for a safe drinking water supply.

(c) Nutrients

The National Eutrophication Survey Study determined that the reservoir ranged from a eutrophic state in the southern end to a mesotrophic state in the north, as evidenced by a decrease in the average phosphorus and nitrogen levels. Nitrate levels range from 0.03-0.06 mg/l-N, and total phosphorus from 0.03-0.10 mg/l-P (EPA 1977). A decrease in average total productivity, as measured by chlorophyll concentration, occurs toward the discharge end, with the depth of the euphotic zone increasing as the suspended solids settle out. The high nutrient concentrations in the southern end are caused by high influent nutrient concentrations.

(d) Toxic Substances

There have been no toxic substances found in significantly high concentrations in Bighorn Lake.

(e) Floating Debris

A large amount of debris is carried into Bighorn Lake every year during spring runoff. Large dead cottonwood trees are washed out by floods and sink to the bottom of the lake. The debris deposited on the bottom of the lake eventually decays, contributing to the nutrient content of the lake. Some of the debris is collected and disposed because it presents a boating hazard.

g. Air Quality

The air quality in Bighorn Canyon National Recreation Area is usually very good. There are no large urban areas, power plants, or industrial sources of air pollution in the vicinity. The only significant source of air pollution locally is a bentonite mining and processing operation east of Lovell, which is owned by the American Colloid Company. The plant is approximately 7 miles south of Horseshoe Bend. The operation is a source of localized particulate pollution due to the extraction process and trucks operating on dirt roads. Ambient particulate levels in the entire area are high at times due to strong winds and arid conditions. This problem is particularly evident around the Kane area during low water periods when extensive mudflats are exposed.

There has been no monitoring of air quality in the recreation area. Particulates have been monitored in areas near the north and south ends of the recreation area. Nine samples were taken at Lovell, Wyoming, over a 2½-year period. The average 24-hour concentration was 34 ug/m<sup>3</sup>, and the peak 24-hour concentration was 45 ug/m<sup>3</sup>. Over the same period and number of samples, the results at Hardin, Montana, were 23 ug/m<sup>3</sup> average 24-hour concentrations and 34 ug/m<sup>3</sup> maximum 24-hour concentration. These concentrations are well within the existing standards (see table 8).

Bighorn Canyon is subject to federal class II air quality increments, as well as applicable Wyoming and Montana state standards. The applicable air quality standards are summarized in Table 8.

The region surrounding the recreation area is mainly an agricultural area with large areas of federally owned forest. Coal is the most prevalent mineral in the region, and there are extensive deposits scattered throughout eastern Wyoming and Montana and southwestern North Dakota. The closest deposits to the recreation area are about 80 km (50 mi) to the east (Missouri River Basin Commission 1978). The deposits are generally undeveloped to date. Ambient air quality in the region may be affected by mining and powerplant operation if these coal deposits are developed.

h. Aesthetic Quality

Bighorn Canyon offers a variety of visual and aesthetic experiences that change according to a visitor's mode of travel and activities pursued. The perception of these visual and aesthetic qualities varies depending on a divergent set of criteria, which may or may not be present in any one individual. Consequently, the analysis of the visual environment is a highly subjective area.

Table 8  
AIR QUALITY STANDARDS

<u>Regulatory Agency</u>	<u>Pollutant</u>	<u>Maximum Concentration</u>	<u>Duration</u>
Federal primary	Particulate	75 ug/m <sup>3</sup> 260 ug/m <sup>3</sup>	Annual 24 hour
Montana	Particulate	75 ug/m <sup>3</sup> 200 ug/m <sup>3</sup>	Annual geometric mean 24 hour
Wyoming	Particulate	60 ug/m <sup>3</sup> 150 ug/m <sup>3</sup>	Annual 24 hour
Montana	Settled particulate	15 ton/mi <sup>2</sup> /mo	3 month
Wyoming	Settled particulate	10 g/m <sup>2</sup> 5 g/m <sup>2</sup>	Annual 24 hour
Federal primary	Sulfur dioxide	80 ug/m <sup>3</sup> 365 ug/m <sup>3</sup>	Annual 24 hour
Montana	Sulfur dioxide	52 ug/m <sup>3</sup> 260 ug/m <sup>3</sup> 650 um/m <sup>3</sup>	Annual 24-hour average* **
Wyoming	Sulfur dioxide	60 ug/m <sup>3</sup> 260 ug/m <sup>3</sup> 1300 ug/m <sup>3</sup>	Annual 24 hour 3 hour
Wyoming	Carbon monoxide	10 mg/m <sup>3</sup> 40 mg/m <sup>3</sup>	8 hour 1 hour

\*Not to be exceeded 1 percent of days in 3-month period.

\*\*Not to be exceeded more than 1 hour in 4 days.

SOURCES: Federal - 40 CFR Part 50  
 Montana - 16-2.14(1)-S14040 Ambient Air Quality Standards May 7, 1967  
 Wyoming - 35-502.6, 10, 12, 14, and 18 Air Quality Standards and Regulations March 9, 1978

There are at least two distinct modes of travel that affect visitors' visual experiences. Nearly everyone travels into the recreation area by automobile and experiences it first from the road. Boat travel provides a second major experience, but it is not engaged in by all. The automobile experience varies depending on whether visitors enter the north or south district of the recreation area.

From the south, the recreation area is entered along U.S. 14A and WY 37 and is indistinguishable from the surrounding lands. Without the aid of entrance signs, there would be no knowledge of being in the recreation area. The early visual perceptions in the south district are composed of views of an arid environment similar to other environments in this part of the country. Proceeding north on the Bad Pass Road visitors view a similar landscape that is occasionally dotted with small developments. Of particular note are the bentonite mining operations and the abandoned night club near the intersection of the Horseshoe Bend access road.

If visitors proceed to Horseshoe Bend, they see an arid environment, which has had little chance to camouflage the recent activities of man. The employee housing, ranger station, and concession trailer all stand out in these barren conditions. In addition, there is little vegetation in the campground to disguise the multicolored cars, tents, and trailers parked there. The primary view is the expansive lake, and this is one of the few views of the open lake.

Proceeding north on the Bad Pass Road, visitors are increasingly aware of the Pryor Mountains that begin to predominate views. The road and surrounding environs become more undulating and diverse. The vegetation changes to one of more trees and fewer grasses and shrubs. Throughout this area, livestock and wild horses are common sights.

At Sorenson Ranch and again along North Fork Trail Creek, visitors experience the oasis-like qualities of riparian habitats. At the termination of the road to Barry's Landing, autobound travelers experience the lake as it is generally viewed by boaters--deep canyon walls with a ribbon of water lying between them.

Visitors entering the recreation area via Ft. Smith are greeted by a much less pristine scene. Housing, administrative buildings, and other disturbed areas dramatically affect the foreground view. The background is dominated by the mountains and hogbacks west of the Afterbay developed area. Upon closer inspection of this area, visitors find remnants of the construction of the Yellowtail Dam, including road scars, stockpiles of aggregate, and deep borrow pits along the river.

Proceeding south towards Ok-A-Beh, visitors are presented with a totally different experience. The road crosses a visual patchwork of rolling meadows and scattered islands of conifers. Livestock on or near the road are common, and the careful viewer with field glasses may spot buffalo on the south side of Black Canyon. At Ok-A-Beh, visitors are greeted with scenes similar to those at Barry's Landing.

The boaters' experience is much different than the motorists' and is generally perceived to be more dramatic. The lake varies from wide open areas south of Horseshoe Bend to a very narrow gorge between the Narrows and Dryhead. At every turn of the reservoir, boaters encounter something new. The canyon walls dominate the view, controlling the sun's access and giving the viewer an uncanny sense of smallness. The changes in geology and geomorphology are perceptible to even the untrained eye. Only when boaters are disturbed by other visitors is this awareness of nature destroyed.

4. Probable Future Environment Without the Proposal  
a. Trends in the Development and Use of Federal Lands

Without the proposal, the existing developments within Bighorn Canyon National Recreation Area would be maintained and modified in minor ways to improve recreational activities, interpretation, and other park functions. Visitor use would continue to be concentrated in the existing developments at Horseshoe Bend, Barry's Landing, Ok-A-Beh, and Afterbay. As visitation and demand increased, demands on existing facilities, natural resources, and park staff would also increase.

Without development of a general management plan, there would be no overall framework governing the role of the National Park Service in the future development and use of lands within the recreation area boundaries. Management would tend to respond to problems as they arose, rather than pursuing an orderly plan for managing resources throughout the recreation area. In the absence of a comprehensive program of resource management, the significance and extent of some of the archeological sites and districts would remain unknown.

Existing developments would continue to serve boaters, campers, and fishermen, but recreational support facilities such as marinas would be lacking. Campgrounds would be available to cross-country travelers, but day uses such as picnicking and hiking would be limited to existing facilities. Recreational opportunities would continue to favor regional and local residents, as opposed to cross-country travelers.

b. Trends in the Socioeconomic Environment

The dominant trend in the region is the projected increase in energy resource development, particularly in Big Horn County, Montana. This is expected to stimulate growth in population and the services necessary to support new people. The remainder of the surrounding region is expected to grow at a slow rate, continuing to be based primarily on agriculture.

Without the proposal, Bighorn Canyon National Recreation Area would be expected to serve a growing regional population (the largest visitor component) with the facilities that currently exist. Although in some cases existing facilities would be adequate to accommodate increased regional recreation demand (Horseshoe Bend

campground, for example), the remaining facilities would become congested, particularly on peak weekends, resulting in increased visitor conflicts and a decline in the quality of the experience offered at Bighorn Canyon. This would be evident primarily at marina launch facilities, picnic facilities, and in the entire Afterbay area.

While regional and national trends indicate an increase in cross-country visitors (improvements in U.S. 14A, increasing national per capita recreation demand and projected increases in Yellowstone National Park visitation), it can be assumed that without the proposed development nonregional visitation to Bighorn Canyon would increase at a somewhat slower rate. Those cross-country travelers arriving at Bighorn Canyon would find a distinct lack of variety in land-oriented activities and interpretive services. The quality of this experience would be considerably less than that provided in the proposal.

c. Trends in the Cultural Environment

The quality of archeological resources would continue to decrease as surface materials continued to be discovered and collected. Valuable information would be lost if monitoring, salvage, and investigation did not occur as proposed. Use of facilities and roadways would continue to disturb archeological sites, but there would be no additional disturbance associated with construction or restoration activities.

Historic resources would not be managed within a comprehensive framework of priorities based on professional recommendations in a cultural resource management plan. Historic structures would continue to be dealt with on a case-by-case basis, and no comprehensive plan would be developed.

d. Trends in the Natural Environment

Without implementation of the proposal, approximately 235 acres of land slated for development would be left in its present state. The riparian habitat at Hough Creek would not be impacted from development and use of the site. Use of North Fork Trail Creek would continue to be heavy and unregulated at peak periods.

Vegetation and soils of the areas proposed for development would remain essentially as they exist today. The ecosystem at Hough Creek would continue to support a diverse flora and fauna. Use of North Fork Trail Creek would continue to degrade the vegetation and soils in this riparian zone.

Impacts of visitor use (such as compaction of soils, disruption of wildlife, and disturbance of vegetation) would be confined to the present developed areas at Horseshoe Bend, Barry's Landing, Ok-A-Beh, and Afterbay.

No differences in water quality or air quality are anticipated due to implementation or nonimplementation of the proposal.

**PART: 2 FINAL ENVIRONMENTAL STATEMENT**

SUMMARY

( ) DRAFT (X) FINAL ENVIRONMENTAL STATEMENT  
Department of the Interior, National Park Service

1. Type of Action: (X) Administrative (X) Legislative
2. Brief Description of Action: A general management plan for Bighorn Canyon National Recreation Area, within Big Horn and Carbon counties, Montana, and Big Horn County, Wyoming, to guide overall park management and development for approximately 20 years, including specific development concept plans for all major developed areas inside the park and the wilderness recommendations for the park.
3. Summary of Environmental Impacts and Adverse Environmental Effects: Camping will increase by 65%, picnic facilities will increase by 184% and parking will increase proportionally. Three new marinas will be provided, and one existing marina will be removed. Concession opportunities will be increased significantly.

Eight archeological sites will be directly affected by construction activities. Six historic structures will be affected by the proposed actions. The Crow Indians will be allowed to perpetuate their cultural heritage inside the recreation area.

Approximately 0.3% of the total landbase of the recreation area will be affected by the plan. About 1,600 m<sup>3</sup> of bedrock will be removed by construction activities. About 380 acres of vegetation and soils will be impacted by development activities and associated visitor use. Development of facilities will destroy or displace resident fauna on approximately 15 acres. A total of 125,000 gallons per day will be required for freshwater supply at the developments at maximum capacity. The new developments will permanently change the visual landscape where they are constructed.

4. Alternatives Considered:
  - a. No action
  - b. Emphasize cultural resources and provide a minimal amount of recreational development.
  - c. Provide opportunities for a large range of recreational and social activities.
  - d. Establish a regional cultural and recreation area through cooperative efforts with applicable agencies and groups.

5. Comments Have Been Received From The Following:

Federal

- \*Advisory Council on Historic Preservation
- Department of Agriculture
  - Forest Service
  - Soil Conservation Service
- \*Department of Energy
- Department of the Interior
  - \*Bureau of Indian Affairs
  - \*Bureau of Land Management
  - \*Fish and Wildlife Service
  - \*Geological Survey
  - \*Heritage Conservation and Recreation Service
  - \*Water and Power Resources Service
- \*Environmental Protection Agency
- Water Resources Council

State

- \*Montana State Clearinghouse
- \*Montana State Historic Preservation Officer
- \*Wyoming State Clearinghouse
- \*Wyoming State Historic Preservation Officer

Other

- \*Crow Tribal Council

\*Comments Received

6. Date Made Available to CEQ and the Public:  
Draft Statement: May 16, 1980  
Final Statement:

I. DESCRIPTION OF THE PROPOSAL

An orientation to Bighorn Canyon National Recreation Area and a description of the proposals of the general management plan appear in sections I and II of the preceding plan.

II. DESCRIPTION OF THE ENVIRONMENT

The description of the environment may be found in section III of the preceding plan.

### III. Impacts of the Proposed Action

#### A. Impacts on the Socioeconomic Environment

##### 1. Impacts on Regional and Local Residents and Crow Tribe

###### a. Kane/Lovell

With 70 percent of all recreation area users coming from Wyoming and Montana and an estimated 60 to 90 percent of those coming from the region immediately surrounding Bighorn Canyon, significant regional benefits will be accrued from recreational development. Impacts on regional residents related to a visitor experience in the recreation area are discussed in more detail in the next section. Generally, in the Kane/Lovell area, regional residents will benefit particularly from improved fishing opportunities at the Kane Causeway.

###### b. Horseshoe Bend

Regional residents will enjoy marina expansion and beach improvement as discussed in the next section.

###### c. Hough Creek

Regional residents will enjoy increased land-oriented recreational benefits as discussed in the next section.

###### d. Barry's Landing

Regional residents will benefit from the improved marina facilities. These are discussed in the next section.

###### e. Ok-A-Beh/Afterbay

Increased recreational benefits will be enjoyed by the regional population as discussed in the next section.

Improved and increased facilities in the north district will increase the attractiveness of recreational opportunities, stimulating greater visitation to the district. Thus, greater traffic flow will result through the towns of Hardin, St. Xavier, and Ft. Smith--resulting in the potential for higher tourist expenditures and income to these towns.

The possibility also exists that as increased traffic and related congestion in these towns occurs greater local expenditures will be required for such services as traffic control and police protection. The possibility of this occurring strictly as a result of Bighorn Canyon visitation is quite low in the communities approaching the recreation area due to the high quality of the highway through them, as well as expected increases in population from energy development. A greater potential exists in Ft. Smith, which lies adjacent to the recreation area and will receive the greatest traffic flow.

Conflicts could result from unauthorized use of the Pretty Eagle site and other Crow tribal lands along the Ok-A-Beh Road. Visitor use (both Indian and non-Indian) will result in the deterioration of the Pretty Eagle site and non-Indian use could adversely affect the religious and cultural quality of the sites, as well as increase the ill feeling of many of the Crow towards the non-Indian visitor population and the National Park Service. Increased use in the Afterbay could result in increased conflicts on private and reservation lands.

f. Wilderness

Establishment of a wilderness area within Bighorn Canyon National Recreation Area will restrict routine use of motorized vehicles and will restrict developments that are substantially noticeable in the area. This should have little or no effect on ranchers since horses are used primarily in driving cattle within the area proposed for wilderness.

2. Impacts on the Visitor Experience

a. Kane/Lovell

Recreational improvements in this area will primarily benefit the local population, particularly at the Kane Causeway. Much of the existing use at this site is bank-fishing and related daytime activities, and most of the visitors are local residents (discussion with recreation area staff). Improvement of fishing access will benefit local users, and the construction of a picnic/rest area will improve opportunities for day activities adjacent to the fishing area. The picnic/rest area will also provide nonlocal travelers and Kane/M-L Ranch visitors with convenient facilities and picnicking opportunities close to their travel routes. The addition of trees and shelters will increase the aesthetic value and comfort of the site, encouraging a more pleasant experience. Inundation of this area and its possible closure may inconvenience some visitors during periods of high water levels in Bighorn Lake.

Elimination of the Kane Bridge boat ramp and overnight facility will prevent visitors who have used these facilities in the past, mostly local residents, from doing so in the future.

Development at the M-L Ranch will improve access for all visitors to the historic site and allow interpretation of early ranching culture.

b. Horseshoe Bend

Due to the access to the lake provided at Horseshoe Bend and the suitability for land-oriented activities (such as camping and picnicking), this area presents opportunities to serve a broad range of visitors and activities. Furthermore, because of its easy accessibility to the southern end of the recreation area, Horseshoe Bend is convenient for those spending greater amounts of time in the recreation area, as well as those through travelers seeking overnight accommodations or a brief orientation to Bighorn Canyon.

The proposal will provide services and opportunities for boaters (including fishermen, pleasure boaters, and water skiers), campers, swimmers, hikers, and those seeking information. Services and activities will be in a concentrated area. Campers with boats will have immediate access to marina and launch facilities; campers, boaters, picnickers, and swimmers will have access to food and convenience facilities, as well as the swimming beach and hiking trails; and all overnight and day users will have access to information/orientation services. All facilities will be available to both disabled and able-bodied visitors. Disabled persons will benefit particularly from the addition of a port-a-lift at the courtesy dock.

Enlargement of the marina and construction of a dry boat storage area will allow local residents and extended stay boaters to store boats rather than trailering them in and out. Fuel services will be available for boaters, including those arriving from other parts of the lake.

Improvement of the beach area and the addition of a bathhouse, comfort station, and raft will improve the experience at this area, which is heavily used by local residents. The addition of shade shelters and trees and shrubs in the campground will increase visitor comfort on hot days and improve the aesthetic value of the site--improving visitor enjoyment of the area.

At the Crooked Creek site, the 0.5-mile hiking trail from Horseshoe Bend will increase hiking opportunities and allow foot access between the two sites, providing picnicking and bank-fishing activities for fishermen and sightseers. The addition of a pedestrian bridge across Crooked Creek from Horseshoe Bend will make the picnic area more accessible and convenient for visitors--especially for the elderly and children.

c. Hough Creek

Development at Sorenson Ranch will increase picnicking, day hiking, and interpretation opportunities in the pleasant surroundings of the ranch. Information on the recreation area will be provided, increasing visitor awareness of the recreational experiences, settlement patterns, and human relationships to the Bighorn area environment. Possible inundation of the day use area by flood waters of Hough Creek may require closure of this area, inconveniencing some visitors.

The Hough Creek area will provide camping in one of the most aesthetically pleasing locations in the recreation area. This will be convenient to Barry's Landing marina users and to most visitors in the south district.

Deterioration of the pristine qualities of Hough Creek will result from increased development. This is likely to detract from the experience of visitors who prefer the qualities inherent in the area prior to development.

Hiking trails will provide unique hiking access to Layout Canyon and the Pryor Mountains. These trails will be convenient for campground users and increase the variety of interpretive opportunities. Walk-in campsites will provide a more primitive experience but still be convenient to other facilities.

d. Barry's Landing

The development of picnic areas along the North Fork Trail Creek will increase picnicking, especially for Barry's Landing users. The conversion of this site from camping to picnicking will provide a somewhat less intrusive use, improving views along the creek for visitors approaching Barry's Landing; however, this conversion could detract from the experience of some visitors who repeatedly used these campsites.

Possible inundation of the picnic area by flood waters of North Fork Trail Creek may require closure of this area, inconveniencing some visitors.

The Barry's Landing marina and marina services will provide fishing, boating and boat launching, and boating convenience services. Services will also be available to boaters arriving from other points on the lake (4 to 10 percent of the boats launched from Horseshoe Bend and Ok-A-Beh). Boaters who do not wish to pull their craft out of the water will be offered overnight storage. Development at Barry's Landing will provide a convenient combination of activities, permitting visitors to engage in several activities without having to travel any distance. All facilities will be made accessible to the handicapped.

Because of the close proximity of fishing access points to boat launching facilities, fishermen may be bothered by motor noise, and other conflicts between boaters and fishermen will possibly result.

With the development of parking areas, comfort stations, horse and foot trails, and improved fishing access at Chain Canyon Cove, increased day use opportunities will be provided adjacent to the lake and away from other intensive use areas. The pedestrian bridge to be constructed across the cove will make the day use area more accessible without forcing people to walk around the end of the cove.

Horse and hiking trails will provide access to Hillsboro and areas north of Barry's Landing.

The Medicine Creek Cove camping and picnicking area will permit these activities away from developed areas and in a scenic secluded location within the recreation area. Because this area will be designed to be highly accessible, it will offer backcountry experiences to a broad range of visitors.

e. Ok-A-Beh

Similar to the Medicine Creek Cove, the boat-in camp/picnic areas at Black Canyon and Frozen Leg will provide activities away from more developed areas of the recreation area in a scenic and secluded portion of the lake. These developments will provide a backcountry experience to all visitors with boats. Comfort facilities at these sites will be convenient for boaters on the lake as well. Inundation of the Black Canyon area and its possible closure may inconvenience visitors during periods of high water levels in Bighorn Lake. Possible inundation of the picnic area at Frozen Leg by flood waters of the small creek originating west of the area could cause temporary closure of the area.

The potential for conflicts between non-Indian visitors and Crow exists at Black Canyon because the campground is adjacent to reservation lands. With visitors spending large amounts of time here, there exists the possibility of visitors hiking onto reservation lands.

Removal of the Frozen Leg marina will improve the visual integrity of the cove and make it available for stationary uses such

as boating, fishing, and picnicking. However, removal of the marina will prevent use of the facility by repeat visitors, many of whom are local residents.

The Ok-A-Beh marina site will serve both the sight-seeing tourist and the boater on Bighorn Lake. For the motorist, the scenic drive to Ok-A-Beh provides significant views of the canyon and surrounding geologic features. At Ok-A-Beh, visitors will find necessary and helpful information about such things as swimming and boating regulations, geologic features, and the relationship of recreation area lands to Crow lands. Concession services as well as informational services will free the motoring and boating visitor from having to travel back to Ft. Smith or other parts of the lake for these services. The design of the Ok-A-Beh facilities will allow access for all visitors.

During peak weekends, demand for boat-launching facilities at Ok-A-Beh exceeds the existing launch capacity (recreation area staff observation). This results in considerable congestion and frequent conflicts between visitors approaching the area and waiting to launch boats. The addition of a 50-slip marina will play a significant role in relieving congestion and improving the experience of all visitors to the area. A large portion of the peak daily launches will remain in the water overnight or for extended periods of time, increasing the availability of launching facilities for the one-day boater.

f. Afterbay

Information, sales, and interpretive services at the Yellowtail Dam visitor center will increase visitor awareness of the dam and related functions and of the Crow tribe and culture. Improvement of the existing walkways and dock on the dam and establishment of concessioner-operated boat tours on the lake will increase access to the lake for visitors without boats, including the handicapped. These improvements will expand interpretive potentials in order to provide visitors with knowledge of the lake, canyon, and surrounding geologic features.

The Afterbay area is one of the major use locations within the recreation area. Development of fishing access, campgrounds, and picnic areas will make the Afterbay area attractive to all visitors, including the handicapped.

Provision of camping facilities within Afterbay will increase overnight accommodations in the north district--not only for fishermen (who are currently the major Afterbay users) but also for hikers, sightseers, and Ok-A-Beh boaters. Separate facilities will provide experiences for cohesive groups (schools, families, organizations, and Crow visitors) desiring activities and gathering places away from the general visitor population. This will be of particular interest to Crow visitors, who because of their social distinctiveness might prefer facilities that allow them to function as a family unit or group in the context of the greater visitor population.

The location of Afterbay and its development will make this activity center convenient to a variety of activities and services

in Ft. Smith and at the recreation area headquarters. Because of the concentration of activities, however, a feeling of congestion may result for some visitors, and conflicts may occur.

g. Wilderness

Wilderness designation will preserve the natural, primitive character of the land for the enjoyment of visitors desiring wilderness recreational opportunities. Wilderness lands will be in close proximity to USFS and BLM wilderness study areas.

Wilderness designation will prevent future development (such as roads, interpretive programs, and support facilities) and the use of these lands by visitors unable or unwilling to travel in a wilderness setting.

3. Impacts on Other Federal Agencies

Many of the Bighorn National Forest recreational facilities on U.S. 14A are used heavily or to capacity during the summer season. The development of the Kane Causeway picnic/rest area will potentially alleviate some of this demand on USFS facilities. If the proposed facility relieves some pressure from existing facilities, benefits will be derived by the U.S. Forest Service by slowing the rate of growth in expenditures for operation and maintenance.

Hiking trails into the Pryor Mountains from Hough Creek will open areas administered by the U.S. Forest Service and, to a lesser degree, by the Bureau of Land Management to backcountry use pressures. Should use increase to a level high enough to cause significant resource deterioration, increase fire danger, or interfere with multiple use practices, the two managing agencies may be forced to place greater emphasis, manpower, and expenditures on the recreational management of the area. This will require increased coordination between the National Park Service, U.S. Forest Service, and Bureau of Land Management to monitor and manage these recreational uses.

Close coordination between the National Park Service and the Water and Power Resources Service will be required in the use and interpretation of the Yellowtail Dam and use and development of the Afterbay area. This will ensure the protection of facilities, visitor safety and enjoyment, and provide for activities necessary to the operation of the dam and the Afterbay area.

Because of restrictions on access to BLM grazing lands due to designation of the wilderness area, close coordination will have to occur between the National Park Service and the Bureau of Land Management to prevent confusion of permittees and to mitigate any impacts on their grazing operations.

With an increased supply of designated wilderness land in the region, future use will be dispersed over a larger landbase. This should benefit the Forest Service by lowering their maintenance and management costs.

#### 4. Impacts on Concessioners

As a result of development, increased visitation to Horseshoe Bend, Barry's Landing, and Ok-A-Beh will increase the economic feasibility of concession operations and increase related employment opportunities. At Ok-A-Beh and Barry's Landing this will be of particular importance to the Crow tribe because they hold the first right of refusal on concession operations in the Montane portion of the recreation area.

#### B. Impacts on the Cultural Environment

##### 1. Impacts on Archeological Resources

Bighorn Canyon National Recreation Area contains a rich diversity of widely distributed archeological resources representing almost 9,000 years of nearly continuous human occupation in the Bighorn Canyon/Pryor Mountain area (see appendix C). All significant archeological sites identified by nine years of archeological field studies have been zoned for historic preservation--a designation that will help insure their protection.

The General Management Plan will not result in the transfer, sale, demolition, or substantial alteration of any of those resources listed on or eligible for nomination to the National Register of Historic Places. However, there are two National Register sites of critical scientific value which will be directly affected by development activities. The Bad Pass Trail (24CB853) and the Pretty Creek site (24CB4&5) will be affected by the construction of the parking area, picnic area, and trail system at Hough Creek and Sorenson Ranch. A description of the types of impacts that construction and visitor use could have on these sites follows. Intensive archeological investigations will be necessary to determine actual impacts on the Bad Pass Trail and Pretty Creek sites.

Construction of buildings, campgrounds, picnic areas, parking lots, and trails could destroy archeological resources. Construction activities will affect the uppermost layers of the earth, as vehicles compact the soils and alter the horizontal and vertical distribution of buried archeological remains, and will destroy surface sites by damaging and destroying artifactual remains and their contextual environments.

The use of campgrounds, picnic areas, and trails will directly and indirectly affect archeological resources in the immediate vicinity. Archeological resources adjacent to or easily accessible from active recreational use areas will be vulnerable to surface disturbance, inadvertent damage, and vandalism. Visitors using campgrounds and picnic areas will moderately compact soils and might remove surface artifacts. A loss of the surface archeological materials, alteration of artifact distribution, and a reduction of contextual evidence will result. On the lake, recreational activities in frequently used areas may adversely affect archeological resources at or near water level through the action of water-caused deterioration of pool-level remains. Backcountry use may have an adverse effect on archeological resources because of the lack of direct protection by park personnel. Resources in these areas will be vulnerable to both inadvertent disturbance and

deliberate and illicit disturbance in the form of digging and collecting of archeological materials.

Grazing activities in the Dryhead Common Grazing Allotment and the Pryor Mountain Wild Horse Range will have an adverse effect on archeological resources. Surface remains will be subject to damage and destruction by livestock. Alterations in vegetative cover will change erosional patterns, causing buried remains to be washed away or exposed to trampling, breakage, scattering, and natural deterioration.

The probability of wear and vandalism will be less for archeological resources in the natural zone and wilderness area because of the decreased visitor use due to the lack of motorized access. However, the restriction on motorized vehicles will hamper research, inventory, and protection of archeological resources.

Table 9 shows the numbers and rankings of archeological sites that will be affected at each development site. Sites known to be immediately within the proposed development area are listed under direct effect and sites in the general vicinity of a development area are listed under indirect effect.

Each development site will be intensively surveyed by qualified, professional archeologists prior to construction activities. Any cultural remains in danger of destruction will be recorded, mapped, and subjected to a comprehensive program of data retrieval and analysis. All proposed actions affecting significant cultural resources will be in accordance with the memorandum of agreement executed March 31, 1981 on the general management plan by the National Park Service, the Advisory Council on Historic Preservation, and the Montana and Wyoming State Historic Preservation Officers (see Appendix H).

This plan calls for the interpretation of the Crooked Creek tipi ring site. This site was disturbed by previous construction activities and will be used as a research project to determine the effects of visitor use on archeological sites. The site will be thoroughly mapped and inspected periodically for damage, both inadvertent and deliberate. The results of this experiment will help management to determine which, if any, of the other archeological resources in the recreation area will be made accessible to the public.

## 2. Impacts on Crow Resources

In accordance with the wishes of the Crow, no developments are proposed for any area within the Crow Reservation lands of Bighorn Canyon National Recreation Area. Consequently, no direct impacts to Crow-owned lands within the legislated boundaries of the recreation area are anticipated at this time. Notwithstanding, there are a number of indirect impacts from the overall use and development of the Bighorn Canyon/Pryor Mountain region that can be anticipated.

The Crow are a tradition-observing people whose ethnic identity and cultural participation are of great and growing importance to them. Evidence of this commitment can be seen in the growing influence

of the tribally authorized Crow Cultural Committee; expansion of the Native American Church; and active participation of Crow tribal members in the formulation and enactment of the American Indian Religious Freedom Act. Crow commitment can also be seen in the increasing concern on the part of Crow teachers and curriculum staff to record, transmit, and strengthen traditional Crow cultural identity, values, customs, and traditional knowledge. The growing skepticism and resistance of tribal members to what is perceived as potentially adverse effects on Crow economics and culture from the encroachments of non-Crow developers, miners, ranchers, farmers, and governmental agencies is another example of this commitment.

In consideration of the potential consequences of proposed NPS plans for development and interpretation of Crow culture, representatives of the Crow Cultural Committee were questioned in an initial meeting in St. Xavier, Montana (Lloyd Old Coyote, George Reed, Robert Old Horn, April 10-12, 1979). The following presentation of potential effects on Crow culture is a result of informal discussions with these men and their suggestions made at that time. It is not necessarily the recommendation of the National Park Service, but it illustrates the types of effects that NPS-planned and NPS-designed features and programs could have on the cultural practices of this local Native American population.

The lands within and adjacent to the recreation area have special meaning to the Crow and figure prominently in their legends, traditions, and ceremonial life. Within the Bighorn Canyon/Pryor Mountain area, grasslands, canyons, and vistas are natural and historic (and proto-historic) locales where Crow have traditionally sought meditation and vision quest experiences. The Crow have gathered important economic plant and animal resources--serviceberries, medicinal plants, eagle feathers, and elk teeth. They have continuously visited for generations Arrow Rock cairn, Pryor Creek battlefield, Plenty Coup spring, Dryhead and Grapevine buffalo jumps, and Big Metal's grave in order to pass on or renew traditional knowledge and to maintain a strong cultural identity (USDI, NPS 1979f).

The American Indian Religious Freedom Act (P.L. 95-341, August 11, 1978) guarantees that Native Americans will have access to sacred sites (including burial grounds, ceremonial grounds, hot springs, mountains, hills, and streams); the right to possess and use sacred objects (including eagle feathers, certain herbs and plants, and medicine bundles); and the power of retrieval of certain artifacts for religious purposes. Proposed developments may indirectly cause degradation of both natural and cultural environments vital to the maintenance of traditional Crow customs. Increased land use and development of visitor-oriented facilities may result in (a) inadvertent damage to fragile archeological and historic resources important to Crow culture; (b) the deliberate vandalism to and removal of artifacts from significant and/or Crow-related archeological resources; (c) damage to or destruction of important and localized plant resources; and (d) degradation of once pristine locales used for the purpose of meditation or spiritual guidance.

Table 9  
 ARCHEOLOGICAL SITES AFFECTED  
 BY THE PROPOSAL

<u>DEVELOPMENT AREA</u>	<u>DIRECT EFFECT</u>		<u>INDIRECT EFFECT</u>	
	<u>Site No.*</u>	<u>Research Potential**</u>	<u>Site No.*</u>	<u>Research Potential**</u>
M-L Ranch	Unknown		48BH3	5,6
Kane Causeway	Unknown		48BH224	5,6
Kane Bridge	Unknown		--	--
Horseshoe Bend	None		48BH213	5,6
			48BH214	5,6
			48BH215	5,6
			48BH459	5
Crooked Creek	48BH210	3	48BH211	5,6
			48BH461	5
Devil Canyon	None		24CB231	3
			24CB908	3
Sorenson Ranch and Hough Creek	24CB4&5	1	Unknown	
	24CB853	1		
North Fork Trail Creek	None		24CB225	5,6
			24CB807	1
			24CB853	1
Hillsboro	None		24CB232	3
Barry's Landing	None		24CB853	1
			24CB201	5,6
			24CB223	5,6
			24CB224	5,6
			24CB250	5,6
			24CB251	5,6
			24CB254	5,6
			24CB258	5,6
			24CB259	5,6

Chain Canyon Cove	24CB810	4	24CB202	5,6
	24CB226	3	24CB221	5,6
			24CB222	5,6
			24CB252	5,6
			24CB253	5,6
Medicine Creek Cove	Unknown		Unknown	
Black Canyon	Unknown		Unknown	
Ok-A-Beh	None		24BH778	3
			24BH779	3
Afterbay	Unnamed	4	Native American burials	
	Unnamed	4		
Ft. Smith	Native American burials		24BH778	3
TOTAL		8	32	

\* Unknown - Area has not yet been surveyed for archeological sites  
None - Area has been surveyed and no sites were found

\*\* 1 - Critical scientific value (National Register potential)  
2 - Major scientific value (possible National Register potential)  
3 - Moderate scientific value  
4 - Minor scientific value  
5 - Trivial scientific value  
6 - Archeological site has been inundated

SOURCE: Loendorf, personal communication, December 14, 1978

Consultation between representatives of the National Park Service and the Crow could improve communications, understanding, and cooperative efforts toward the preservation and protection of resources of mutual concern. Park Service-Crow coordination could be beneficial in the areas of resource protection and patrol, methods and approach for interpretation of certain cultural resources, and possibly in the NPS-assisted recordation of Crow oral traditional accounts as they pertain to significant cultural resources in and adjacent to the recreation area.

### 3. Impacts on Historic Resources

Impacts on historic resources at Bighorn Canyon National Recreation Area are associated with their restoration, natural deterioration, and adaptive use.

Restoration is the process of recovering the general historic form and details of an object or structure through the removal of incompatible accretions and the replacement of missing elements as appropriate. It may be for exteriors and interiors and may be partial or complete restoration. The M-L Ranch has been partially stabilized. Stabilization of this ranch enhances the resource by retaining the historic scene of the 1900s.

Natural deterioration involves the gradual disintegration of the resource through lack of maintenance, exposure to climatic conditions, etc. The Advisory Council on Historic Preservation has agreed that Hillsboro (Cedarvale) will be allowed to deteriorate naturally. The structures built by G. William Barry will eventually be lost, and the historic setting will be affected. There will also be no attempts made to restore the Fort C.F. Smith Historic District, as only ruins exist at the present time. The policy of neglect recommended by the National Park Service for the Bighorn Canal Headgate may result in the eventual loss of this structure. Allowing these resources to deteriorate will result in the eventual loss of significant resources, affecting the historic setting and those aspects that qualified those features for National Register status.

Adaptive use usually calls for the preservation or restoration of a building facade and the conversion of the interior to a modern, functional space. Original fabric is retained wherever possible. Adaptive use may result in changes in quality or understanding of those aspects that qualified the resource for entry on the National Register of Historic Places. The exterior of the Sorenson Ranch has been informally restored, and the interior has been converted to a ranger residence. The adaptive use, restoration, and maintenance of the Sorenson Ranch will retard normal deterioration and susceptibility to vandalism by providing staff to protect and preserve the resource. If the decision is made to adaptively use the Lockhart Ranch, this will ensure that continued deterioration due to nonoccupancy and the associated problems, such as vandalism, roof leaks, and lack of continual maintenance, will be arrested.

Increased visitor use of historic structures can lead to excessive wear and tear and eventual deterioration of the resource. Sites in the recreation area that will be affected by increased visitor use

include the M-L and Sorenson ranches. The provision of a picnic area near the Sorenson Ranch may visually impact and adversely affect the existing historic scene. Increased interpretive programs at the Sorenson and M-L ranches will improve the visitor's opportunity to understand those historic structures and stimulate cooperation with preservation-oriented regulations.

C. Impacts on the Natural Environment

1. Impacts on Geologic Features

Blasting and removal of approximately 1,600 m<sup>3</sup> (57,000 ft<sup>3</sup>) of bedrock will be required to install the landscaping trees and shrubs at Horseshoe Bend. This will result in a permanent disturbance in bedrock of the Chugwater and Embar formations. Fossils in these formations are sparse, and the chances of significant damage to the paleontologic record is very low.

Blasting and removal of bedrock material may be required to install buildings that are proposed for development. Final determination and evaluation of these impacts will be addressed at the design stage.

2. Impacts on Soils

a. Kinds of Impacts

(1) Areas Occupied by Development

Roadways, parking areas, trails, buildings, and tent pads are impermeable and therefore will alter local soil moisture regimes. To the extent that runoff from impermeable structures is not efficiently collected and diverted to natural drainage systems, the potential for soil erosion by means of new channelization will increase. Larger than normal discharge of water into existing drainage courses may, in sufficient volume, cause excessive erosion along established channels.

Roads, trails, and other impermeable structures will either wholly or partially eliminate direct inflow of water to soil. Compaction of the soil in these areas will occur either deliberately (as is the case for roads), or as a result of settling caused by the weight of the structure. Site preparation (leveling) for buildings, roads, trails, and parking areas will result in either removal or addition of earth, destroying the soil structure.

Any construction site where soil is disturbed will undergo accelerated erosion, at least temporarily, until drainage structures are fully operable and vegetation recovers in cleared areas.

(2) Areas Adjacent to Impervious Structures

Buildings, roads, and other structures will collect and divert precipitation to adjacent areas. The runoff not collected and diverted to natural drainages will pour out on adjacent areas, increasing the local soil moisture regime. The increased runoff in these areas may result in localized increases in erosion and changes in soil nutrient transport. Altered vegetative composition could also cause slight changes in the soil chemistry.

(3) Foot Traffic

Areas in and around campgrounds, picnic areas, and interpretive facilities will be impacted by foot traffic. The primary impact on soil will be compaction, which will decrease permeability and locally alter the soil moisture, thereby diminishing the storage capability of soils. This will result in slower rates of water transmission within soils and increased runoff on the surface, increasing soil erosion. Gradual decreases in vegetation resulting from prolonged trampling will lead to increased exposure of bare ground to the direct erosive impact of rainfall. Erosion will take the form of channelization on barren areas of even slight slopes. Because of erosion potential, the Soil Conservation Service development suitability ratings for camping and picnic areas is severe if the slope is over 15 percent. Compaction of the soil will be minimized in many areas due to frost action, which expands the soil particles on the surface.

b. Specific Impacts on Soils at Development Sites

The following description of the specific impacts on soils at each of the development areas is summarized in table 10.

(1) Kane/Lovell

The soils at the M-L Ranch are fine sandy loams. Installation of hard-surface trails in the M-L Ranch area will result in severe impacts on 0.2 acre of the area now moderately impacted (see Table 10 for definitions of moderate and severe impacts).

The soils in the proposed picnic/rest area at Kane Causeway consist of gravelly and fine sandy loams. In some areas, up to 30 percent of the volume of the soils consists of rocks larger than 7.6 cm (3 in) in diameter. The soils are moderately to well drained (permeability is from 1.5-5 cm/hr or 0.6-2.0 in/hr), and shrink/swell potential and frost action are rated as low. The topsoil layer is about 10 cm (4 in) thick, and the depth to bedrock is greater than 152 cm (60 in), resulting in low susceptibility to erosion by foot traffic.

About 5 acres at the Kane Causeway picnic/rest area will be subjected to the moderate impacts of foot traffic. This will result in minor losses of soil due to increased erosion and reduction in the overall organic content of the soil in areas where vegetation is trampled. Severe impacts on soils will occur over a 1-acre area due to installation of the picnic tables.

Elimination of visitor use and removal of the boat ramp and campground at Kane Bridge will allow the 3.3 acres of soils in that area to return to a natural state.

(2) Horseshoe Bend

Soils at Horseshoe Bend are fine silty loams interspersed with a fairly significant amount of sharp angular gravel. Percolation is fairly rapid, and in some areas nutrients are washed out of the top layer. The depth to bedrock is variable and the shrink/swell potential and frost action are low. The soils range from fairly alkaline to salty throughout the development area. Wind-deposited fines contribute to the soil composition.

The estimated area of impact at Horseshoe Bend upon completion of development is 243 acres. Approximately 33 acres of soil within this development will be severely impacted due to installation of roads, parking, buildings, trees, and tent pads; 100 acres will be moderately impacted by foot traffic. Planting of trees and shrubs in the campground will completely alter the existing topsoil for 2-3 m (7-10 ft) on all sides of the plantings. The new soil will be much richer in organic matter and will have a greater moisture retention capacity. About 1,600 m<sup>3</sup> (57,000 ft<sup>3</sup>) of topsoil will be replaced.

Moderate soil erosion could occur in areas where slopes are greater than 8 percent; however, the camping areas and picnic sites will be situated on nearly level terrain. The soils are not easily compacted. Construction of utilities will disturb about 600 m<sup>3</sup> (16,000 ft<sup>3</sup>) of soil. This disturbance will reduce the organic content of the soil.

Moderate impacts of foot traffic will occur on an estimated 20 acres at Crooked Creek. Erosion will be minimal because the slope is less than 8 percent. Severe impacts on the soil will occur over a 1-acre area due to installation of picnic tables.

### (3) Hough Creek

The riparian habitat near Hough Creek (which includes the Sorenson Ranch) is supported by a rich silty loam soil with high organic content, good water retention capacity, and moderate-to-high permeability. Construction of paved roads and additional structures will result in severe impacts on 0.7 acre of soils. Random foot traffic associated with interpretive activities will moderately impact an additional 0.4 acre of soils.

The campground will be built on fairly gravelly, alkaline soils with a high silt and clay content. Permeability is relatively low, and the erosion potential is moderate where slopes are less than 15 percent.

About 20 percent of the entire development area is underlain with a local shale bedrock outcrop. The soils in this area are similar to the soil described above except that the volume of rocks is higher and the depth to bedrock is very shallow (less than 153 cm or 60 in).

Moderate soil impacts will occur in and around the entire development area due to increased foot traffic. Because the soil is gravelly and not easily compacted, the direct impacts of foot traffic will be minimal. However, an increase in erosion is anticipated due to loss of low shrubs that help hold the soil in place. The roads and trails associated with the Hough Creek development will severely impact about 9.3 acres of soils. Foot traffic and associated visitor use of the development will moderately impact an additional 173 acres.

Installation of utilities and a septic tank leachfield will result in a disturbance of approximately 7,000 m<sup>3</sup> (187,000 ft<sup>3</sup>) of soil. The topsoil will be mixed with underlying material,

resulting in a loss of effective organic content in the top layer. Because the soil in the area has a fairly low organic content, this effect will be minimal.

The 4 km (2.5 mi) trail to the Pryor Mountains could cause erosion in places where trail cutting and random walking occurs. Installation of the trail will severely disturb 1.2 acres of soils.

(4) Barry's Landing

The Barry's Landing and Chain Canyon Cove developments are on a sandstone outcrop. There is essentially no soil because bedrock is at the surface with sand particles and rocks collected in depressions. Because of these characteristics, limitations for development are severe. Increased erosion from foot traffic will be insignificant in comparison with natural erosion.

The North Fork Trail Creek picnic area is in an area where a shallow sandy loam soil has developed, and the depth to bedrock is very shallow. Conversion of the area from a campground to a picnic area will reduce the amount of foot traffic and will minimize further damage to the soil. Currently, there are no indications of soil erosion. Construction of paved parking areas will severely impact 0.9 acre in this area.

Construction of additional roadway and parking at Chain Canyon Cove will severely impact 0.3 acre of soils. Visitor use of the area will moderately impact an additional 15 acres.

Several hundred meters of sewage force main, two or three lift stations, and a treatment facility will be constructed from Barry's Landing to the flatland above the canyon. The total acreage of disturbed soils will be determined after further tests and studies are conducted and a practical system is designed.

The 16 km (10 mi) trail from Chain Canyon Cove to Dryhead will severely disturb approximately 5 acres of soil. About 70 percent of the trail will be built over rock outcrops that have no soils. The other 30 percent is limited to sandy, gravelly soils, which are not easily compacted. Moderate erosion of 5 additional acres will take place in areas where trail cutting and random walking occur.

The Medicine Creek Cove boat-in camp/picnic area is on a sandstone outcrop. There will be no significant impacts on the sandy, rocky deposits in this area beyond those already occurring.

(5) Ok-A-Beh

Conversion of the Frozen Leg marina to a boat-in camp/picnic area will reduce moderate impacts and increase severe impacts over that affected by existing use, but the net change to soil impacts will be negligible.

There is a minimal amount of foot traffic in the general vicinity of Ok-A-Beh at the present time, with most random walking occurring along the reservoir shoreline. The existing disturbed areas will not be expanded significantly.

(6) Afterbay

The soil on the north side of Afterbay is a moderately permeable organic loam. The shrink/swell potential is low and the frost action is high. There are relatively few rocks or gravel, and the depth to bedrock is greater than 152 cm (60 in). The erosion hazard is low where slopes are less than 15 percent; however, streambank erosion is occurring at the edges of Afterbay, especially on the north side.

The area proposed for development on the north side of Afterbay is about 100 acres. Moderate impacts of foot traffic will occur throughout the area due to random walking and fishing. These impacts will be slight where the slopes are less than 15 percent. The soil is subject to moderate compaction; however, the frost action is high and this minimizes the amount of compaction. Soil erosion is occurring all along the 5.5 km (3.3 mi) of fishing access shoreline; however, the impact of foot traffic in this area will be insignificant in comparison with natural erosion. Bank stabilization measures will be implemented, so only slight impacts caused by foot traffic along the bank will occur.

About 9 acres of soils on the north side of Afterbay will be severely impacted by installation of impermeable structures and pavement.

The soils on the south side of Afterbay are extremely variable. They range from a silty clay loam with characteristics similar to the soil on the north side to almost pure gravel. Most of the proposed developments will occur on the existing gravel parking lot.

Impacts of foot traffic on the 40 acres of soils on the south side of Afterbay will be minimal. Random walking will be discouraged due to the dense vegetation. The slope of the development area is less than 15 percent, and soil erosion is not a severe hazard. Less than 1 acre of soil will be severely impacted as a result of the projected development. Most of the proposed development site is already disturbed.

(7) Wilderness

Designation of a wilderness area at Bighorn Canyon National Recreation Area will protect the soils in that area from soil erosion caused by offroad vehicle use and from road construction or development.

3. Impacts on Vegetation

a. Kinds of Impacts

(1) Areas Occupied by Development

Construction of buildings, roads, trails, parking areas, picnic tables, and campground pads will completely destroy vegetation.

Table 10  
 IMPACTS OF THE PROPOSAL ON SOILS AND VEGETATION  
 (Acres/Relative Disturbance)

DEVELOPMENT SITE	EXISTING USE			TOTAL USE WITH PLAN			NET CHANGE WITH PLAN		
	Moderate	Severe	Total	Moderate	Severe	Total	Moderate	Severe	Total
M-L Ranch	2	0.1	2.1	1.8	0.3	2.1	-0.2	0.2	0
Kane Bridge	3	0.3	3.3	0	0	0	-3	-0.3	-3.3
Kane Causeway	0	0	0	5	0.9	5.9	5	0.9	5.9
Horseshoe Bend	100	10	110	200	43	243	100	33	133
Crooked Creek	0.7	0.1	0.8	20	1.2	21.2	19.3	1.1	20.4
Sorenson Ranch	0.2	0	0.2	0.6	0.7	1.3	0.4	0.7	1.1
Hough Creek	227	0	227	400	9.3	409.3	173	9.3	182.3
Pryor Trail	0	0	0	1.2	1.2	2.4	1.2	1.2	2.4
North Fork Trail Creek	3	0.1	3.1	3	1	4	0	0.9	0.9
Barry's Landing	20	0.4	20.4	20	0.8	20.8	0	0.4	0.4
Chain Canyon Cove	0	0	0	15	0.3	15.3	15	0.3	15.3
Dryhead Trail	0	0	0	5	5	10	5	5	10
Medicine Creek Cove	3	0.2	3.2	3	0.2	3.2	0	0	0
Black Canyon	3	0.1	3.1	3	0.1	3.1	0	0	0
Frozen Leg	0.5	0.4	0.9	0.4	0.5	0.9	-0.1	0.1	0
Ok-A-Beh	27	2.4	29.4	27	2.4	29.4	0	0	0
Afterbay	140	8	148	140	19.7	158.7	0	11.7	11.7
<b>TOTAL</b>	<b>529.4</b>	<b>22.1</b>	<b>551.5</b>	<b>845.1</b>	<b>85.6</b>	<b>930.6</b>	<b>315.6</b>	<b>63.5</b>	<b>379.1</b>

**Moderate**

Soils will be compacted by foot traffic, but they will not be permanently destroyed.

Vegetation will not be permanently excluded, but it will be disturbed by such activities as foot traffic or installation of utilities.

**Severe**

Soils will be covered by pavement or impermeable structures.

Vegetation will be permanently excluded by pavement or impermeable structures.

(2) Areas Adjacent to Impervious Structures

Precipitation normally falling on buildings, roads, and other impervious structures will not be absorbed. To the extent that this runoff is not efficiently collected and diverted to natural drainage systems, it will pour out into adjacent vegetated areas, altering the natural composition of vegetation. In addition, the vegetation adjacent to roads will be subject to crushing by cars and to changes in soil temperature induced by the pavement's high solar heat retention. These conditions could encourage the growth of exotic species such as cheatgrass brome and Russian thistle. Other plants observed along roadsides are bindweed morning glory, milkweed, and blazing star. The vegetative cover along the sides of roads will usually be slightly more dense than in adjacent areas.

(3) Foot Traffic

Areas near campgrounds, picnic areas, trailheads, buildings, and scenic attractions will be impacted by random foot traffic. This foot traffic will cause soil compaction and change the amount of moisture available to plants. Increased erosion may lead to exposure of root systems and the subsequent death of the more mesic plants. Germination of some species of plants may be inhibited by the soil compaction resulting from random foot traffic. The impacts of trampling by foot traffic may range from complete exclusion of vegetation to slight shifts in species composition. In shrublands the amount of grass and the number of low plants between the shrubs will be reduced, and in grasslands the proportion of annuals and quick-spreading perennials will increase. The changes in moisture availability due to soil compaction by foot traffic may alter the relative abundance of some species. Plants that invade disturbed areas may become more common.

(4) Disturbed and Revegetated Areas

Excavation for utility trenches and other construction activities will remove vegetation and disturb topsoil in areas that will later revegetate. Wherever the topsoil is removed and replaced it will be mixed up, effectively reducing the organic content in the top layer. In other disturbed areas the soil will not be affected, but the vegetation will be crushed.

During the recovery period, the artificially seeded or replanted native vegetation will not be identical in composition to vegetation in adjacent areas. A reduction in organic content of the soil may cause a slight change in species composition for several years. The following table lists the estimated recovery periods for disturbed areas in some of the major vegetative communities.

(5) Fire

Visitor-caused wildfires have been sparse in the recreation area. However, increasing numbers of visitors in the future may lead to greater frequency of range and forest fires. The fire management policy of Bighorn Canyon National Recreation Area is to extinguish all natural or human-caused fires that threaten to damage recreational developments, historic sites, or adjacent property.

Table 11  
VEGETATIVE RECOVERY PERIODS

<u>Vegetative Community</u>	<u>Recovery to Conspicuous Vegetative Cover</u>	<u>Recovery to Original Species Composition</u>
Desert shrubland	5 - 30 years	30 - 60 years
Juniper/grass	5 - 30	30 - 60
Foothills grassland	1 - 2	3 - 10
Riparian woodland	3 - 20	50 - 100
Pine savanna	10 - 30	25 - 100
Canyon wall	1 - 10	2 - 100

Fires in sagebrush or juniper vegetation do not spread easily unless there is a very high wind. Grasslands in the northern end of the recreation area pose a greater problem for fire fighting; however, there is less visitor use in this area. Fires in riparian habitats, such as Hough Creek and North Fork Trail Creek, are potentially the most damaging and would be the most difficult to extinguish.

b. Specific Impacts on Vegetation at Development Sites

The following description of the specific impacts on vegetation at each of the development sites is summarized in table 10.

(1) Kane/Lovell

The M-L Ranch is situated in a grassy clearing in a cottonwood riparian habitat. Improved accessibility will be provided by a new parking lot and walkway. Existing moderate impacts caused by foot traffic will be reduced by concentrating pedestrian traffic on walkways, resulting in elimination of 0.2 acre of vegetation. About 2 acres surrounding the historic structure will continue to be mowed, constituting a moderate impact on vegetation.

The abandoned 3.3-acre development at Kane Bridge will be removed, and the desert shrubland community restored.

The naturally occurring vegetation in the Kane Causeway area is in a process of transition due to the construction of the reservoir and the subsequent elevation of the groundwater table. Shade plantings will replace 0.9 acre of vegetation, and about 5 acres in the area will be moderately impacted by foot traffic.

(2) Horseshoe Bend

Most of the vegetation at Horseshoe Bend is short grasses and shrubs. Sage and saltbush are the dominant low shrubs, and blue grama makes up most of the sparse grass component.

Utah juniper is the conspicuous vegetation in the bottoms of washes and on moderate-to-steep slopes. These low trees contribute to soil development by causing small windblown particles to collect on the downwind side.

Most of the impacts on vegetation at Horseshoe Bend will result from development. Vegetation in the campground area (100 acres) will become more heavily impacted by foot traffic and by other improvements. Planting native and exotic plants for shade will completely alter the naturally occurring vegetation, eliminating about 33 acres of desert shrubland vegetation.

Crooked Creek supports a variety of plants requiring a relatively high amount of moisture. Cottonwood, willow, and skunkbush grow along the main channel; cattail, rushes, reeds, ryegrasses, wheatgrass, and tall saltbush grow adjacent to the desert shrubland community and in the bog north of Crooked Creek. The development at Crooked Creek will replace 1.1 acres of desert shrubland community, impacting none of the riparian woodland community. Approximately 20 acres of vegetation will be moderately impacted due to foot traffic.

### (3) Hough Creek

The Sorenson Ranch is in a well-developed cottonwood riparian habitat. The parking and picnic areas will eliminate 0.7 acre of vegetation, and an additional 0.4 acre will be impacted by foot traffic. Foot traffic will increase the proportion of grasses and annual plants in comparison with other vegetation. Large trees and medium shrubs will not be affected unless their roots are exposed and the soil is compacted, which would lead to loss of available water for these plants.

The proposed Hough Creek campground will be situated in the juniper/grass community. The junipers in this area range from 1 to 2 m in height (3-6 ft), and a sparse mixture of grasses and low plants occupies those areas between the junipers. Roads, camping pads, parking lots, and comfort stations will eliminate approximately 9.3 acres of vegetation. Random foot traffic could trample 173 additional acres of grasses, low plants, and some junipers.

### (4) Barry's Landing

The North Fork Trail Creek is a riparian habitat alongside the Barry's Landing access road. Once the campsites are converted to picnic sites, vegetation around the picnic tables will continue to be crushed, and its growth and germination inhibited by concentrated foot traffic. A moderate intensity of foot traffic will prevent the growth of shrubs as described previously. Although most of these impacts will be limited to the grassy streambank, some damage to cottonwood trees adjacent to the streambank is possible. Construction of paved parking will result in 0.9 acre of vegetation being destroyed.

The parking lot, road, and fishing access trails at Barry's Landing and Chain Canyon Cove will be constructed on a rock terrace adjacent to the lake. The vegetation in this area includes Utah juniper, low sagebrush, and a variety of xeric grasses and low plants.

The general vegetative cover is relatively sparse due to the rocky terrain and shallow sandy soils.

Developments in the Barry's Landing area will eliminate about 0.3 acre of vegetation in the vicinity of Chain Canyon Cove; the 16 km (10 mi) trail to Dryhead will eliminate 5 acres of mixed varieties of the juniper/grass community. Moderate impacts resulting from foot traffic will occur throughout Chain Canyon Cove and at popular fishing sites along the trail to Dryhead, an area of approximately 20 acres.

The new wastewater treatment system for the sales building and the comfort station will have to be built on a plateau above the lake. This area is in the juniper/grass community; however, the type and location will be determined following an engineering predesign study.

The existing boat-in camp/picnic area at Medicine Creek Cove is in a riparian woodland community. With continued use in this area, vegetation will not recover on the 0.2 acre occupied by the campsites, and foot traffic will continue to maintain the high proportion of grasses that predominate in the 3-acre area. Previous use of this area has not significantly inhibited development of cottonwoods and shrubs along the creek.

(5) Ok-A-Beh

Some development will be required for expansion of buildings, construction of walkways and gas tanks, and anchoring the marina at Ok-A-Beh. As this area is already disturbed, the amount of vegetation impacted by development will be negligible.

The area used for the boat-in camp/picnic area at Frozen Leg is already disturbed. The grasses will not recover on the 0.5 acre occupied by the campsites and picnic area, and 0.4 acre will continue to be impacted by foot traffic.

No new developments are planned for the Black Canyon boat-in camp/picnic area. Continuation of existing use will result in moderate impacts on 3 acres.

(6) Afterbay

Historically, the Afterbay area was in the floodplain of the Bighorn River. The old pattern of spring flooding and regeneration of cottonwoods and other riparian plants is gone. Today, the flow is regulated and fluctuates 6.1 m (20 ft) between the low and high water levels. All vegetation in the Afterbay area where development is proposed was eliminated during construction of the dam. In many areas on the south side, the ground consists of rounded stones supporting few plants. In the flat areas on the north side of Afterbay, soils are less severely disturbed and support a short grassland community mixed with yucca, prickly pear cactus, and thistle.

On the south side downstream from the existing parking lot, there is a well-developed riparian woodland community. In

most areas, the shrubs are so thick that random walking is impractical, effectively eliminating impacts due to foot traffic.

All of the proposed developments at Afterbay will occur in previously disturbed areas. Severe impacts on 11.7 acres and moderate impacts on 140 acres will continue to occur in the sense that the natural recovery of vegetation will be prevented. An additional 11.7 acres of vegetation will be severely impacted by construction of roads, parking areas, and associated camping and day use facilities. Grasses and low plants will predominate as long as the area is in use. Trees will be planted in the campground, significantly advancing vegetative recovery.

(7) Wilderness

Designation of a wilderness area in Bighorn Canyon National Recreation Area will protect vegetation from destruction by human activities.

4. Impacts on Wildlife

a. Kane/Lovell

There will be no significant impacts on wildlife resulting from development in the Kane/Lovell area. Hunting activity in the Yellowtail Wildlife Habitat Area will result in the taking of deer, waterfowl, and upland game birds. These hunting activities will continue to be managed by the Wyoming Game and Fish Department.

b. Horseshoe Bend

Construction and use of the marina facility at Horseshoe Bend will have minimal impacts on the aquatic fauna in the area. The affected area is subject to periodic exposure and inundation as a result of fluctuating water levels in Bighorn Lake and is therefore not extensively utilized by aquatic forms unable to migrate to other areas under adverse conditions. The area is generally quite windy during the visitor use season, resulting in intensive water-mixing, which inhibits the buildup of harmful pollutants.

Vegetative alterations at the Horseshoe Bend campground and Crooked Creek picnic area will result in the displacement and destruction of resident invertebrates and small vertebrates and will likely attract a variety of small mammals and birds not previously found at the sites. Visitors using the Crooked Creek picnic area will have minor disruptive effects on small mammals and birds utilizing the riparian zone adjacent to the picnic area.

c. Hough Creek

Development of the Hough Creek facilities will result in destruction of resident invertebrates and small vertebrates and in displacement of small mammals and birds from the development site due to loss of about 10 acres of habitat. Visitor use of the facilities and the surrounding area will result in significant local impacts on the riparian habitat, causing disruption and displacement of resident small mammals, birds, and mule deer that utilize the riparian zone.

d. Barry's Landing

Construction and use of the marina and associated facilities at Barry's Landing will result in combustion by-products, gas and oil, and chemical boat-toilet wastes being introduced into the narrow confines of Barry's Cove. Use of the North Fork Trail Creek picnic sites and Hillsboro will result in some siltation of North and South Fork Trail creeks. These conditions will adversely affect the spawning activities of sport fish utilizing the Trail Creek drainages, particularly rainbow and brown trout.

e. Ok-A-Beh

Continued use of the Black Canyon campground will result in black bear/camper encounters, which may result in human injury, property damage, or forced destruction of problem bears.

There will be no additional impacts on wildlife due to the development of a boat-in camp/picnic area at Frozen Leg.

f. Afterbay

Proposed developments downstream of Yellowtail Dam will have no significant impacts on wildlife.

g. Wilderness

Designation of a wilderness area at the recreation area will protect wildlife from disruption by human activities.

h. Threatened and Endangered Species

The peregrine falcons (an endangered species) reported nesting in the recreation area may be disrupted by visitor activities occurring in the vicinity of their nest.

5. Impacts on Water Resources

a. Impacts of Boating

The most significant source of pollution by motorboats is caused by leakage of oil and gas through the crankcase. A small, nonvolatile hydrocarbon fraction is not removed by evaporation from water exposed to submerged two-cycle engine exhaust emissions. The addition of a maximum of 275 g of hydrocarbons (3-8 percent of the fuel used) per hour per boat will not significantly increase the concentration of hydrocarbons in the total volume of the lake (EPA n.d.). Around the marinas, the emissions will be concentrated; assuming a maximum of 1 boat per 1,000 m<sup>2</sup> of water surface around the marinas and a mixing depth of 3 m (9 ft), the emissions of hydrocarbons will still result in less than a 0.7 mg/l increase. This level is several orders of magnitude less than the levels toxic to fish or which cause a significant increase in productivity (EPA n.d.).

The effects of mixing and stirring induced in the lake by outboard motor operation will probably be minimal in comparison with natural wind and wave action.

Floating logs, which are washed into the lake during spring runoff, will continue to be removed by the staff. This will tend to lower the nutrient content of the lake, as the logs would otherwise

sink to the bottom of the lake and decay, releasing nutrients into solution in the lake water.

Dredging may be necessary at the Horseshoe Bend marina. This will result in increased turbidity, resuspended solids, increased nutrient concentrations, and disturbance of benthic organisms and possibly of plants. Secondary effects could include decreased phytoplankton productivity initially and increased productivity after the water has cleared but high nutrient levels remain.

b. Impacts of Water Supply and Wastewater Disposal

New picnic areas and associated comfort stations will require diversion and use of freshwater either from wells or springs. All wastewater will be collected and disposed of by evaporative (nondischarging) lagoons or by U.S. Public Health Service approved septic tank systems. The water supply sources for each major development area are described below.

(1) Kane/Lovell

A new water supply source will have to be developed for this area. A well less than 1 km (0.5 mi) from the picnic area will probably be adequate. Further study will be needed to determine the exact location.

(2) Horseshoe Bend

The existing water supply system is adequate and can handle the anticipated 50 percent increase in demand. A maximum of 55,648 gpd is projected for the future. The water would otherwise follow the Crooked Creek drainage. New sources of water may have to be developed for the irrigation system.

Except for minor leakage into the groundwater, the proposed expansion of 3.3 acres to the existing nondischarging evaporative lagoons will eliminate any adverse effects incurred by disposal of wastewater. The lagoons may periodically have to be dried out and emptied of solids, and the sediment trucked to a sanitary landfill.

(3) Hough Creek/Barry's Landing

The existing spring intake and water supply system will have to be upgraded to meet the anticipated demand for freshwater. The maximum future daily usage is estimated at 51,000 gpd. The water will be taken from the Hough Creek drainage.

Wastewater from Barry's Landing and Hough Creek will be collected and disposed of into two separate wastewater treatment systems. The systems will be designed according to USPHS standards. A leachfield/septic tank system will be used at Hough Creek, and an evaporative lagoon will be constructed for Barry's Landing if further studies support these proposals.

(4) Ok-A-Beh

The existing spring at Ok-A-Beh has a 20 gpm capacity and produces very good quality drinking water. The well is

close to the lake and does not deplete water from any tributary drainages.

(5) Afterbay

The selection of a new water supply and wastewater treatment system will be made following further study of the economic and environmental factors. The systems will meet all state and federal regulations regarding public safety and design.

(6) Wilderness

Designation of a wilderness area at Bighorn Canyon National Recreation Area will prevent degradation or diversion of water resources in that area.

6. Impacts on Air Quality

Impacts on air quality resulting from implementation of the proposal will be from two sources: automobile emissions and campfires. The levels of both are dependent in part on the total number of visitors. The calculations that follow utilized visitation projections developed for the cost/benefit analysis (see appendix B).

Air quality effects from automobiles are influenced by several factors. The actual amount of pollutant emitted per car is being reduced steadily through the installation of emission-control systems on new vehicles and the gradual phasing out of older vehicles. Also, the total number of automobiles, the speed of traffic, and the location of roadways affect air quality.

The general atmospheric conditions affect the dispersal of emissions and, therefore, air quality. Atmospheric stability, a measure of the tendency for vertical air movement, greatly affects the amount of mixing and dispersion of pollutants. Highly unstable air shows large amounts of vertical mixing, which disperses emissions. Strong winds also cause increased dispersion and dilution of pollutants. Highly stable conditions, such as inversions, are characterized by very light intermittent winds, and virtually no vertical mixing, almost as if a lid were placed over the air layer next to the ground. Stable conditions do not allow dispersion of pollutants and can cause serious air pollution problems in areas of high emissions.

To analyze the potential impacts on air quality at Bighorn Canyon, a model utilizing the above parameters was used. The assumptions, calculations, and conclusions are summarized below.

For automobile emissions, the most reliable models are for carbon monoxide. Sulfurous and nitrous oxides and hydrocarbons have more complex chemistries once emitted and are not considered in this model.

The problem areas in Bighorn Canyon will be valley areas where large developments exist, such as Horseshoe Bend and Afterbay. These areas will receive the heaviest volumes of use and could be locations for inversions to develop, although high winds in these areas

could disperse pollution. The calculations below consider air quality in the Horseshoe Bend and Afterbay areas, and are a "worst case" analysis.

The emissions for the U.S. automobile and light truck fleet have declined and will likely continue to decline due to federally mandated pollution control devices. The 1980-year model assumes a carbon monoxide (CO) emission rate of 35 g/mi; the 2000-year model assumes an emission rate of 9 g/mi. These rates are based on linear regression on data presented in Compilation of Air Pollutant Factors published by the EPA in 1973.

The peak hour traffic volume in the Horseshoe Bend area will not likely exceed 250 vehicles/hour in the year 1980; 340 was assumed so as to give a conservative estimate. The peak hour traffic volume in the year 2000 at Horseshoe Bend will not likely exceed 450 vehicles; 540 was assumed. The Afterbay peaks will be somewhat smaller, but the same peaks were assumed for the calculations.

For atmospheric conditions, a worst-case "F" stability (highly stable) was assumed with wind speeds of about 1 m/sec (approximately 2 mi/hr). The initial vertical cell dimension was assumed to be 12 feet.

The model calculates the concentration "C" in grams per cubic meter of pollutant at any point within the mixing cells during a one-hour period. "C" is defined as:

$$C = A \frac{Q}{U} \frac{1}{K} \frac{W}{30.5}$$

where:

- A = the downwind concentration ratio for parallel winds, which is dependent on stability (In our case, this is 0.3, "F" stability.)
- Q = the emission factor in grams per second multiplied by the number of vehicles per hour
- U = the wind speed in meters per second
- K = empirical constant (4.24)
- W = width of the road in meters from shoulder to shoulder

In our worst-case analysis, the peak hour carbon monoxide concentration for 1980 is 1.06 mg/m<sup>3</sup>.

$$C = 0.3 \frac{5.26 \times 10^{-6} \times 340 \text{ vehicles/hour} \times 35 \text{ g/mi}}{1 \text{ m/sec}} \times \frac{1}{4.24} \times \frac{1}{30.5} \times \frac{7.3}{1}$$

$$C = 1.06 \text{ mg/m}^3$$

The year 2000 peak hour carbon monoxide concentration is 0.43 mg/m<sup>3</sup>.

$$C = 0.3 \frac{5.26 \times 10^{-6} \times 540 \text{ vehicles/hour} \times 9 \text{ g/mi}}{1 \text{ m/sec}} \times \frac{1}{4.24} \times \frac{1}{30.5} \times \frac{7.3}{1}$$

$$C = 0.43 \text{ mg/m}^3$$

The one-hour standard for carbon monoxide is 40 mg/m<sup>3</sup>. Thus, the projected automobile emissions of CO are not estimated to create any significant air quality problems at Bighorn Canyon.

Campfires in the campgrounds will be another source of air pollution. Fox (1975) has developed emission rates for recreational campfires, which are summarized below:

- about 10 pounds of wood per hour is used in an average campfire
- per ton of wood combusted, about 100 pounds of CO and 17 pounds of particulates are generated
- thus, emission rates of 0.5 pound of CO per campfire per hour and 0.085 pound of particulates per campfire per hour are indicated

Utilizing the above information, a box model can be used to estimate the impacts of campfires at Bighorn Canyon. Assuming 100 campfires at Horseshoe Bend, with virtually no wind and stable atmospheric conditions, the following calculations indicate the likely concentrations that will result from a worst-case situation.

$$C = \frac{(Q \times 453597) (n)}{(w \times l \times h)}$$

C = concentration in micrograms (ug) per cubic meter where  
 Q = emission rate in pounds per hour  
 453597 = constant (for conversion of pounds to milligrams)  
 n = number of campfires  
 w = width of mixing volume in meters  
 l = length of mixing volume in meters  
 h = vertical height of mixing volume in meters

For the calculations, a 50-meter vertical mixing height and 2000-meter length and width were assumed.

The one-hour CO concentration resulting from campfires:

$$C = \frac{(0.5 \times 453597) (100)}{(2000)(2000)(50)}$$

$$C = 0.11 \text{ mg/m}^3 = 110 \text{ ug/m}^3$$

The one-hour particulate concentration resulting from campfires:

$$C = \frac{(0.085 \times 453597) (100)}{(2000)(2000)(50)}$$

$$C = 19.3 \text{ mg/m}^3 = 0.019 \text{ ug/m}^3$$

Clearly, the contribution of 0.11 mg/m<sup>3</sup> of CO from campfires is insignificant when compared to the 40 mg/m<sup>3</sup> standards. The

one-hour concentration of particulates must be converted to a 24-hour average to allow comparison. Application of the commonly<sup>3</sup> used conversion factor of 0.25 gives a 24-hour concentration of 4.83 ug/m<sup>3</sup>, well below the most stringent Wyoming standard of 150 ug/m<sup>3</sup>.

Based on the analyses presented above, it appears that no significant air quality impacts will result from implementation of proposed recreational developments at Bighorn Canyon National Recreation Area.

#### 7. Impacts on Aesthetic Quality

The proposed major development sites at Afterbay, Ok-A-Beh, Barry's Landing, Hough Creek, and Horseshoe Bend will create the most extensive changes to the existing landscape and will, consequently, stand the greatest chance of adversely impacting the visual resources of the recreation area. Less intensive, minor development sites, such as picnic areas and boat-in campgrounds, will be much less noticeable in their effects on the landscape. Visual impacts will occur primarily where development sites are easily visible to large numbers of park users. Because backcountry and offroad uses in the recreation area are minimal, the primary areas from which developments will be seen are along the major park roads and from the lake.

A computer-assisted visual analysis was undertaken to identify places in the recreation area from which each major developed area could be seen, and these were overlaid onto maps of the reservoir and road system, to identify visually sensitive areas.

##### a. Horseshoe Bend

New developments proposed for this area will be an extension of the existing development. This site is without vegetation and is in a swale or bowl that is very visible from the Horseshoe Bend entrance road. The development will also be visible from most of the new hiking trails proposed here. Boaters will see the development when approaching from the south. The maintenance area will be visible from the Bad Pass Road.

##### b. Hough Creek

The proposed campground and other Hough Creek/Sorenson Ranch developments will be visible from the immediate area of the entrance road and from the overlook above the Sorenson Ranch. The relatively dense vegetation will screen most views into this area.

##### c. Barry's Landing

Views of the marina development at Barry's Landing will be blocked from all areas except the water and the cliff above the marina. The multipurpose building will be visible from the Barry's Landing entrance road for about the last half mile and from the water immediately around the marina area. The picnic area will be visible from the water just below the site and from the Barry's Landing entrance road just across the creek channel. The comfort station and small bridge at Chain Canyon Cove will be visible from the short entrance road into the area. In addition, the bridge will be seen by boaters passing the mouth of Chain Canyon.

d. Ok-A-Beh

Construction of the marina adjacent to the boat launch ramp will be the major addition at Ok-A-Beh. There will also be an expansion of the restroom/overlook building to include a ranger station and a concession facility.

The marina will be visible primarily from the water because the brow of the cliff above the lake effectively blocks views from all locations except the canyon rim and water. The building expansion will be visible from the two parking areas and for a short distance along the entrance road.

The removal of the boat docks and superstructure will improve the appearance of Frozen Leg. The proposed campsites, picnic area, and boat dock will be visible from the lake.

e. Afterbay

The 87-unit campground will be the largest and most site-intensive new development in the Afterbay area. The proposed development site is very open and quite visible for some distance. Other developments in the Afterbay area will be situated in previously disturbed areas and will have minor or no visual impacts.

The computer analysis shows that the campground will be visible along Montana 313 from the federal land boundary at Ft. Smith to the Afterbay picnic area, a distance of about 1 mile. The campground will also be visible from the Ok-A-Beh Road along that portion in federal ownership. Camping equipment and automobiles are generally brightly colored and will stand out more than naturally colored objects.

#### IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

##### A. Mitigation of Impacts on the Socioeconomic Environment

The proposed Ok-A-Beh marina will serve as an adequate substitute for those long-term users who are displaced by the closure of the Frozen Leg marina.

Unauthorized visitor use of the Pretty Eagle site and other Crow tribal lands can be mitigated by signing, frequent ranger patrol, and visitor information describing the status of tribal lands. Some unauthorized use will be unavoidable, however.

The proposed Hough Creek campground will serve as a substitute for those visitors who previously used the North Fork Trail Creek campsites.

Conflicts between boaters and fishermen at the Barry's Landing marina will be mitigated by the maintenance of the wakeless zone around the marina. This will reduce the motor noise and interference from boat wakes.

Congestion at the Ok-A-Beh boat ramp could be lessened by operational measures such as ranger supervision and changes in traffic circulation.

Impacts of the floodplain on visitor use will be minimized by locating only day use facilities in the potential floodplain areas. All facilities at Kane Causeway, Black Canyon, and Frozen Leg will be designed to be portable or to withstand inundation.

##### B. Mitigation of Impacts on the Cultural Environment

All proposed actions affecting significant cultural resources will be in accordance with the memorandum of agreement executed March 31, 1981 on the general management plan by the National Park Service, the Advisory Council on Historic Preservation, and the Montana and Wyoming State Historic Preservation Officers (see Appendix H).

As in the past, surveys will be conducted in areas to be affected by construction, public use, or other activities. After formulation of the cultural resource management plan, decisions regarding treatment of the resources will be integrated into the overall goals of the plan. Until that time, decisions regarding mitigating measures for specific projects or problems will be made on an individual basis, in accordance with the previously mentioned policies.

Adverse effects on archeological resources will be minimized by the following procedures involving site identification, testing, and protection (Executive Order 11593 requirements).

All areas not previously surveyed will be examined for cultural remains by qualified professional archeologists. Additional archeological investigations, including recording and mapping, and a rigorous program of sampling/collecting/testing of archeological features and artifacts will be performed in those areas where cultural remains will be affected by the plan.

Prior to any land-modifying activities, a qualified professional archeologist will inspect the present ground surface of the proposed development site and the immediate vicinity for the presence of cultural remains, both prehistoric and historic. Should newly discovered or previously unrecorded cultural remains be located, additional investigations will be accomplished prior to earth-disturbing activities. Similarly, in those areas where subsurface remains appear likely, an archeologist will be on hand to monitor land-modifying actions. Of particular sensitivity are the Hough Creek, Barry's Landing, and Horseshoe Bend areas, which will be monitored for the possibility of unearthing subsurface remains. The two concentrations of Native American burials near Grapevine Creek and south of the government housing development at Ft. Smith will be professionally documented and protected with the knowledge, advice, and assistance of the Crow tribe.

In addition, a rigorous program of ranger patrol and general education will be implemented to discourage vandalism and inadvertent destruction of cultural remains. Known archeological sites in the wilderness area will be visited periodically to determine the need for protection, preservation, or data retrieval necessitated by grazing of wild horses, natural erosion, or human impact.

The following actions will partially mitigate the potentially adverse impacts of the proposed developments on Crow culture. Intensified patrol of potentially sensitive locations by recreation area staff will combat inadvertent and deliberate damage to meaningful cultural and natural resources. Severe restrictions on the dissemination of information pertaining to the location of significant and vulnerable archeological resources will help to protect them. Thoughtful interpretation of pre-Crow and Crow period archeological remains through a combined program of general education and interpretive talks and exhibits, which have been prepared with the input of the Crow tribe, will help to encourage visitors to preserve and respect those remains. Carefully considered restrictions on use of particular portions of the recreation area (particularly certain mountainous sections used traditionally by the Crow as vision quest/meditation sites) will also help to preserve important aspects of Crow culture.

Potential adverse impacts associated with preservation and restoration of historic structures will be avoided by following the actions described in historic structure reports.

Natural deterioration of historic buildings will be preceded by recording at standards of the Historic American Building Survey reports (as has been performed at the Hillsboro site); significant artifacts will be salvaged and preserved. Properties proposed for natural deterioration will be periodically inspected for potential hazards and any additional historic information that may be revealed.

Whenever possible, buildings will be used in the historic or adapted manner to guarantee necessary maintenance and prevent vandalism. Adaptive use will not interfere with preservation of features specified by a historic architect using a professionally acceptable historic structure report.

C. Mitigation of Impacts on the Natural Environment

1. Geologic Features

There are no measures that can be implemented to mitigate the impacts of bedrock removal.

2. Soils

a. Areas Occupied by Development

Topsoil will be removed from areas to be covered by pavement or buildings and will be used to supplement any shortage of topsoil incurred in installation of utilities or other facilities. This will minimize the overall loss of topsoil caused by development.

b. Areas Adjacent to Impervious Structures

Construction of roads, buildings, and other impervious structures will be restricted to the minimum area required for building. Topsoil will be retained and replaced where possible in order to conserve available organic matter.

c. Foot Traffic

All visitor use developments will be constructed where the slopes are less than 15 percent to minimize the soil erosion created by foot traffic. Paved trails will be provided where heavy foot traffic is anticipated, and visitors will be encouraged to stay on maintained trails. Trail construction will include special design methods in areas where slope is high and soils are easily eroded.

The fishing access shoreline around Afterbay will be stabilized, minimizing the amount of soil erosion caused by foot traffic in that area.

2. Vegetation

b. Areas Adjacent to Impervious Structures

Construction of buildings, roads, trails, parking areas, picnic tables, and campground pads will be performed in a manner that minimizes the area disturbed. Topsoil from disturbed areas will be set aside and replaced following construction, minimizing the loss of organic material in the soil. These areas will be reseeded with native species to speed the rate of recovery and to minimize the encroachment of invading species. To the maximum extent possible, water runoff from impervious structures will be directed to natural drainages, minimizing the impact of increased moisture availability.

Paved roads in the recreation area will be signed to inform visitors that vehicles are restricted to paved roads and shoulders. This will minimize disturbance to vegetation along roadsides.

c. Foot Traffic

Campgrounds, picnic areas, buildings, and scenic areas will be provided with paved access trails where heavy foot traffic is

anticipated. This will consolidate foot traffic, minimizing damage to vegetation in the general area.

d. Disturbed and Revegetated Areas

Prior to the installation of utilities and other construction activities, the topsoil will be scraped off and set aside. The topsoil will be replaced and reseeded with native species, resulting in more rapid recovery of native vegetation. Revegetation of jeep trails that are to be abandoned in the wilderness area will be aided where possible by grading soil from the sides of the trail into the ruts to provide a better substrate for plant growth.

e. Fire

Park personnel will be trained to suppress fires and will be fully equipped with the necessary equipment. Special emphasis will be placed on preventing fires in riparian habitats such as Hough Creek and North Fork Trail Creek.

4. Wildlife

Proper design and physical layout of the campground, picnic, and trail facilities at Hough Creek will reduce the amount of wildlife disruption occurring in the riparian zone by channelling visitor use to the less sensitive areas at Hough Creek.

A thorough survey of the entire recreation area to determine the occurrence and document potential habitat of the peregrine falcons will be undertaken. Areas in the vicinity of suspected nesting sites will be strictly patrolled to reduce visitor activities that could adversely affect the falcons. The survey program and visitor use controls will be coordinated with endangered species personnel of the U.S. Fish and Wildlife Service.

5. Water Resources

All water supply systems will be built in accordance with USPHS regulations. The design will include all the appropriate water conservation techniques and appliances. This will minimize the amount of water diverted from natural watersheds.

All lagoons will be nondischarging and impervious. Septic tank leachfields will be installed in accordance with the appropriate USPHS standards. Proper design will minimize contamination of groundwater or surface streams.

6. Air Quality

If an unacceptable deterioration in air quality seems imminent, restrictions on the use of 2-cycle engines and campfires could be implemented to mitigate adverse impacts on air quality.

7. Aesthetic Quality

The new buildings proposed for the Horseshoe Bend area will be architecturally designed to minimize visual impacts. They will replace temporary structures, which are currently quite visually intrusive. Landscaping of the campground will make that area more aesthetically pleasing. The maintenance area will be screened from view by a natural-colored fence and landscaping.

The originally proposed campground location at Hough Creek has been changed to minimize intrusion on the visual landscape. The new location will allow much more use of vegetation to screen undesirable views. All buildings will blend with the landscape.

The marina complex at Barry's Landing has been moved from its originally proposed location to a new site, which is less intrusive on the landscape. The multiple use building at Barry's Landing and the comfort station at Chain Canyon Cove will be designed and painted to be harmonious with the surroundings.

Expansion of the building adjacent to the lower parking lot at Ok-A-Beh will be architecturally harmonious with the existing structure. The gasoline tanks needed for fuel storage will be buried out of sight in the lower parking lot.

The campground area at Afterbay will be landscaped with trees and shrubs and will be reshaped to provide berms between the different use areas. The combined effect of these two measures will help blend the development into the natural landscape. Buildings will be of an architectural style and color to blend with the environment.

V. ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

A. Unavoidable Adverse Impacts on the Socioeconomic Environment

Visitor use of the Pretty Eagle site and other Crow lands (both Indian and non-Indian), resultant deterioration of sites, and adverse effects on the religious and cultural quality of certain accessible sites will be unavoidable. Increased ill feeling by the Crow towards non-Indian visitors could result.

As visitation grows, traffic congestion will increase on access roads, and local communities (particularly Ft. Smith) will have to increase expenditures for such services as traffic control and police protection.

Deterioration of the pristine qualities of Hough Creek will result from increased development. This is likely to detract from the experience of visitors who prefer the qualities inherent in the area prior to development.

Congestion and conflicts between boaters waiting to launch boats at Ok-A-Beh will be unavoidable during peak use periods.

Inundation of visitor use areas by flood waters or high water levels in Bighorn Lake may inconvenience some visitors at Kane Causeway, Hough Creek, North Fork Trail Creek, Frozen Leg, and Black Canyon.

Because of the concentration of visitors and activities in Afterbay, congestion and conflicts between visitors will occur at peak use times.

B. Unavoidable Adverse Impacts on the Cultural Environment

Eight archeological sites in Bighorn Canyon National Recreation Area (see table 9) will be directly impacted by construction of campgrounds, picnic areas, parking areas, and trails. Two of these sites, the Bad Pass Trail (24CB853) and the Pretty Creek site (24CB4&5), are on the National Register of Historic Places. The remaining six sites have been classified as having moderate or minor research potential. These sites will be subject to deterioration of land surfaces and inadvertent damage and deliberate destruction from active recreational use.

Some of the archeological and contextual information contained in sites that must be excavated or tested prior to land-developing activities will no longer be available to archeologists when new techniques are developed for data retrieval and/or analysis in the future. At sites where only selected portions of the resource have been tested, excavated, or otherwise collected, visitor traffic and unauthorized collecting may result in the loss of the remaining information contained in the unsampled portion of the site. Recreational activities in frequently used areas may adversely affect archeological resources at or near water level through the action of water-caused erosion and degradation of pool level remains.

Grazing activities will continue to damage and destroy surface remains. Alterations in vegetative cover due to grazing will change erosional patterns, causing buried remains to be newly exposed and subject to natural deterioration as well as trampling, breakage, scattering, and eventually data loss.

Proposed developments may indirectly cause degradation of both natural and cultural environments vital to the maintenance of traditional Crow customs. Increased land use and development of visitor-oriented facilities may result in (a) inadvertent damage to fragile archeological and historic resources important to Crow culture; (b) the deliberate vandalism to and removal of artifacts from significant and/or Crow-related archeological resources; (c) damage to or destruction of important localized plant resources; and (d) degradation of once pristine locales used for the purpose of meditation or spiritual guidance.

Historic resources (Hillsboro, Bighorn Canal Headgate, Fort C.F. Smith) that will be allowed to deteriorate naturally will permanently disappear from Bighorn Canyon National Recreation Area's cultural environment, along with their historic settings and those aspects that qualified them for National Register status.

Increased visitor use of the Sorenson and M-L ranches may lead to excessive wear and tear and eventual deterioration of the resources. The provision of a picnic area near the Sorenson Ranch may visually impact and adversely affect the existing historic scene.

Currently unknown resources--archeological, for example--that could be discovered in the wilderness area will not be accessible to most of the public and may lose their potential for interpretation. Wilderness management policy may preclude the use of motorized access and equipment by scientists for research purposes.

#### C. Unavoidable Adverse Impacts on the Natural Environment

Approximately 1,600 m<sup>3</sup> (57,000 ft<sup>3</sup>) of bedrock will be removed to plant shade trees at Horseshoe Bend. Additional bedrock may have to be removed at other development sites if design of the facilities requires it.

About 65 acres of vegetation and soils will be severely impacted due to development of roads, parking areas, buildings, and plantings. This impact will occur mainly at Hough Creek, Horseshoe Bend, and Afterbay developed areas. An additional 315 acres will be impacted as a result of anticipated increases in foot traffic. Moderate alteration of the vegetative composition will occur in these areas.

The vegetative modifications at Horseshoe Bend and Crooked Creek will destroy or displace many resident invertebrates and small vertebrates and will likely attract many species of small mammals and birds not previously native to the area.

Development of the facilities at Hough Creek will destroy or displace the resident fauna on approximately 10 acres. The surrounding area, notably the riparian habitat, will be impacted by visitor use of the

facilities, resulting in disruption and displacement of small mammals, birds, and mule deer now using the area adjacent to the development site.

Construction and use of the marina facility at Barry's Landing and use of the North Fork Trail Creek picnic area will adversely affect the spawning activities of rainbow and brown trout using the Trail Creek drainage.

Use of the Black Canyon boat-in camp/picnic area will result in continued bear/camper encounters, which may result in human injury, property damage, or forced destruction of problem bears.

A total of 125,000 gpd will be required for freshwater supply at the developments at maximum capacity. Existing springs and wells will be expanded and new facilities will be designed at Barry's Landing and Kane Causeway. This will result in minor diversions from natural drainages and slight depletion of groundwater near these wells.

There are no unavoidable adverse effects on air quality due to the proposal.

The new developments will permanently change the visual landscape where they are constructed. These structures and facilities will be well designed and aesthetically pleasing but, none the less, will permanently alter the landscape.

VI. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Long-term integrity of archeological sites will decrease as a result of development and use of visitor facilities at Bighorn Canyon. Eight sites will be directly affected, and 30 sites will be indirectly affected. Historic structures will be subject to short-term adverse effects resulting from preservation and restoration activities. Long-term enhancement of the historic resources will result from such preservation and restoration activities.

Development of recreational facilities for short-term use will result in long-term alteration of the environments in the Horseshoe Bend, Hough Creek, Crooked Creek, Chain Canyon Cove, and Afterbay areas. These alterations include, but are not limited to, removal of bedrock, compaction and erosion of soils, vegetative alterations, and disruption and displacement of wildlife.

Designation of a wilderness area will eliminate short-term consumptive uses of the environment and will preserve and enhance the long-term productivity of the wilderness lands.

VII. ANY IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES THAT WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

Closure of Frozen Leg marina and removal of camping from North Fork Trail Creek will result in the irretrievable loss of recreational opportunities for long-term users of these sites and facilities. Increased local expenses due to increased visitation will require an irretrievable commitment of revenues by local communities.

Commitment of operational and development funds, as well as manpower, fossil fuels, and materials, will be irreversible and irretrievable, in as much as they cannot be used in another area or for another purpose.

Development and use of recreational facilities will directly impact 8 archeological sites and indirectly affect an additional 30 sites. The resultant loss of site integrity and informational value will be irreversible.

Development of the recreational facilities at Horseshoe Bend will result in irreversible and irretrievable modifications of the local bedrock and vegetation. Facility development at Hough Creek will have significant effects on the flora and fauna of the site. While these effects will not necessarily be irreversible, the loss of ecosystem stability and diversity during the period of visitor use is an irretrievable commitment. Use and development of all other visitor use sites will have the same irretrievable commitments of environmental stability and diversity during the lifetime of those facilities.

No irreversible or irretrievable commitments of resources will occur as a result of wilderness designation. If mineral deposits of national interests are discovered in the wilderness area, they may be retrieved through the legislative process.

## VIII. ALTERNATIVES TO THE PROPOSED ACTION

Recognizing the differences between the National Park Service and the Crow over the 1967 Memorandum of Agreement, the future development included in all of the alternatives would be confined to the area included within the boundary of Bighorn Canyon National Recreation Area by Congress in P.L. 89-664 on October 15, 1966, just as the proposal confines development to this area. Table 13 in Appendix B: "Cost/Benefit Analysis" details development for the proposal and all alternatives.

### A. No Action Alternative

#### 1. Introduction

Maintenance and improvement of existing facilities would continue under the No Action alternative, but there would be no further expansion of facilities. Access and circulation would be provided by existing roads. There would be no further development or interpretation of cultural resources. The No Action alternative would allow management to proceed with renegotiation of the 1967 Memorandum of Agreement with the Crow without establishing facilities or management policies that might later prove unnecessary or invalid.

#### 2. Description

##### a. Development

##### (1) Kane/Lovell

Existing structures and access road at the M-L Ranch would continue to be preserved and maintained. There would be no development of a picnic/rest area at Kane Causeway. Overnight use would be eliminated at Kane Bridge, but no efforts would be made to rehabilitate the site.

##### (2) Horseshoe Bend

Under the No Action alternative the existing access road, comfort station, parking lots, fish-cleaning station, boat ramp, and courtesy dock would be retained at Horseshoe Bend. The existing food concession building, ranger station, storage yard, and sewage lagoon would also remain in operation. An unmanned information kiosk would be constructed at the boat ramp, and boat tours of the lake would also be provided. The shade shelters, trees and shrubs, drip irrigation system, tent pads, and amphitheater for the campground proposed in the preferred alternative would also be constructed under the No Action alternative. The informal Crooked Creek picnic area would remain, with the access road also being retained.

##### (3) Hough Creek

There would be no development at the Hough Creek area in the No Action alternative. The Sorenson Ranch would continue its use as a ranger residence, and the existing access road would be retained.

Asphalt trails will be provided from the existing parking lot at Devil Canyon overlook to the rim to improve access.

(4) Barry's Landing

Camping along North Fork Trail Creek would continue in this alternative. The access road and the service road/foot trail to Hillsboro would continue to be maintained. Hillsboro would be allowed to deteriorate naturally in accordance with the agreement with the Advisory Council on Historic Preservation.

At Barry's Landing, camping in the existing parking lot would be permitted for self-contained vehicles. The existing access road, boat ramp, and courtesy dock would be retained. An unmanned information kiosk would be provided at the boat ramp.

The access road to Chain Canyon Cove would continue to be maintained, although there would be no development of the proposed day use area. The primitive boat-in camp/picnic area at Medicine Creek Cove would be retained.

(5) Ok-A-Beh

The existing floating comfort station/ courtesy dock and six camp/picnic sites at Black Canyon would be retained in the No Action alternative. The marina at Frozen Leg would be removed, but there would be no construction of a comparable marina at Ok-A-Beh. The existing boat ramp, access road, comfort station, parking lots, fish-cleaning station, and courtesy dock at Ok-A-Beh would continue to be maintained. Boat gas and oil service and dumping station facilities would be provided at Ok-A-Beh under this alternative.

(6) Afterbay

The Yellowtail Dam visitor center would retain its informational, interpretive, and sales functions in the No Action alternative. The existing dock would be retained, and the walkway improved.

In the Afterbay area the existing boat ramp and parking area would be retained, and an unmanned information kiosk would be constructed at the boat ramp. There would be no construction of a new campground; informal camping would continue in the parking area on the south side of Afterbay. The picnic areas and swimming facility described in the proposal would not be constructed in the No Action alternative.

b. Visitor Use and Interpretation

(1) Kane/Lovell

The M-L Ranch and the Bighorn visitor center at Lovell would remain the major focuses of interpretation. All current interpretive programs would be retained. Fishing would remain available at Kane Bridge.

(2) Horseshoe Bend

Horseshoe Bend would continue to serve boaters, campers, and swimmers, but recreational support facilities would be noticeably lacking. The campground would be available to cross-country travelers, but day uses (such as picnicking and hiking) would be limited to existing facilities. Crooked Creek would provide opportunities primarily for fishermen.

All existing interpretive programs for the entire area would continue in their present form. Water safety information would be provided at the Horseshoe Bend boat launch ramp and swim beach.

(3) Hough Creek

Under the No Action alternative, the Sorenson Ranch area would be exclusively an interpretive facility and ranger residence with no opportunities for picnicking or other day uses. Hough Creek would remain as a primitive day use area, with opportunities for day hiking, backpacking, and nature study. Present interpretive programs would continue.

(4) Barry's Landing

Development at Barry's Landing and North Fork Trail Creek would continue to serve overnight visitors and day boaters, with no provisions available for overnight mooring. This would allow boaters to camp in close proximity to the launch ramp but would necessitate the removal of boats from the water at night. Overnight recreational vehicle camping would be allowed at Barry's Landing parking lot, but only limited day use and comfort facilities would be available.

Chain Canyon Cove would remain undeveloped in the No Action alternative, providing for more primitive day use activities. Medicine Creek Cove would continue to serve as a primitive boat-in camp/picnic area, with no improvements of comfort or recreational facilities.

All interpretive programs currently implemented in the Barry's Landing area would continue. Water safety information would be provided at the launch ramp.

(5) Ok-A-Beh

The north end of the lake would function under the No Action alternative much as it would under the proposal. Those seeking marina facilities, however, would have no place to anchor their boats. The Frozen Leg marina is being removed for safety reasons, and under the No Action alternative, there would be no provisions for any replacement. Only limited first-aid and information would be available at Ok-A-Beh, with no food or recreational services. Existing interpretive programs would continue. Water safety information would be provided at the Ok-A-Beh launch ramp.

(6) Afterbay

The Yellowtail Dam visitor center would continue to function in a manner similar to the proposal under the No Action alternative. The Afterbay area would serve only a limited number of visitors, primarily those interested in fishing and recreational vehicle camping, with no support facilities provided.

There would be few facilities provided for those desiring other day use activities such as picnicking or swimming at Afterbay under the No Action alternative. All interpretive activities available at the present time in the area downstream of the Yellowtail Dam

would continue to be provided under this alternative. Water safety information would be provided at the Afterbay boat ramp.

c. Resource Management

Management of natural resources under the No Action alternative would occur in the same manner as described in the proposal.

Archeological sites would continue to be protected, and historic structures would continue to be maintained and adapted for recreation area uses in compliance with established procedures for the preservation of cultural resources. However, in the absence of a comprehensive plan and detailed research studies, management of cultural resources would tend to respond to problems as they arose rather than pursuing an orderly plan for managing resources throughout the recreation area.

3. Impacts

a. Impacts on the Socioeconomic Environment

(1) Impacts on Regional and Local Residents and Crow Tribe

Residents of the Bighorn Canyon area would find recreational opportunities similar to those currently existing but significantly less than those proposed in the other alternatives. Expected increases in visitation would result in increased competition for limited facilities and resources and in increased conflicts as local residents found more nonlocal visitors coming to the recreation area. This would be particularly evident with the lack of additional marina facilities. Peak weekend launch demand is currently at or exceeding the capacity of existing launch ramps. Without wet boat storage, launch ramps would become increasingly congested with longer lines of visitors waiting to launch boats. This would decrease the quality of the local boater's experience and may force many to seek other regional boating opportunities.

(2) Impacts on the Visitor Experience

(a) Kane/Lovell

The lack of picnic/camp and comfort facilities would cause visitors to the M-L Ranch and Kane area to travel to Horseshoe Bend to find these accommodations in the recreation area.

(b) Horseshoe Bend

Lack of increased marina facilities would cause congestion at launch ramps during peak weekends due to the necessity of daily launches. With no additional picnic facilities at either Horseshoe Bend or Crooked Creek, day visitors seeking developed picnicking opportunities would have to travel elsewhere in the recreation area to find them. Improvements in the campground would increase its aesthetic value and the amount of privacy between sites, improving the visitor's experience.

(c) Hough Creek

The pristine qualities of the area would be preserved for the enjoyment of all visitors without the development of the Sorenson Ranch day use area and the Hough Creek campground.

The addition of asphalt trails to the rim at Devil Canyon overlook will improve access to this area.

(d) Barry's Landing

The continuation of camping along North Fork Trail Creek would add to the convenience of Barry's Landing users by providing overnight accommodations close to the activity locations. Continued deterioration of the riparian habitat would result, however, in detraction from the experience of many visitors who would prefer the streambanks in their natural state. This is likely because of the limited availability of similar environments in the recreation area and the large number of visitors viewing this area from the road to Barry's Landing.

At Barry's Landing, picnic facilities would be severely limited, presenting an inconvenience to those who cannot picnic from vehicles or boats. The closest picnic facilities accessible by road would be at Horseshoe Bend.

Lack of additional development at Medicine Creek Cove would result in no facilities for recreation or comfort on the southern end of the lake other than at the marinas. This may inconvenience some boaters and may result in congestion at Barry's Landing.

(e) Ok-A-Beh

This alternative would provide boat services and dumping facilities for north end visitors and those arriving from other parts of the lake. Launch opportunities would be limited to the boat ramp at Ok-A-Beh, thus, congestion existing at the launch ramp during peak use periods would continue, perpetuating existing conflicts and aggravation.

(f) Afterbay

The lack of additions or improvements in the Afterbay area would result in congestion and conflicts during peak use periods. Specific groups (such as fishermen, campers, and picnickers) would be forced to use existing facilities in increasing numbers. Those visitors, particularly Crow families and local groups, seeking more private facilities would find none without the development of a group activity area. This would force them to use nongroup facilities, detracting from the cohesiveness of the group and resulting in the potential for conflicts with the general visitor population who might be insensitive to the needs and activities of the group.

(3) Impacts on Other Federal Agencies

No impacts would result above those existing at the present time in the No Action alternative.

(4) Impacts on Concessioners

Benefits to concessioners would increase with increased visitation but not as a result of increased development.

b. Impacts on the Cultural Environment

(1) Impacts on Archeological Resources

Impacts on archeological resources would be much the same as those described for the proposal. Although relatively little new development would occur, use of existing developed areas would continue to impact archeological resources. There would be no new impacts associated with facility or road construction. Relatively minor construction and maintenance projects would affect individual sites. In the absence of a comprehensive program of cultural resource management, the significance and extent of some of the archeological sites and districts would remain unknown.

(2) Impacts on Crow Resources

Impacts on Crow Indian resources would be the same as those described for the proposal.

(3) Impacts on Historic Resources

Impacts on historic resources would be much the same as the proposal under the No Action alternative. However, wear and tear due to increased visitor use would not be as great because there would be no further development at the M-L and Sorenson ranches.

c. Impacts on the Natural Environment

(1) Impacts on Geologic Features

Approximately 1,600 m<sup>3</sup> (57,000 ft<sup>3</sup>) of bedrock would be removed to plant shade trees at Horseshoe Bend.

(2) Impacts on Soils and Vegetation

No additional severe impacts on soils or vegetation in the recreation area would occur due to construction of impervious structures. Moderate impacts that result from foot traffic -- including soil erosion and compaction, trampled vegetation, and shifts in species composition -- would increase and intensify around the existing development areas.

(3) Impacts on Wildlife

Continued overnight camping at North Fork Trail Creek would displace or destroy many invertebrates, small mammals, and birds dependent on the small area of riparian habitat. Use would cause some erosion of the streambanks and siltation of the streambed, adversely affecting the spawning activities of rainbow and brown trout. Use of the Barry's Landing launch site by boaters would also contribute to the fishery impacts but on a smaller scale than a marina development.

Continued use of the Black Canyon boat-in camp/picnic area would result in black bear/human encounters, with the possibility for human injury, property damage, or forced destruction of problem bears.

The peregrine falcons reported nesting in the recreation area might be disrupted by visitor activities occurring in the nest vicinity.

(4) Impacts on Water Resources

Boats would continue to add small amounts of hydrocarbons to the reservoir. Total boating activity would increase by 79 percent with the continued use of existing facilities. The existing water demand would increase by 57 percent over the next 20 years, resulting in a corresponding increase in the diversion of water from the existing wells and springs.

(5) Impacts on Air Quality

Visitation and use levels do not vary significantly by alternative. Therefore, the analysis of air quality impacts of the proposal is valid for this alternative. No significant impacts on air quality would occur under the No Action alternative.

(6) Impacts on Aesthetic Quality

The only significant construction would be the landscaping of the campground at Horseshoe Bend. This action would create a more amenable site.

4. Mitigating Measures

Mitigating measures for the No Action alternative would be generally the same as those described for the proposal. However, there would be no marina development at Ok-A-Beh to substitute for the closure of the Frozen Leg marina.

B. Alternative 2

1. Introduction

Reflecting the current moratorium on development, this alternative provides for a limited expansion of facilities. A moderate level of recreational development would be balanced with interpretation of the area's outstanding cultural resources. A greater emphasis would be placed on passive forms of recreation tied more closely to the resources and their interpretation.

In alternative 2, cultural resources would be interpreted by displays in the Yellowtail Dam visitor center, the Bighorn visitor center at Lovell, and at selected sites along the Bad Pass Road corridor. Access and circulation would be provided by existing roads. Natural resources would be managed in accordance with existing agreements with the appropriate agencies, just as in the proposal.

2. Description

a. Development

(1) Kane/Lovell

Under alternative 2, development at the M-L Ranch, Kane Causeway, and Kane Bridge would be the same as described in the proposal.

(2) Horseshoe Bend

Development at Horseshoe Bend would be identical to that described in the proposal, with the following exceptions. The swimming beach would remain in its present location, and a six-stall bathhouse with exterior showers and a comfort station would be installed. Ninety-seven shade shelters would be constructed in

the existing campground and a 150-seat amphitheater provided. The shade plantings at the campground would not be provided in this alternative. The quality of the existing ranger station would be upgraded to a prefabricated building, with 20 gravel parking spaces available. The picnic area at Crooked Creek would be the same as described in the proposal except that there would be no planting of trees and shrubs.

(3) Hough Creek

The day use area and road improvements proposed for Sorenson Ranch would be implemented under this alternative. The Sorenson Ranch would continue to be utilized as a ranger residence, and a small maintenance yard would be provided. There would be no construction of a campground at Hough Creek in alternative 2, eliminating the necessity of installing additional utilities or sewage systems. There would be 2,500 feet of paved roads provided in the area.

(4) Barry's Landing

Under alternative 2, camping would continue to be permitted along North Fork Trail Creek. The access road to the point would be improved, and the service road/foot trail to Hillsboro would continue to be maintained. The picnic area on the point at Trail Creek would be developed as described in the proposal.

At Barry's Landing, development of facilities would be as described in the proposal with these exceptions: There would be no boat slips or sales building constructed; therefore, no rental boats would be available. Vault toilets would be provided, and there would be no installation of a septic system or a fish-cleaning station.

Developments at Chain Canyon Cove would be the same as described in the proposal except that the pedestrian bridge would not be built. Medicine Creek Cove would be developed as described in the proposal.

(5) Ok-A-Beh

Development at Black Canyon, Frozen Leg, and Ok-A-Beh would be the same as described in the proposal.

(6) Afterbay

Facilities and improvements for the Yellowtail Dam visitor center and Afterbay would be the same as those described in the proposal.

b. Visitor Use and Interpretation

(1) Kane/Lovell

Visitor use and interpretation in the Kane/Lovell area would be the same under this alternative as that provided for in the proposal.

(2) Horseshoe Bend

Visitor use in the Horseshoe Bend area would be the same as that provided for in the proposal, but there would be

additional interpretive opportunities. Geology would be interpreted at the Chugwater Trail, Red Cliffs, Devil Canyon overlook, and Sykes Ridge. Paleontology would be interpreted at Sykes Ridge. Prehistoric and historic lifeways would be interpreted at Sykes Spring, Bandit site, Bad Pass Trail, and Crooked Creek tipi ring site. Rock art would be interpreted at the Tillet Ranch and Medicine Man petroglyphs sites. Interpretation of the wild horses would be the same as the proposal. Water safety information would be available at the Horseshoe Bend boat launch ramp.

(3) Hough Creek

Sorenson Ranch would provide visitor use experiences and opportunities similar to those in the proposal. Hough Creek, however, would remain as a primitive day use area with opportunities for day hiking, backpacking, and nature study.

Interpretation at Hough Creek and Sorenson Ranch would be the same as the proposal. In addition, Canyon View quarry site and Many Trails tipi ring site would be interpreted for their roles in early human use of the land.

(4) Barry's Landing

Barry's Landing and North Fork Trail Creek would continue to serve overnight users along the creek and day boaters at Barry's Landing, with no provisions for overnight mooring. This would allow boaters to camp in close proximity to the launch ramp but would necessitate the removal of boats from the water at night. Chain Canyon Cove and Medicine Creek Cove would function as in the proposal.

Interpretation of Barry's Landing and Hillsboro would be the same as in the proposal. In addition, the Lockhart Ranch would be interpreted for its historical significance, and prehistoric hunters and weapon making would be interpreted at the Good Point quarry site. Water safety information would be provided at the Barry's Landing launch ramp.

(5) Ok-A-Beh

Visitor use in the north end of Bighorn Lake would be the same as that provided for in the proposal.

Interpretation of Ok-A-Beh, Bull Elk basin, Cabin Creek, and Black Canyon would be the same as in the proposal. The story of bison (past and present) would be interpreted along the portion of the Ok-A-Beh Road. Water safety information would be provided at the Ok-A-Beh boat ramp.

(6) Afterbay

This area would provide the same visitor experiences and opportunities as in the proposal.

Interpretation at the Yellowtail Dam visitor center, Afterbay, Bighorn Canal Headgate, and the Fort C.F. Smith Historical District would be the same as in the proposal. The hogback ridges would be interpreted for their geologic features. The Grapevine

buffalo jumps and the Fort Smith medicine wheel would be interpreted offsite for their role in Crow culture. Water safety information would be provided at the Afterbay boat ramp.

c. Resource Management

Management of natural resources would occur in the same manner as described in the proposal.

A cultural resource management plan would be developed under alternative 2. This plan would contain a detailed inventory of the appropriate resources, a description of management problems, and a recommendation of solutions to these problems. All actions taken would be the same as described in the proposal.

3. Impacts

a. Impacts on the Socioeconomic Environment

(1) Impacts on Regional and Local Residents and Crow Tribe

The impacts of alternative 2 would be the same as those described for the proposal.

(2) Impacts on the Visitor Experience

The impacts of this alternative would be the same as those described for the proposal with a few exceptions. At Horseshoe Bend, no trees would be planted in the campground. This would maintain the present level of aesthetic value. The perceived capacity would be less than what would exist if mature vegetation provided screening and privacy.

Without a pedestrian bridge across Crooked Creek, access would be more difficult for those walking from Horseshoe Bend.

With no campground provided at Hough Creek, the area would be preserved in its present pristine state, adding to the enjoyment of hikers and other day visitors to Sorenson Ranch.

Continuation of camping along North Fork Trail Creek would add to the convenience of Barry's Landing users by providing overnight accommodations close to activity locations. However, this would result in continued deterioration of the riparian habitat, detracting from the experience of visitors who are sensitive to this.

Interpretation would be increased throughout the recreation area under this alternative, stressing the importance of human occupation in the Bighorn Canyon area as well as the outstanding geologic features. This would increase visitors' awareness of early human cultures and its relationships with the natural environment and the changes in human occupation from Paleo-Indian inhabitants to the (white) ranching culture. Increased interpretation would also stimulate a sensitivity to

(3) Impacts on Other Federal Agencies

The impacts of alternative 2 would be the same as those described for the proposal.

(4) Impacts on Concessioners

Impacts of the alternative on concessioners would be the same as those described for the proposal.

b. Impacts on the Cultural Environment

(1) Impacts on Archeological Resources

Impacts on the archeological resources of the recreation area under alternative 2 would be similar to those detailed in the proposal. One exception would occur in the Hough Creek area; the deletion of the campground would lessen the impact on the Pretty Creek archeological site (24CB4&5). Fewer numbers of visitors would utilize the area, lessening the disturbance due to soil compaction and removal of surface artifacts.

There is a possibility that the increase in the number of archeological sites interpreted in this proposal could lead to their eventual deterioration or destruction. The information obtained from the fate of the Crooked Creek tipi ring site after exposure to visitor use would help to determine impacts on additional sites exposed to the same level of interpretation.

(2) Impacts on Crow Resources

Impacts on Crow Indian resources would be the same as those described for the proposal.

(3) Impacts on Historic Resources

Impacts on historic resources would be the same as those described for the proposal.

c. Impacts on the Natural Environment

(1) Impacts on Geologic Features

Removal of bedrock might be required in some areas as a result of road and building construction. These areas would be identified after predesign studies were completed. There would be no removal of bedrock at Horseshoe Bend to install plantings under this alternative.

(2) Impacts on Soils and Vegetation

The impacts on soils and vegetation would be the same as those described for the proposal with the following exceptions:

Horseshoe Bend -- Moderate impacts on soils and vegetation in the Horseshoe Bend development area would be the same as the proposal (100 acres). Severe impacts on vegetation and soils would be about 1 acre less than the 33 acres estimated under the proposal because native vegetation would not be replaced by plantings.

Hough Creek -- There would be 2 acres of severe impact and minimal moderate foot traffic impacts at Hough Creek instead of the 9.3 acres of severe impacts and 173 acres of moderate impacts associated with the proposal.

Barry's Landing -- Camping along the road at North Fork Trail Creek would continue, resulting in greater impacts on the riparian habitat than would occur under the proposal. There would be no additional impacts on vegetation and soils at Barry's Landing because there are only minor changes in the existing development proposed in this alternative.

(3) Impacts on Wildlife

The impacts on wildlife resulting from implementation of this alternative would be essentially the same as the impacts of the proposal with these exceptions: No vegetative modifications would occur at the Horseshoe Bend campground, and no replacement of the native fauna utilizing the area would occur. Under alternative 2, no marina facility would be constructed at Barry's Landing, reducing the impacts to the trout spawning in the Trail Creek drainage.

(4) Impacts on Water Resources

The impacts on water resources would be the same as the proposal with the following exceptions:

Horseshoe Bend -- Irrigation for tree plantings at Horseshoe Bend and Crooked Creek would not be required. The water demand and diversion from the Crooked Creek drainage would be proportionally lowered. Expansion of the existing water supply system might not be required.

Hough Creek -- There would be no impacts at Hough Creek on water resources under this alternative.

Barry's Landing -- There would be no impacts at Barry's Landing on water resources under this alternative.

(5) Impacts on Air Quality

Visitation and use levels do not vary significantly by alternative. Therefore, the analysis of air quality impacts of the proposal is valid for this alternative. No significant impacts on air quality would occur under alternative 2.

(6) Impacts on Aesthetic Quality

The impacts on aesthetic quality would be the same as the proposal with the following exceptions:

Horseshoe Bend -- This alternative calls for prefabricated buildings for food services and the ranger station. These would be somewhat less attractive than the individually designed structures included in the proposal. Landscaping would not be undertaken in the campground, making this alternative slightly less amenable than the proposal.

Hough Creek -- There would be no construction of a campground under this alternative, eliminating visual impacts.

Barry's Landing -- Courtesy slips would not be constructed, thereby slightly reducing visual impacts in the boat dock area. The pedestrian bridge would not be built at Chain Canyon Cove.

4. Mitigating Measures

Mitigating measures for this alternative would be the same as those described for the proposal.

C. Alternative 3

1. Introduction

This alternative would provide for expanded levels of development without the inclusion of Crow lands and construction of a transpark road. Development levels are derived from sections of the 1977 (Draft) Master Plan and Environmental Analysis.

This alternative would involve expansion of a number of existing recreational facilities. Cultural resources would be interpreted by displays in the Yellowtail Dam visitor center, the Bighorn visitor center at Lovell, and at selected sites along the Bad Pass Road corridor. Natural resources would be managed in accordance with existing agreements with appropriate agencies, just as in the proposal.

2. Description

a. Development

(1) Kane/Lovell

Development at the M-L Ranch would proceed as identified in the proposal. There would be no construction of a picnic/rest area at Kane Causeway; however, there would be a group camping area provided at Kane Bridge. This camping area would contain 20 picnic tables and fire grills, 30 parking spaces, 2 comfort stations, a group shelter enclosing 8 tables, and 24 campsites. The access road to Kane Bridge would be retained, and the boat ramp would be removed under alternative 3.

(2) Horseshoe Bend

Under this alternative, development at Horseshoe Bend would be the same as described in the proposal with these exceptions: All improvements in the campground would be implemented, with provisions made for a 100-site expansion area. The amphitheater would seat 320 visitors. A 100-slip marina would be provided with all of the facilities identified in the proposal along with a breakwater. The proposed picnic area would contain 25 picnic tables and shade shelters. The swimming beach would include all of the amenities described in the proposal, with the addition of a playground and an expansion of the bathhouse to provide 16 stalls with exterior showers and a comfort station. Forty asphalt parking spaces would be provided at the ranger station. The dry boat storage area would be expanded to an 80-boat capacity, with 29,259 sq ft of asphalt surface, 750 ft of 8-ft fence, and a guard building.

The Crooked Creek picnic area would be the same as described in the proposal, but all 12 sites would be developed immediately, instead of in two phases of six.

(3) Hough Creek

Under alternative 3, a ranger station complex would be developed near Sorenson Ranch. Facilities would include a 1,200 sq ft building with office space and staff quarters and a 1,000 sq

ft maintenance yard. The existing access road would be hard-surfaced. A day use area would be provided near the Sorenson Ranch and would include 1 mile of dirt trails, 25 picnic tables, 40 parking spaces, and comfort stations. A septic tank and leachfield would also be installed.

Under this alternative, a 60-site campground would be constructed at Hough Creek, with comfort stations and a 150-seat amphitheater. Utilities and a trailhead would be provided as described in the proposal.

(4) Barry's Landing

At North Fork Trail Creek, development for alternative 3 would be identical to that described in the proposal, with the addition of one more picnic area along the road. This would provide a total of 24 picnic tables and 40 asphalt parking spaces for visitor use.

At Barry's Landing, in addition to those facilities included under the proposal, this alternative provides for a picnic area with 25 tables, shade shelters, and a comfort station. The marina would include the same facilities as identified in the proposal, but 80 boat slips instead of 20 would be provided. In alternative 3, the marina would be in the protected cove west of the launch ramp and would be accessed via an anchored floating walkway.

Under alternative 3, a picnic area would be provided at Chain Canyon Cove. The access road would be hard-surfaced, and the picnic area would include 30 tables, 40 asphalt parking spaces, vault comfort stations, and a pedestrian bridge. A fish-cleaning station, corral, and loading chute would also be available for visitor use under this alternative.

The existing primitive boat-in camp/picnic area at Medicine Creek Cove would be expanded under alternative 3. Twelve sites with tables, fire grills, and flat areas for tents would be provided, along with a floating comfort station/courtesy dock. A group camping area with 25 sites and a quarter mile access trail would also be provided in this alternative.

(5) Ok-A-Beh

The existing boat-in camp/picnic area at Black Canyon would be expanded to provide 12 sites. The existing floating comfort station/courtesy dock would be retained.

The present marina at Frozen Leg would be removed, and a comparable facility would be constructed at Ok-A-Beh, as described in the proposal. A permanent ranger station with a control tower would also be provided at Ok-A-Beh.

(6) Afterbay

All development at the Yellowtail Dam visitor center would be the same as described in the proposal.

Under alternative 3, all facilities described in the proposal would be constructed at Afterbay with the exception of the

campground. The group and family picnic area would include an 80-space asphalt parking area, and the adjoining picnic area would contain 20 picnic tables, 15 shade shelters, and a comfort station. A swimming facility would be provided.

A campground along Bighorn River would be constructed under this alternative in place of the one described at Afterbay in the proposal. The campground would be situated at the former Lind property, approximately 4 miles downstream of Ft. Smith. This would be a 200-site campground with 1 mile of paved road, circulation roads, comfort stations, fish-cleaning station, boat ramp, and 380-seat amphitheater.

b. Visitor Use and Interpretation

(1) Kane/Lovell

Visitor use would be the same in alternative 3 as in the proposal except the area would serve more as a cross-country travel service area with the addition of a campground at Kane Bridge. This would also provide somewhat more convenient accommodations for overnight visitors.

The concept of open-range cattle ranching would be interpreted at the M-L Ranch.

(2) Horseshoe Bend

Similar to the proposal, the Horseshoe Bend area would continue to serve as the major focal point for recreation in the south district. This would be enhanced by the increase in recreational services at the marina, swimming beach, and campground under this alternative.

Interpretation at Horseshoe Bend would be oriented to recreation and water safety. Prehistoric hunters and gatherers would be interpreted at the Bad Pass Trail pullout.

(3) Hough Creek

The Hough Creek area would be the major land-oriented recreation site under this alternative, as in the proposal. The greater development at the campground in this alternative would change the area's pristine, primitive character more than would the proposal.

In the area from Hough Creek to Pryor Trail, the themes of riparian habitat and irrigation would be interpreted. In the area of Sorenson Ranch and Hough Creek, the stories of prehistoric hunters and gatherers, Crow culture, mining, and homesteading would be presented. The geology of Bighorn Canyon would be interpreted at the Devil Canyon overlook.

(4) Barry's Landing

The Barry's Landing area would provide visitor opportunities similar to those in the proposal. However, assuming that expanded facilities, particularly the marina, picnic facilities, and horse

corral at Chain Canyon Cove, served the demand for which they were designated, the Barry's Landing area would become a more intensively used area, more overnight oriented, and more integrated with expanded overnight facilities at Hough Creek.

Interpretation would cover water safety and recreation, prehistoric hunters, gatherers, and outlaws. At Hillsboro the stories of mining and dude ranching would be told.

(5) Ok-A-Beh

Visitor use in the north end of the lake would be the same as that provided for in the proposal. Water safety and recreational information would be provided at the Ok-A-Beh boat launch site.

(6) Afterbay

Similar visitor experiences would be provided for in this alternative as in the proposal. The campground (proposed for Afterbay) would be moved to a site below the Afterbay Dam and expanded considerably. This is predicated upon the opening of this land and the Bighorn River to recreational users and would add these fishing and recreational resources to the proposed concepts of Afterbay recreation and Ok-A-Beh services.

Crow culture would be interpreted at the Bighorn Canal Headgate. Military history would be presented as it relates to the Fort C.F. Smith Historical District. Water safety information would be provided at the Afterbay launch ramp.

c. Resource Management

Resource management would be identical to that described in the proposal.

3. Impacts

a. Impacts on the Socioeconomic Environment

(1) Impacts on Regional and Local Residents and Crow Tribe

All impacts of alternative 3 would be the same as those described for the proposal with one exception: impacts of the campground at Bighorn River. Currently, considerable controversy has arisen over the Crow's native rights to the fisheries and lands surrounding this portion of the recreation area. Development at this location would greatly increase the potential for conflict, even with legal resolution of the problem, between non-Indian visitors and Crow members seeking access to the river. Antagonism and ill feeling on the part of the Crow towards the National Park Service would be the logical outcome of this situation.

(2) Impacts on the Visitor Experience

(a) Kane/Lovell

All impacts of this alternative would be the same as those described for the proposal except that provision of overnight group camping and picnicking facilities at Kane Bridge would increase camping and picnicking opportunities, particularly benefiting

cross-country travelers on U.S. 14A and fishermen using the site for bank-fishing.

(b) Horseshoe Bend

Generally the impacts of this alternative would be the same as the proposal impacts. Unlike the proposal, however, if the marina were increased to 100 slips, with dry storage for 80 vessels, the carrying capacity would be exceeded during peak use periods (see appendix D). This assumes that all boats from the Horseshoe Bend marina would be on the lake, in addition to those from the other two marinas at Barry's Landing and Ok-A-Beh. This would likely result in a detracting from the experience of some visitors, as well as safety hazards posed to fast-moving and stationary craft.

The development of a group picnic area at Horseshoe Bend would provide separate picnic facilities for groups, leaving the same number of picnic sites for individuals as exists now, and thus not affecting that capacity. One hundred additional campsites would be provided to relieve congestion and to provide for increased demand should needs dictate. Within the swimming beach area, the development of a playground would benefit overnight and day visitors with small children.

(c) Hough Creek

The following impacts on the visitor experience would be different from impacts of the proposal. Paving the access road to Sorenson Ranch would eliminate road dust, thus improving the entrance experience for visitors. The increase in camping at Hough Creek (60 sites) would allow more visitors to experience the scenic and environmental qualities of that area; however, the increase would exceed the optimum carrying capacity and detract from the pristine character of the site, thus decreasing the quality of the experience for those visitors who value these characteristics.

(d) Barry's Landing

Similar to the situation at Hough Creek, the expansion of facilities (in this case picnic sites) to 24 sites would considerably exceed the optimum carrying capacity (see appendix D), thus detracting socially and environmentally from the experience of some visitors. Improvement of the road to the picnic sites on the point, however, would likely improve the visitor experience at this site by suppressing road dust.

Additional picnicking facilities at Barry's Landing would be available to marina users.

The increase of the marina to 80 slips would cause portions of the lake to exceed optimum carrying capacity during peak use period, causing a deterioration of the experience for some boaters and posing safety hazards due to congestion (see appendix D).

At Chain Canyon Cove, the paving of 2,200 feet of road would improve the visitor experience by suppressing road dust. The addition of a corral and loading chute would assist parties with large numbers of horses, such as commercial wranglers.

At Medicine Creek Cove, the development of a group camping area would provide for groups desiring cohesive camping opportunities, which would enhance both the group's and the general visitor's experience by avoiding conflicts of interest.

Other impacts would be the same as impacts of the proposal.

(e) Ok-A-Beh

Generally, the impacts of this alternative would be the same as impacts of the proposal. However, the doubling of the number of campsites at Black Canyon might decrease the quality of the experience for some visitors by increasing congestion and the potential for conflicts.

(f) Afterbay

The impacts of this alternative would be the same as the proposal impacts except that development of a campground below the Afterbay Dam on the Bighorn River would greatly increase camping opportunities in the aesthetically pleasing river environment.

(3) Impacts on Other Federal Agencies

The impacts of this alternative on other federal agencies would be the same as impacts of the proposal.

(4) Impacts on Concessioners

The impacts of this alternative on concessioners would be the same as impacts of the proposal except that more marina slips would be available for concessioners to lease.

b. Impacts on the Cultural Environment

(1) Impacts on Archeological Resources

Impacts on archeological resources under this alternative would be similar to those detailed in the proposal. However, the impact on the Pretty Creek archeological site (24CB4&5) would be greater than the impact of the proposal. More visitors would utilize the area, increasing the disturbance due to soil compaction and removal of surface artifacts. Kane Bridge, Medicine Creek Cove, Black Canyon, and the campground site on the Bighorn River have not yet been surveyed for archeological sites, and it is possible that the expanded levels of development could impact unknown resources more than would implementation of the proposal.

(2) Impacts on Crow Resources

Impacts on Crow resources would be the same as those described for the proposal, although these impacts would be slightly greater due to expanded levels of development.

(3) Impacts on Historic Resources

Impacts on historic resources would be the same as those described for the proposal.

c. Impacts on the Natural Environment

(1) Impacts on Geologic Features

Impacts on geologic features for alternative 3 would be the same as those described for the proposal.

(2) Impacts on Soils and Vegetation

The impacts on vegetation and soils would be the same as those described for the proposal with these exceptions:

Kane/Lovell -- About 50 additional acres of desert shrubland would be moderately impacted by foot traffic, and 1.5 additional acres of vegetation and soils would be severely impacted at the Kane Bridge area in this alternative in comparison to the proposal. Deletion of the picnic/rest area at Kane Causeway would eliminate 5 acres of moderate impacts and 1 acre of severe impacts.

Horseshoe Bend -- About 4.7 acres would be severely impacted by development in addition to the 33 acres estimated for the proposal. The amount of foot traffic might be more but would probably not affect a larger area than the 100 acres identified under the proposal.

Hough Creek -- An additional 0.5 acre would be severely impacted by development of a larger picnic area at the Sorenson Ranch. Moderate impacts would increase by about 0.4 acre in this area, compared to the proposal. The severe and moderate impacts at Hough Creek would be the same as those for the proposal with the exception of 1 additional acre severely impacted as a result of the expanded campground.

Barry's Landing -- At North Fork Trail Creek, approximately 0.6 acre of severe impact would be incurred in addition to the 0.9 acre estimated for the proposal. An additional picnic area not called for in the proposal would result in about 0.6 acre of severe impacts and possibly 3 acres of moderate impact. Severe impacts would occur on an additional 0.5 acre at Chain Canyon Cove in conjunction with the picnic area proposed under this alternative. The expanded picnic area and group camping area at Medicine Creek Cove would impact an additional 1.2 acres and would moderately impact an additional 3 acres, when compared to the proposal.

Afterbay -- Severe impacts on 4.4 acres on the north side of the Afterbay would be avoided under this alternative by not building the proposed campground. About 1 additional acre of severe impact would occur due to the expansion of the picnic areas under alternative 3. The campground at Bighorn River would result in about 200 acres of moderate impacts and 11.5 acres of severe impacts if this alternative were implemented. The vegetation and soils in this area are similar to those described under the proposal for the Hough Creek riparian woodland community.

(3) Impacts on Wildlife

The impacts on wildlife associated with this alternative would be the same as the proposal, with the following exceptions. The marina development at Horseshoe Bend would

unree times larger under this alternative as compared to the proposal; however, since marina capacity in this case would have very little influence on use levels (see appendix D), the additional impact on aquatic fauna would be minimal.

Overnight and day use facilities at Hough Creek would be twice as large as those in the proposal. The limited space available for such development, combined with the sensitivity and small size of the riparian zone at Hough Creek, would result in significant increases in disruption and destruction of the riparian habitat due to visitor use; therefore, the corresponding impacts on wildlife would be more severe under this alternative. Species that may be disturbed or dispersed by the proposed development might be eliminated entirely from the Hough Creek area by implementation of this alternative.

Development of the campground on the Bighorn River would result in destruction of many invertebrates and small vertebrates unable to migrate away from construction sites. Development and use of the facility would displace many other species of small mammals, birds, and large mammals such as white-tail deer. Due to the large spatial extent of the riparian zone along the Bighorn River, the above impacts would not be critical to wildlife able to migrate away from the development zone.

#### (4) Impacts on Water Resources

The impacts on water resources would be the same as those described for the proposal with the following exceptions:

Kane/Lovell -- There would be no impacts at the Kane Causeway due to the deletion of a picnic/rest area. A freshwater supply system would have to be developed at the Kane Bridge area for the campground proposed under this alternative. This would result in either groundwater depletion or surface water diversion. Potential water supplies for this area have not been identified.

Barry's Landing -- Potable water would have to be supplied to the fish-cleaning station at Chain Canyon Cove. This would result in an additional diversion from the North Fork Trail Creek drainage.

Afterbay -- A water supply system for the campground near Afterbay as described in the proposal would not be necessary under this alternative. A freshwater supply would have to be developed for the campground on the Bighorn River. Maximum demand is estimated at 35,000 gpd.

#### (5) Impacts on Air Quality

Visitation and use levels do not vary significantly by alternative. Therefore, the analysis of air quality impacts of the proposal is valid for this alternative. No significant impacts on air quality would occur under alternative 3.

(6) Impacts on Aesthetic Quality

(a) Horseshoe Bend

The marina at Horseshoe Bend would be larger and consequently more visible than it would be under the proposal. The breakwater for this larger facility would be highly visible from both the entrance road and the water. The alternative 3 boat storage area would be larger and consequently slightly more visible than the proposed area.

(b) Hough Creek

The maintenance building would be larger and in a more visible location than in the proposal. The ranger station complex would be large and easily seen from the entrance road. The picnic area that would be constructed near the historic ranch house would visually intrude on this historic setting. The campground proposed for Hough Creek would be larger and in a visually more sensitive area than the proposed campground.

(c) Barry's Landing

A picnic area would be constructed on the point above the boat launch, where it would be visible from the entrance road and the water. The marina and floating concession would be larger than the proposed facilities and would visually impact the primitive setting of the North and South Fork Trail creeks.

(d) Ok-A-Beh

Visual impacts at the Ok-A-Beh area under this alternative would be the same as described for the proposal.

(e) Afterbay

The campground in this alternative would be situated at the former Lind property, approximately 4 miles downstream from Ft. Smith. This property is much more heavily vegetated than the proposed site, thereby providing a more amenable locale and better visual screening. The group picnic area at the Afterbay area would be larger than the proposed picnic area and somewhat more visible.

4. Mitigating Measures

Mitigating measures for this alternative would be the same as those described for the proposal.

D. Alternative 4

This alternative would provide for a cooperative effort to establish a regional cultural and recreation area. The National Park Service, U.S. Forest Service, Bureau of Land Management, Water and Power Resources Service, Bureau of Indian Affairs, and the Crow would jointly manage the regional area. Each agency would retain jurisdiction over the lands it presently controls, but cultural and natural resource management plans would be developed on a regionwide basis. This alternative would also provide for possible interpretation of the entire region based on geomorphology and scenic and cultural values.

This management policy was previously used in the investigations of archeological resources. Settlement patterns of previous inhabitants of this area include the region from the Pryor to the Bighorn mountains. This transhumance lifeway would be particularly amenable to interpretation on a regionwide basis.

The National Park Service would serve as the lead agency for assembling information to assist in the coordination of all agencies. A regionwide interpretive and recreation development plan would be produced.

Because a detailing of development is infeasible without joint agency planning, only the philosophical base is discussed in this statement.

E. Wilderness Alternatives

1. No Action Alternative

a. Description

This No Action alternative would result in all roadless areas being managed basically as indicated on the Management Zoning map, with options allowing park management to change the zoning and to build roads and other structures should the need ever arise.

b. Impacts

Very little change would occur within the subject area unless existing mining claims were validated in accordance with P.L. 94-429 and became active. Those mining operations and claims on lands within and adjacent to the area could have a serious effect on all resources by destroying archeological resources, wildlife habitat, and vegetation; increasing dust, noise, and siltation of drainages; and degrading aesthetic values.

Use of motorized vehicles by mining operators would lead to soil erosion and an increase in noise.

c. Mitigating Measures

Should it become apparent in the future that continued vehicle use was causing serious resource damage, corrective measures (such as increased ranger patrol and fencing) would be taken.

2. Wilderness Alternative 1

a. Description

This alternative would designate approximately 3,899 acres of roadless area A to be managed as wilderness (see Wilderness Proposal and Alternatives Map). This alternative would exclude the existing Dryhead Common Grazing Allotment and an additional 1,020 acres, as compared to the proposal. This would allow development of administrative and visitor use facilities in the excluded areas if future needs arise.

b. Impacts

Impacts of wilderness alternative 1 would be the same as those described for the wilderness proposal. The amount of acreage impacted would be less, but general impacts on resources would remain the same.

c. Mitigating Measures

Mitigating measures for this alternative would be the same as for the wilderness proposal.

3. Wilderness Alternative 2

This alternative would designate the 4,739 acres in roadless area C as wilderness (see Wilderness Proposal and Alternatives Map). This would involve those lands extending west of the NPS boundary, south of the Montana and Wyoming state line, and east of the 3,675-foot maximum pool elevation.

In accordance with the requirements of P.L. 94-429, 67 mining claim recordation submissions have been filed in this area. These claims are in the northeast corner of roadless area C. Because mining is an unacceptable use in a wilderness area, this alternative should be eliminated.

IX. CONSULTATION AND COORDINATION WITH OTHERS

A. Consultation and Coordination in the Development of the Proposal and in the Preparation of the Draft Environmental Statement

The following agencies and organizations were contacted in connection with the preparation of this General Management Plan/Final Environmental Statement:

Federal:

Bureau of Indian Affairs  
Department of Agriculture  
    Forest Service  
    Soil Conservation Service  
Department of Energy  
Department of the Interior  
    Bureau of Land Management  
    Fish and Wildlife Service  
    Geological Survey  
    National Park Service  
    Water and Power Resources Service  
Environmental Protection Agency

State:

Montana Department of Community Affairs  
Montana Department of Fish and Game  
Montana Department of Health and Environmental Sciences  
Montana Department of Water Quality  
Montana State Historic Preservation Officer  
Montana State Parks

Wyoming Department of Agriculture  
Wyoming Game and Fish Department  
Wyoming Department of Environmental Quality  
Wyoming Recreation Commission  
Wyoming Soil Conservation Service

City:

Hardin Chamber of Commerce - Hardin, Montana  
Lovell Chamber of Commerce - Lovell, Wyoming  
Lovell City Hall - Lovell, Wyoming

Indian:

Crow Cultural Committee  
Crow Tribal Council

Universities:

University of California - Davis, California  
Montana State University - Bozeman, Montana  
University of North Dakota - Grand Forks, North Dakota  
University of Wyoming - Laramie, Wyoming

Other:

Mountain West Research, Inc. - Tempe, Arizona  
National Parks and Conservation Association - Washington , D.C.  
National Parks and Recreation Association - Arlington, Virginia  
Wirth Associates - Billings, Montana

B. Coordination in the Review of the Draft Environmental Statement

Copies of the draft environmental statement were sent to the following for review and comment:

\*Indicates comments were received on the draft environmental statement, and responses are included in Appendix F.

Federal:

Department of Agriculture

Forest Service

Soil Conservation Service

\*Advisory Council on Historic Preservation

\*Department of Energy

Department of the Interior

\*Bureau of Indian Affairs

\*Bureau of Land Management

\*Fish and Wildlife Service

\*Geological Survey

\*Heritage Conservation and Recreation Service

\*Water and Power Resources Service

\*Environmental Protection Agency

Water Resources Council

State:

\*Montana State Clearinghouse

\*Montana State Historic Preservation Officer

\*Wyoming State Clearinghouse

\*Wyoming State Historic Preservation Officer

Other:

\*Crow Tribal Council

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## APPENDIX A

### LEGISLATION

#### 4. Bighorn Canyon

**An Act to provide for the establishment of the Bighorn Canyon National Recreation Area, and for other purposes. (80 Stat. 913)**

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That (a) in order to provide for public outdoor recreation use and enjoyment of the proposed Yellowtail Reservoir and lands adjacent thereto in the States of Wyoming and Montana by the people of the United States and for preservation of the scenic, scientific, and historic features contributing to public enjoyment of such lands and waters, there is hereby established the Bighorn Canyon National Recreation Area to comprise the area generally depicted on the drawing entitled "Proposed Bighorn Canyon National Recreation Area", LNPMW-010A-BC, November 1964, which is on file in the Office of the National Park Service, Department of the Interior.

(b) As soon as practicable after approval of this Act, the Secretary of the Interior shall publish in the Federal Register a detailed description of the boundaries of the area which shall encompass, to the extent practicable, the lands and waters shown on the drawing referred to in subsection (a) of this section. The Secretary may subsequently make adjustments in the boundary of the area, subject to the provisions of subsection 2(b) of this Act, by publication of an amended description in the Federal Register.

Sec. 2. (a) The Secretary is authorized to acquire by donation, purchase with donated or appropriated funds, exchange, or otherwise, lands and interests in lands within the boundaries of the area. The Secretary is further authorized to acquire, by any of the above methods, not to exceed ten acres of land or interests therein outside of the boundaries of the area in the vicinity of Lovell, Wyoming, for development and use, pursuant to such special regulations as he may promulgate, as a visitor contact station and administrative site. In the exercise of his exchange authority the Secretary may accept title to any non-Federal property within the area and convey in exchange therefor any federally owned property under his jurisdiction in the States of Montana and Wyoming which he classifies as suitable for exchange or other disposal, notwithstanding any other provision of law. Property so exchanged shall be approximately equal in fair market value: *Provided*, That the Secretary may accept cash from, or pay cash to, the grantor in such an exchange in order to equalize the values of the properties exchanged. Any property or interest therein owned by the State of Montana or the State of Wyoming or

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any political subdivision thereof within the recreation area may be acquired only by donation or exchange.

(b) No part of the tribal mountain lands or any other lands of the Crow Indian Tribe of Montana shall be included within the recreation area unless requested by the council of the tribe. The Indian lands so included may be developed and administered in accordance with the laws and rules applicable to the recreation area, subject to any limitation specified by the tribal council and approved by the Secretary.

(c) (1) Notwithstanding any other provisions of this Act or of any other law, the Crow Indian Tribe shall be permitted to develop and operate water-based recreational facilities, including landing ramps, boathouses, and fishing facilities, along that part of the shoreline of Yellowtail Reservoir which is adjacent to lands comprising the Crow Indian Reservation. Any such part so developed shall be administered in accordance with the laws and rules applicable to the recreation area, subject to any limitations specified by the tribal council and approved by the Secretary. Any revenues resulting from the operation of such facilities may be retained by the Crow Indian Tribe.

(2) As used in this subsection, the term "shoreline" means that land which borders both Yellowtail Reservoir and the exterior boundary of the Crow Indian Reservation, together with that part of the reservoir necessary to the development of the facilities referred to in this subsection.

SEC. 3. (a) The Secretary shall coordinate administration of the recreation area with the other purposes of the Yellowtail Reservoir project so that it will in his judgment best provide (1) for public outdoor recreation benefits, (2) for conservation of scenic, scientific, historic, and other values contributing to public enjoyment and (3) for management, utilization, and disposal of renewable natural resources in a manner that promotes, or is compatible with, and does not significantly impair, public recreation and conservation of scenic, scientific, historic, or other values contributing to public enjoyment.

(b) In the administration of the area for the purposes of this Act, the Secretary may utilize such statutory authorities relating to areas administered and supervised by the Secretary through the National Park Service and such statutory authorities otherwise available to him for the conservation and management of natural resources as he deems appropriate to carry out the purposes of this Act.

SEC. 4. The Secretary shall permit hunting and fishing on lands and waters under his jurisdiction within the recreation area in accordance with the appropriate laws of the United States and of the States of Montana or

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Wyoming to the extent applicable, except that the Secretary may designate zones where, and establish periods when, no hunting or fishing shall be permitted for reasons of public safety, administration, fish or wildlife management, or public use and enjoyment, and except that nothing in this section shall impair the rights under other law of the Crow Tribe and its members to hunt and fish on lands of the Crow Tribe that are included in the recreation area, or the rights of the members of the Crow Tribe to hunt and fish under section 2(d) of the Act of July 15, 1958. Except in emergencies, any regulations of the Secretary pursuant to this section shall be put into effect only after consultation with the Montana Fish and Game Department or the Wyoming Game and Fish Commission.

Sec. 5. There is hereby authorized to be appropriated not more than \$555,000 for the acquisition of land and interests in land pursuant to this Act.

Approved October 15, 1966.

*Legislative History*

House Report No. 1819 accompanying H.R. 2778 (Committee on Interior and Insular Affairs).

Senate Report No. 64 (Committee on Interior and Insular Affairs).

Congressional Record:

Vol. 111 (1965): Feb. 10, considered and passed Senate.

Vol. 112 (1966):

Sept. 19, considered and passed House, amended, in lieu of H.R. 2778.

Oct. 3, Senate concurred in House amendment with an amendment; House concurred in Senate amendment.

## APPENDIX B

### COST/BENEFIT ANALYSIS

The cost/benefit analysis presented here uses several separate but interrelated methods of evaluating the cost effectiveness of the plan. The following sections contain data that are useful in their own right and are also used in various cost/benefit analyses. No attempt has been made to artificially weight one view of cost-effectiveness as being more important than another or one visitor experience as being more valuable than another. The conclusions that follow are presented in their basic form; it is up to the reader's discretion to make any value judgements concerning the relative importance of various factors.

#### LEGISLATIVE INTENT

The act establishing Bighorn Canyon National Recreation Area requires the National Park Service to "provide for public outdoor recreation use . . . of the proposed Yellowtail Reservoir and lands adjacent thereto" and "preservation of the scenic, scientific and historic features contributing to public enjoyment of such lands and waters." All alternatives considered in the current planning effort, including the No Action alternative, comply with the guidelines set forth in the enabling legislation by providing land- and water-based recreational opportunities and preservation of the area's scenic, scientific, and historic resources.

#### MANAGEMENT OBJECTIVES

One measure of the effectiveness of a general management plan is how well its elements comply with management objectives. The management objectives from the approved "Statement for Management" for Bighorn Canyon National Recreation Area are presented below, with an evaluation of the alternatives relative to each objective.

##### Cooperation

To protect and enhance the area's recreational, natural, and cultural resources through cooperation in planning and management with the Crow Indian Tribe, Bureau of Reclamation, Forest Service, Bureau of Indian Affairs, Bureau of Land Management, and other Federal, State and local agencies.

The recreational and natural resources of Bighorn Canyon have been subject to cooperative planning with the Bureau of Reclamation (now Water and Power Resources Service), U.S. Forest Service, Bureau of Land Management, and applicable state agencies since the introduction of NPS management in the area. Cooperative research on the cultural resources in the region occurred in the early 1970s, and multiagency meetings were held in early 1979 as a result of the current planning effort. Crow reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to NPS

planning without permission of the Crow Tribal Council and the secretary of the interior. Efforts are currently underway to reconcile the existing differences between the Crow and the National Park Service; until such time as this occurs, the current position calling for a moratorium on planning or development on tribal lands remains in effect. All the alternatives evaluated during the general management planning effort satisfy this management objective.

### Recreational Use

To provide optimum recreational uses and enjoyment of the reservoir and adjacent lands through the acquisition of an adequate land base and the provision of facilities and services that have minimal impact on the environment.

Optimum recreational use of the area through the provision of facilities with minimal environmental impacts highlights the conflict between providing for use and preserving the environment. Based on the various demands and visitor use analyses presented below, the following conclusions are apparent.

Alternative 3, which calls for large-scale facility development in all parts of the recreation area, provides a level of use in excess of demand, with the largest environmental impact of the alternatives considered. The sizing of marina facilities appears to be well above that desired to maintain boat use within the capacity of the lake. The large campgrounds at Hough Creek and on the Bighorn River provide a level of service well in excess of anticipated demand and at the cost of severe environmental impacts to the riparian ecosystems. These riparian zones are ecologically the most diverse and most sensitive within the recreation area. Alternative 3 is the least desirable from the standpoint of a recreational use objective.

The No Action alternative, by not providing marinas at any point on the lake, does not allow for optimal use of the recreational opportunities provided by the reservoir. The current problems with overcrowded launching ramps and underutilized water areas would continue to grow, with no clear advantage gained in environmental benefits over any other alternatives. The land-based areas at Hough Creek and Bighorn River are being withheld from development, thus preserving these important areas. The No Action alternative is about equal to alternative 3 in satisfaction of the recreational use objective.

The proposal provides an adequate level of recreational facilities and opportunities. The Hough Creek development is scaled below the level of alternative 3 but still has significant environmental impact. The north district campground is in the Afterbay rather than in the riparian zone along the Bighorn River and has comparatively minor environmental effects in this location. The proposal is significantly more effective in meeting the recreational use objective than is alternative 3.

Alternative 2 provides nearly the same facilities and opportunities as the proposal, with two significant exceptions. No camping is allowed at

Hough Creek, thus preserving the important and fragile riparian ecosystem found there. Demand analysis indicates that the additional Hough Creek camping opportunities are not required except for occasional peak weekends that are likely to occur around the year 2000. Additional camping at Horseshoe Bend could be substituted if demand dictates additional facilities. No marina facilities are provided at Barry's Landing. This helps alleviate potential problems with exceeding lake capacity in the area but does not provide any opportunity for short-term mooring of boats at Barry's Landing. Alternative 2 best satisfies the recreational use objective.

### Visitor Safety

To encourage public safety by increasing visitor awareness of the hazards associated with boating, swimming, hunting, climbing, or other activities in the park.

All alternatives equally satisfy the visitor safety objective.

### Historic Preservation and Interpretation

To protect and interpret the cultural resources of the area by inventorying, identifying, and evaluating archeological and historical remains, and to preserve them in accordance with the requirements of historic preservation law and policy.

To provide visitors with an opportunity to appreciate man's relationship with the Bighorn Canyon environment through interpretive and educational programs.

As previously discussed, the historic and archeological resources of the region are being preserved and protected. The various alternatives do not differ significantly in the emphasis placed on this management element.

Interpretation in alternative 3 and the No Action alternative is the minimum considered during the planning process. The proposal has a significant increase in interpretation over alternative 3 and the No Action alternative. Alternative 2 has the greatest emphasis on interpretation. Alternative 2 and the proposal adequately meet this management objective while alternative 3 and the No Action alternative fall short of meeting the intent of the interpretation objective.

### Resource Protection

To protect the area's facilities and resources from overuse, vandalism, and other inappropriate uses through the development of adequate regulations and maintenance programs, and through cooperative surveillance and enforcement efforts with other agencies.

All alternatives equally satisfy this resource protection objective.

#### Wildlife Management, Environmental Monitoring, and Reservoir Management

To work cooperatively with the Fish and Game Departments of Montana and Wyoming, the U.S. Fish and Wildlife Service and the Crow Tribe in developing a viable wildlife management program, including reintroduction of extirpated species.

To develop an effective environmental monitoring system, which will measure the effect of human activities on the park's environment.

Continue to cooperate with the Bureau of Reclamation in the maintenance of reservoir water levels which promote adequate fishery reproduction and quality water oriented recreation.

The above management objectives were treated in the "Natural Resource Management Plan" prepared separately from the other elements of the General Management Plan. No evaluation is attempted; all alternatives considered were developed in cognizance of these management objectives.

#### VISITATION/FACILITY SIZING ANALYSIS

For the purposes of a meaningful cost/benefit analysis, it has been necessary to develop a method of projecting future levels of visitor use at Bighorn Canyon and to determine how proposed development relates to these anticipated use levels. The base figures for such projections must be as accurate as possible, and the assumptions used in projecting future use must be sensitive to levels and types of uses at the recreation area, trends in the regional population and their recreational behaviors, and national influences. The use levels presented here include these factors but should not be construed to be a prediction; they are projections based on current trends. However, barring major unforeseeable changes in the overall social and economic climate, these projections are useful in evaluating future visitor use at the recreation area.

#### Visitation Characteristics

Reported visitation to Bighorn Canyon increased 58 percent from 1973 to 1977. The major portion of this increase has been in the south district of the recreation area, in response to additional access provided by completion of segments of the Bad Pass Road. Reported visitation to the recreation area is summarized as follows:

<u>Year</u>	<u>Total Reported Visitation</u>
1973	220,467
1974	211,659
1975	298,744
1976	291,926
1977	348,579

The visitation figures were collected by the recreation area staff and include assumptions that recent evaluation has shown to be incorrect. The resulting errors in visitation records are easily corrected and adjustments have been incorporated into the projections that are listed in the "Visitation Projections" section. A summary of these adjustments follows.

Traffic counter information was used almost exclusively to arrive at total visitation counts. The reports previously assumed that all vehicles entering the recreation area had two axles (no trailers). A 70/30 nontrailer/trailer ratio has subsequently been adopted, based on recreation area boating records and regional traffic information from the Greater Yellowstone Cooperative Regional Transportation Study (1978). A load factor (the average number of people per vehicle) of 3.0 was used in the past at Bighorn Canyon. Based on the regional information from the study, the load factor has been increased to 3.4.

The total reported visitation also included visitation to the Yellowtail Wildlife Habitat Area, which is managed by the Wyoming Game and Fish Department. The methodology used to gather information for the habitat area is poorly defined, making the actual counts unreliable. Also, no NPS development or operational funds go to management of the habitat area. Therefore, visitor use of the Yellowtail Wildlife Habitat Area has been deleted from projections of visitation to the north and south districts of the recreation area.

When adjusted by the above criteria, 1977 visitation was 252,343 -- 102,039 in the north district and 150,304 in the south district.

Camping and boating are the major visitor activities at the recreation area for which statistics are recorded. Reliable statistics for such activities are kept by the recreation area staff. For 1977, 2,283 campsites were occupied in the north district -- multiplied by the 3.4 load factor, this represents 7,762 visitors, or 7.6 percent of the north district visitation. The south district figures for 1977 were 3,633 occupied sites, or 12,352 visitors, representing 8.2 percent of the district's visitation. In the north district, 3,811 boats were launched, or 12,957 visitors, accounting for 12.7 percent of the district's visitation. The south district launching total for 1977 was 5,164 boats, or 17,557 visitors, which was 11.7 percent of district visitation. Obviously, there is considerable overlap between boaters and campers (estimates of up to 75 percent for specific areas within the recreation area were obtained from NPS staff; the exact overlap is uncertain at this time). Boaters and campers likely account for about 15-16 percent of total recreational visitation.

In 1968, a survey of visitors to Bighorn Canyon indicated that about 76 percent of all visitors to this area were from Montana and Wyoming. A license plate survey conducted in 1978 showed Wyoming and Montana contributing 77 percent of the total visitation. Further information from a 1978 survey of Wyoming residents statewide showed that about 85 percent of all Wyoming users of the recreation area are from Big Horn and Park counties. The Montana visitors are also from the immediate local area, primarily the Billings metro area and adjacent counties. The range of alternatives considered in the plan lies within the current emphasis of serving the weekend recreational needs of the local population. Therefore, the origins of visitors to Bighorn Canyon will not likely change significantly.

An important consequence of serving the local population's weekend needs is the unavoidable peaks in demand, which occur five or six weekends during a summer, while the remainder of visitation is at comparatively much lower levels. The distribution of visitors over the use season, the effects this can have on demand for facilities, and the cost-effectiveness of facility development and operations is discussed in detail in the sections that follow.

#### Visitation Projections

Using the base figures developed previously, a methodology based on regional trends was developed to project visitation to the year 2000. The assumptions used in the model are summarized as follows:

The regional population will increase due to energy development and is expected to be 50 percent more by the year 2000.

Per capita demand for recreational activities in the regional population will also increase. General recreational demand is expected to be up 12 percent by 2000; boating, 19 percent; and camping, 17 percent.

Cross-country travel will continue to rise at a moderate rate, resulting in a 40 percent increase by 2000.

Highway improvements on U.S. 14A will shift existing cross-country travel, resulting in an immediate 5 percent increase in the cross-country travel component at the south district at Bighorn Canyon.

Facility development, by increasing site attractiveness to specific segments of the population, can affect visitation levels. No accurate assessments of this factor have been done. For this analysis, a 10 percent differential between maximum development and no development has been assumed.

The projections in table 12 are based on implementation of the proposal.

Due to the predominance of local weekend use, nearly half of the current campsite use and over half of the boat launches occur during weekends.

Table 12  
VISITATION PROJECTIONS

Recreation Visitation

	1980-1990 (10-year period)	1990 (1-year period)
North District	1,249,500	143,600
South District	1,576,000	183,700
	2,825,500	327,300

	1990-2000 (10-year period)	2000 (1-year period)
North District	1,488,100	168,000
South District	2,001,500	230,600
	3,489,600	398,600

6,315,100 (20-year period)

Campsites Occupied

	1980-1990 (10-year period)	1990 (1-year period)
North District	29,200	3,380
South District	44,860	5,150
	74,060	8,530

	1990-2000 (10-year period)	2000 (1-year period)
North District	36,240	4,330
South District	54,300	6,170
	90,540	10,500

164,600 (20-year period)

Boats Launched

	1980-1990 (10-year period)	1990 (1-year period)
North District	51,630	6,040
South District	69,960	8,190
	121,590	14,230

	1990-2000 (10-year period)	2000 (1-year period)
North District	66,480	7,640
South District	90,080	10,360
	156,560	18,000

278,150 (20-year period)

Over a typical summer season, the five peak weekends account for about 30 percent of the total campsite occupancies and 35 percent of the total boat launches for the year.

Utilizing the yearly projections and the information on the weekday/weekend use differential, the average peak weekend day can be projected. The figures presented below are arrived at in the absence of any facility size assumptions and are used in the demand analysis that follows.

	<u>1990</u>	<u>2000</u>
Campsites occupied on average weekday		
North District	9	11
South District	31	37
Campsites occupied on average peak weekend day		
North District	64	82
South District	77	93
Boats launched on average weekday		
North District	23	29
South District	39	49
Boats launched on average peak weekend day		
North District	92	116
South District	98	124

### Facility Sizing

Development of campground and marina facilities should relate to anticipated use levels. By using the visitation projections, demands for campground and marina space at Bighorn Canyon are evaluated, and the conclusions presented below.

Comparative Facilities: One method of evaluating Bighorn Canyon's future campground and marina requirements is to evaluate the sizes and visitation levels at similar facilities at other reservoir-based recreation areas. Curecanti National Recreation Area (Colorado), Lake Mead National Recreation Area (Nevada and Arizona), Glen Canyon National Recreation Area (Arizona and Utah), Boysen State Park (Wyoming), and Buffalo Bill State Park (Wyoming) were evaluated. Campground occupancy for these areas averaged 80 percent per night for the months of July and August (peak season for all the areas evaluated) and ranged from 75 percent to 100 percent. Total boat launches were compared to the total number of marina slips provided; 2.5 slips per 1,000 boat launches was the mean, with a range of 0.8 to 2.8. By applying these comparative criteria to Bighorn Canyon, the following facility sizes are indicated:

	<u>1990</u>	<u>2000</u>
Number of campsites required based on comparative facilities		
North District	31	39
South District	47	56
Number of marina slips required based on comparative facilities		
North District	15	19
South District	21	26

Peak Demand: Another factor to consider when sizing facilities is peak demand. The demand for campground space at Bighorn Canyon on a July weekend is as follows:

	<u>1990</u>	<u>2000</u>
North District	64	82
South District	77	93

Insufficient data prevents a peak demand analysis of marina facilities.

### Conclusions

In order to understand the large differences in campground sizing, as well as the implications of those differences, the periodicity of Bighorn Canyon visitor use must be considered. The major portion of visitation to Bighorn Canyon originates in the few counties immediately surrounding the recreation area. This visitor population continues to be the major user group. The important consideration is the almost total orientation of this group to weekend use only. Visitor use at Bighorn Canyon is, and will continue to be, characterized by very large peaks on Friday and Saturday nights and very little use during the week. This trend is accentuated in the north district due to the lack of overnight cross-country visitors. Thus, a campground whose size is based on average monthly occupancy functions under capacity during the week but is hopelessly overloaded during the peak use weekends. The other recreation areas all experience a much more even level of use for weekly periods. (The Wyoming state parks specifically are adjacent to the major transportation corridors to Yellowstone National Park, have generally better fisheries resources, a less-constraining water base, and use overflow camping to handle the one or two weekends per year when demand exceeds capacity.) The alternative method, defining size by looking at average peak demand, provides facilities large enough to handle the weekend visitation but which are nearly empty for most of the days during the summer season. The comparative areas, because of their more even use rates, have an average peak demand that is much closer to their average demand.

Due to the large differences in weekday versus weekend visitation at Bighorn Canyon, it becomes difficult to make rational decisions on sizing of campground facilities. One choice maximizes the use of facilities but causes serious management problems during peak use periods when demand exceeds capacity. The other choice provides for peak use but results in an average occupancy rate near 40 percent, rather than the 80 percent indicated by comparison to other areas.

Specifically, the campground at Horseshoe Bend is more than adequate for the south district, even for the average peak demand in the year 2000. The proposed campground at Afterbay provides adequate sites for peak demand in the year 2000 but at the cost of being extremely underutilized for the greater part of the visitor season.

Proposed marina facilities appear reasonably sized. The Ok-A-Beh facility seems somewhat larger than required. However, marina support facilities constitute the major portion of construction, operation, and maintenance costs; these costs increase very slowly as sizing increases.

#### DOLLAR COST ANALYSIS

Implementation of a general management plan requires money for construction, operation, and maintenance of recreation area facilities. This analysis presents estimated costs for construction of additional facilities, additional staffing requirements as a result of these facilities, and operations and maintenance costs. (All costs are in 1980 dollars.) These costs are assessed to the users of the campgrounds, marinas, and general recreation area facilities for the 1980-2000 period, based on anticipated phasing and projected use rates.

#### Construction Cost Estimates

The following costs (table 13) are class C estimates, based on actual construction costs for similar facilities in other NPS areas.

Table 13  
CONSTRUCTION COST ESTIMATES

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
<u>M-L RANCH</u>	No construction	Same as proposal	Same as proposal
10-space gravel parking lot			
1,300-ft asphalt trail			
\$15,000		\$15,000	\$15,000
\$15,000		\$15,000	\$15,000
<u>KANE CAUSEWAY</u>			
12-site picnic/rest area	No construction	Same as proposal	No construction
25 trees			
Vault comfort station			
One-quarter mile gravel access road			
\$53,000		\$53,000	
\$53,000		\$53,000	
<u>KANE BRIDGE</u>			
Remove existing facilities and rehabilitate site	No construction	Same as proposal	24-site campground Group shelter 30-car asphalt parking lot 2 vault comfort stations Remove boat ramp
\$125,000		\$125,000	\$85,000
\$125,000		\$125,000	\$85,000
<u>HORSESHOE BEND</u>			
30-slip marina with concession facility	No marina	Same as proposal	100-slip marina with concession facility
\$325,000		\$325,000	\$625,000
12-site picnic area with shade shelters	No picnic area	Same as proposal	25-site picnic area with shade shelters
Asphalt access road	--	\$61,000	Asphalt access road
\$61,000			\$78,000
Swimming beach (120 ft x 500 ft)	No swimming beach	6-stall bathhouse with exterior showers	Swimming beach (120 ft x 500 ft)
Swimming raft		Comfort station	Playground Swimming raft

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
Ski ramps (2) 6-stall bathhouse with exterior showers Comfort station 1,200-ft concrete walkway \$154,000		1,200 ft. concrete walkway  \$151,000	Ski ramps (2) 16-stall bathhouse Comfort station 1,200 ft concrete walkway  \$169,000
Campground improvements 97 shade shelters 2,500 trees Irrigation system 123 tent pads \$334,000	Same as proposal    \$334,000	Campground improvements 97 shade shelters  \$97,000	Campground improvements 126 shade shelters 2,500 trees Irrigation system 123 tent pads \$360,000
No campground expansion	No campground expansion	No campground expansion	Expand existing campground by 100 sites \$363,000
2,100-sq-ft ranger station 170-ft asphalt drive and 20 parking spaces 80 trees and shrubs \$277,000	No construction	Replace ranger station trailer 20-space gravel parking lot \$15,000	Same as proposal except 20 extra parking spaces  \$297,000
180-seat amphitheater \$118,000	Same as proposal \$118,000	150-seat amphitheater \$75,000	320-seat amphitheater \$160,000
5 miles of trail \$7,000	No construction	Same as proposal \$7,000	Same as proposal \$7,000
No group picnic area	No group picnic area	No group picnic area	Group picnic area with 10 tables Group shelter \$40,000
50-boat dry storage area, gravel \$28,000	No dry boat storage	Same as proposal \$28,000	80-boat dry storage area, asphalt \$76,000
Permanent maintenance facility 7,200-sq-ft building 1,600-sq-ft asphalt parking 7,000-sq-ft gravel parking 4,000-ft asphalt road 500-ft fence \$684,000	No construction	Same as proposal      \$684,000	Same as proposal      \$684,000

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
Employee housing 6-unit cluster  \$280,000	No construction	Replace existing employee housing trailers with new ones \$72,000	Same as proposal  \$280,000
Utilities Bury electric lines 600-ft 6-in sewer 2,400-ft 4-in water 1,000-ft additional electric 8 manholes Add 3.3 acres to lagoon \$193,000 \$2,461,000	Same as proposal      \$193,000 \$645,000	Same as proposal      \$193,000 \$1,708,000	Same as proposal      \$193,000 \$3,332,000
<u>CROOKED CREEK</u>			
12-site picnic area 20-space gravel parking lot Vault comfort station 1,000 cu yd earth, plus 80 trees \$60,000 \$60,000	No construction	12-site picnic area 20-space gravel parking lot Vault comfort station   \$18,000 \$18,000	Same as proposal      \$60,000 \$60,000
<u>SORENSEN RANCH</u>			
600-sq ft maintenance building \$3,000	No construction	Same as proposal \$3,000	1,200-sq ft ranger station 1,000-sq ft maintenance yard \$87,000
Day use area 1-mile trail 25 picnic tables 30-car gravel parking lot Comfort station  \$83,000 \$86,000	No construction	Same as proposal     \$83,000 \$86,000	Day use area 1-mile trail 25 picnic tables 40-car asphalt parking lot Comfort station  \$113,000 \$200,000
<u>HOUGH CREEK</u>			
35-site campground 2 comfort stations \$74,000 (possible additional phase of 25 sites, \$25,000)	No campground	No campground	60-site campground 3 comfort stations \$132,000
7,200-ft asphalt road 20-space trailhead parking lot \$456,000	No construction	2,500-ft asphalt road 20-space trailhead parking lot \$174,000	Same as proposal   \$456,000

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
75-seat campfire circle \$15,000	No construction	No construction	150-seat amphitheater \$40,000
Utilities 18 miles electric 14,000-ft 4-in water 9,000-ft 6-in sewer Lift station Septic tank and leachfield \$514,000 \$1,059,000	No utilities	No utilities	Same as proposal
		<u>\$174,000</u>	<u>\$514,000</u> \$1,142,000
<u>DEVIL CANYON OVERLOOK</u>			
Asphalt trail from parking lot to overlook \$9,000 \$9,000	Same as proposal \$9,000 \$9,000	Same as proposal \$9,000 \$9,000	Same as proposal \$9,000 \$9,000
<u>NORTH FORK TRAIL CREEK</u>			
Eliminate camping, convert to 15-site picnic area (3 clusters) 20-space gravel parking lot Vault comfort stations \$27,000	Retain camping	Retain camping	Eliminate camping, convert to 24-site picnic area (4 clusters) 40-space asphalt parking lot Vault comfort stations \$67,000
Improve access road to point 4-site picnic area 20-space gravel parking lot \$56,000 \$83,000	No construction	Same as proposal \$56,000 \$56,000	2,000-ft asphalt access road to point 4-site picnic area 20-space gravel parking lot \$136,000 \$203,000
<u>BARRY'S LANDING</u>			
Ranger/first aid station, concession building \$124,000	Unmanned information kiosk \$5,000	Ranger/first aid station \$100,000	Ranger/first aid station, concession building \$148,000
Comfort station \$45,000	No construction	Vault comfort station \$7,000	Same as proposal \$45,000
Fish-cleaning station \$14,000	No construction	No construction	Same as proposal \$14,000

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
Hard surface existing parking lot \$100,000	No construction	Same as proposal \$100,000	Same as proposal \$100,000
No picnic area	No picnic area	No picnic area	25-site picnic area with shelters, comfort station \$80,000
Marina and concession facilities, 20 slips \$75,000	No marina	No marina	Marina and concession facilities, 80 slips \$300,000
Fuel dock & tanks \$120,000	No construction	Same as proposal \$120,000	Same as proposal \$120,000
Fishing dock \$20,000	No fishing dock	No fishing dock	Same as proposal \$20,000
No additional parking	No additional parking	No additional parking	60-car asphalt parking lot (add) \$60,000
Utilities sewer lagoon 3 lift stations 3,000-ft force main \$260,000 \$758,000	No utilities     <u>\$5,000</u>	No utilities     <u>\$327,000</u>	Same as proposal     <u>\$260,000</u> <u>\$1,147,000</u>
<u>CHAIN CANYON COVE</u>			
Improve access road \$50,000	No construction	Same as proposal \$50,000	Pave access road - 2,200 ft \$132,000
No construction	No construction	No construction	Fish-cleaning station \$14,000
No construction	No construction	No construction	Corral and loading chute \$5,000
Day use area Vault comfort station 20-car gravel parking lot Trails 250-ft pedestrian bridge  <u>\$118,000</u> \$168,000	No construction	Day use area Vault comfort station 20-car gravel parking lot Trails  <u>\$15,000</u> \$65,000	Day use area Vault comfort station 40-space asphalt parking lot 30-site picnic area Trails 250-ft pedestrian bridge  <u>\$148,000</u> \$299,000

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
<u>MEDICINE CREEK COVE</u>			
Floating comfort station/ courtesy dock \$63,000	No construction	Same as proposal \$63,000	Same as proposal \$63,000
8-site boat-in picnic/ campground \$6,000	No construction	Same as proposal \$6,000	12-site boat-in picnic/ campground \$9,000
No group camping <u>\$69,000</u>	No group camping	No group camping <u>\$69,000</u>	25-person group campsite <u>\$7,000</u> <u>\$79,000</u>
<u>BLACK CANYON</u>			
No construction	No construction	No construction	Add 6 campsites to campground <u>\$3,000</u> <u>\$3,000</u>
<u>FROZEN LEG</u>			
6-site boat-in camp/ picnic area \$3,000	Same as proposal \$3,000	Same as proposal \$3,000	Same as proposal \$3,000
Remove marina <u>\$20,000</u> <u>\$23,000</u>	Same as proposal <u>\$20,000</u> <u>\$23,000</u>	Same as proposal <u>\$20,000</u> <u>\$23,000</u>	Same as proposal <u>\$20,000</u> <u>\$23,000</u>
<u>OK-A-BEH</u>			
Redesign ranger station and concession facility \$35,000	No construction	Same as proposal \$35,000	New 1,200-sq-ft ranger station with control tower \$84,000
50-slip marina \$235,000	No marina	Same as proposal \$235,000	Same as proposal \$235,000
Fuel dock \$120,000	Same as proposal \$120,000	Same as proposal \$120,000	Same as proposal \$120,000
Dumping station <u>\$40,000</u> <u>\$430,000</u>	Same as proposal <u>\$40,000</u> <u>\$160,000</u>	Same as proposal <u>\$40,000</u> <u>\$430,000</u>	Same as proposal <u>\$40,000</u> <u>\$479,000</u>
<u>YELLOWTAIL DAM</u>			
Improve walkway and dock <u>\$200,000</u> <u>\$200,000</u>	Same as proposal <u>\$200,000</u> <u>\$200,000</u>	Same as proposal <u>\$200,000</u> <u>\$200,000</u>	Same as proposal <u>\$200,000</u> <u>\$200,000</u>

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
<u>AFTERBAY</u>			
2½ miles fishing access trails with 5 pedestrian bridges \$30,000	No construction	Same as proposal \$30,000	Same as proposal \$30,000
87-site campground with asphalt access road, trailer dumping station, landscaping \$172,000	No construction	Same as proposal \$172,000	No construction (campground on Bighorn River replaces this)
150-seat amphitheater 80-car asphalt parking lot \$107,000	No construction	Same as proposal \$107,000	No construction (amphitheater on Bighorn River replaces this)
Group picnic area, with paved 3,000 ft-access road 40-car parking lot, 15 tables, group shelter, comfort station, landscaping \$343,000	No construction	Same as proposal \$343,000	Same as proposal 80-car parking lot \$356,000
10-site picnic area with shade shelters, comfort station, landscaping \$78,000	No construction	Same as proposal \$78,000	20-site picnic area with shade shelters, vault comfort station, landscaping \$43,000
Swimming pool and bathhouse \$300,000	No construction	No construction	Same as proposal \$300,000
Utilities 18,000-ft water 8,000-ft electric underground 6,000-ft sewer 2 lift stations 2-acre lagoon \$529,000	No construction	Same as proposal \$529,000	Utilities 18,000-ft water \$80,000
Picnic area below Afterbay Dam 6 tables, 6 shade shelters \$8,000 \$1,567,000	No construction	Same as proposal \$8,000 \$1,267,000	Same as proposal \$8,000 \$817,000

<u>PROPOSAL</u>	<u>NO ACTION</u>	<u>ALTERNATIVE 2</u>	<u>ALTERNATIVE 3</u>
<u>AFTERBAY ROAD</u>			
Manned information station \$6,000 \$6,000	No construction	Same as proposal \$6,000 \$6,000	No construction
<u>BIGHORN RIVER CAMPGROUND</u>			
No construction	No construction	No construction	200-site campground 1-mile asphalt road ½-miles asphalt access road 4 comfort stations 380-seat amphitheater Utilities (water, sewer, electric) Fish-cleaning station Boat ramp \$1,870,000 \$1,870,000
<u>TOTAL CONSTRUCTION COSTS (GROSS AMOUNTS)</u>			
\$7,172,000	\$1,042,000	\$4,631,000	\$9,963,000
+46 % (advanced planning design, construction supervision)	+46%	+46%	+46%
\$10,471,000	\$1,521,000	\$6,622,000	\$14,546,000

Table 14  
STAFFING REQUIREMENTS

Horseshoe Bend/Crooked Creek

Permanent

1 Engr. equip. optr. WG-9 (LV)  
 1 Clerk-typist GS-4 (LV)  
 1 Resource mgt. spec. GS-11 (PG)  
 1 Maint. worker - WG-7 (LV, BL, & HC)

Seasonal

1 WY Laborer (LV & BL)  
 .8 WY Park tech. (protection)  
     (LV, BL, & HC)  
 .8 WY Park tech. (interp.)  
 .8 WY Lifeguard

Afterbay/Yellowtail Dam

1 Park tech. (protection) GS-6  
     (OB, HQ, & BN)  
 1 Maint. worker, sanitation WG-7  
     (OB & HQ)

1 WY Lifeguard  
 .8 WY Park tech. (interp.)  
     (OB, HQ, and BN)  
 .6 WY Park tech. (protection)  
     (OB, HQ, & BN)

Ok-A-Beh

1 Park tech. (ranger) GS-6 (PG)  
 1 Maint. mechanic WG-9 (AB, HQ, & BN)

1.6 WY Park tech. (protection)  
     (AF, HQ, & BN)  
 1.2 WY Maint. worker (AB, HQ,  
     & BN)  
 .8 WY Park tech. (interp.)

Hough Creek

1 Motor veh. op. WG-6 (LV, HB, & BL)  
 1 Park tech. (interp.) GS-6 (LV, HB,  
     & BL)

.6 WY Laborer (BL & HB)  
 .6 WY Park tech. (protection)

Barry's Landing/Chain Canyon/Medicine Creek

None--covered from other dev. areas

.8 WY Motor veh. op. (LV, HB,  
     & HC)  
 .8 WY Park tech. (interp.)

M-L Ranch/Kane Causeway/Kane

None--covered from other dev. areas

.8 WY Motor veh. op. (LV & HB)  
 .8 WY Laborer (LV & HB)

Total Permanent: 10

Total Seasonal: 13.8 WY

### Staffing Requirements

Additional facility operation called for in the plan will require additional staff. Estimates of additional staffing required for each developed area are listed in table 14; they were prepared by the superintendent based on requirements at full implementation of the plan. Current staffing levels are 24 permanent positions and 21.6 work-years of part-time and seasonal workers.

### Development Priorities and Phasing

Development of physical facilities at Bighorn Canyon can be constructed in phases based on funding availability and demand for additional facilities. This interim phasing and priority schedule summarizes the general schedule for implementation of facility development at Bighorn Canyon National Recreation Area.

To be constructed 1980-1990

Horseshoe Bend, Crooked Creek, Afterbay, Yellowtail Dam, Ok-A-Beh, Frozen Leg

To be constructed 1991-2000

Hough Creek, Barry's Landing, Chain Canyon Cove, Medicine Creek Cove, M-L Ranch, Kane Causeway

### Operation and Maintenance Costs

Once physical facilities are constructed, salary and materials money must be spent to operate and maintain them. The operations and maintenance costs summarized below are based on full implementation of the proposal.

Table 15  
OPERATION AND MAINTENANCE COSTS

<u>DEVELOPED AREA</u>	<u>PERCENT OF STAFFING &amp; FUNDS</u>
<u>South District</u>	
South Dist. General	40%
Roads, parking, & trails	(18%)
Lake patrol & cleanup	(19%)
Hist. buildings maint.	(03%)
Horseshoe Bend	27%
Marina, store, & swimming beach	(08%)
Campground/picnic area	(07%)
Ranger station, maint. area, & housing area	(12%)
Hough Creek	10%
Barry's Landing	10%
Bighorn Visitor Center	<u>13%</u>
TOTAL	100%
<u>North District</u>	
North District General	50%
Roads, parking, trails	(15%)
Ft. Smith government camp	( 5%)
Protection/road and lake patrol	(10%)
Interpretation	( 5%)
General administration	(15%)
Afterbay/Yellowtail Dam	35%
General maintenance	(15%)
Campground/picnic area	( 6%)
Protection	( 8%)
Yellowtail visitor center	( 6%)
Ok-A-Beh	15%
Marina maintenance	( 8%)
Protection/operations	( 5%)
Interpretation	( 2%)
TOTAL	<hr/> 100%

### Implementation Cost Summary

Utilizing the information in previous sections and the visitation projections, the full cost of plan implementation through the year 2000 can be calculated. The operation, maintenance, and construction costs associated with providing camping and boating facilities have been assessed. A percentage of general support facility (ranger stations, etc.) costs are included in these assessments. No attempt has been made to artificially weight one visitor use over another; in this way the reader may make his or her own judgments concerning relative value of different visitor experiences being provided at Bighorn Canyon.

Table 16  
IMPLEMENTATION COST SUMMARY

Boat Facilities and Related Operations

North District

Cost 1980-1990	
Operations and maintenance	\$2,060,000
Construction	<u>658,000</u>
	\$2,718,000

1990-2000	
Operations and maintenance	\$2,060,000
Construction	<u>0</u>
	\$2,060,000

Total Boats Launched

1980-1990	51,630
-----------	--------

1900-2000	66,480
-----------	--------

Cost per launch

1980-2000	\$40.45
-----------	---------

South District

Cost 1980-1990	
Operations and maintenance	\$1,830,000
Construction	<u>1,310,000</u>
	\$3,140,000

1990-2000	
Operations and maintenance	\$1,970,000
Construction	<u>1,238,000</u>
	\$3,208,000

Total Boats Launched

1980-1990	69,960
-----------	--------

1990-2000	90,080
-----------	--------

Cost per launch

1980-2000	\$39.66
-----------	---------

Campground Facilities and Related Operations

North District

Cost 1980-1990

Operations and maintenance	\$1,300,000
Construction	<u>1,180,000</u>
	\$2,480,000

1990-2000

Operations and maintenance	\$1,300,000
Construction	<u>0</u>
	\$1,300,000

Total Sites Occupied

1980-1990	29,200
-----------	--------

1990-2000	36,240
-----------	--------

Cost per site occupied

1980-2000	\$57.76
-----------	---------

South District

Cost 1980-1990

Operations and maintenance	\$1,390,000
Construction	<u>1,265,000</u>
	\$2,655,000

1990-2000

Operations and maintenance	\$2,030,000
Construction	<u>1,532,000</u>
	\$3,562,000

Total Sites Occupied

1980-1990	44,860
-----------	--------

1990-2000	54,300
-----------	--------

Cost per site occupied

1980-2000	\$62.70
-----------	---------

Day Use Facilities and Related Operations

North District

Cost 1980-1990		
Operations and maintenance		\$2,540,000
Construction		<u>1,033,000</u>
		\$3,573,000
1990-2000		
Operations and maintenance		\$2,540,000
Construction		<u>0</u>
		\$2,540,000

Total Visits

1980-1990	969,700
1990-2000	1,138,000

Cost per visit

1980-2000	\$2.90
-----------	--------

South District

Cost 1980-1990		
Operations and maintenance		\$1,580,000
Construction		<u>1,898,000</u>
		\$3,478,000
1990-2000		
Operations and maintenance		\$1,650,000
Construction		<u>420,000</u>
		\$2,070,000

Total Visits

1980-1990	1,185,600
1990-2000	1,510,000

Cost per visit

1980-2000	\$2.06
-----------	--------

Total Implementation Costs

1980-2000	\$32,784,000
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## Conclusions and Summary of Alternatives

The reasons for the relatively high cost of providing camping have already been discussed. The majority of the visitors are from the immediate local area and continue to use the park, especially for camping activities, on a weekend basis. By sizing the campgrounds to accommodate these weekend peaks, the average occupancy over the visitor season is low; therefore, the cost per site occupied is high.

Cost per boat launch (providing marinas, lake patrol, etc.) is high for the same reason of weekend peaks in visitation. The cost of the actual marina facility is relatively low; the support facilities are the large portion of the costs. Therefore, providing a 100- or 150-slip marina costs marginally more than a 30-slip marina and if utilized to capacity yields a much smaller cost per use. This economy of scale factor is present in Bighorn Canyon and makes the cost per launch in a smaller facility relatively high. An additional critical factor that enters into the analysis at this point is the actual capacity of Bighorn Lake to provide a boating experience. During the mid-July period (peak use), the pool level of the reservoir is such that the actual usable surface area of the entire lake is less than 7,000 acres. The initial carrying capacity analysis, which will be presented later, indicates that the year 2000 will see Bighorn Lake use at or near capacity. Thus, further expansion of marina facilities is not likely and may be undesirable from a capacity standpoint.

Utilizing the methodology presented in the preceding sections, the costs of providing services and facilities for the 1980-2000 period are summarized as follows:

Table 17  
SUMMARY OF COSTS

<u>Boat Facilities and Services</u>	<u>Total Costs</u>	<u>Cost/Use</u>
Proposal	\$11,126,000	\$40.00
No Action	\$ 6,125,000	\$22.45
Alternative 2	\$ 9,216,000	\$34.01
Alternative 3	\$15,398,000	\$52.64

<u>Campground Facilities and Services</u>		
Proposal	\$ 9,997,000	\$60.74
No Action	\$ 5,545,000	\$35.45
Alternative 2	\$ 5,975,000	\$37.25
Alternative 3	\$16,204,000	\$93.77

<u>Day Use Facilities and Operations</u>		
Proposal	\$11,661,000	\$ 2.43
No Action	\$ 5,909,000	\$ 1.29
Alternative 2	\$15,973,000	\$ 3.41
Alternative 3	\$ 9,929,000	\$ 1.97

### Total Implementation Costs

Proposal	\$32,784,000
No Action	\$17,579,000
Alternative 2	\$31,164,000
Alternative 3	\$41,531,000

As previously discussed under the "Comparative Facilities" section, the weekend pattern of visitation at Bighorn Canyon makes optimal sizing of campground and marina facilities impossible. By providing for peak use, the overall occupancy is low and the cost per use high, as compared to other areas. Cost analyses of similar reservoir-based recreation areas show that the cost per launch figures of boat use services and facilities is in the \$3-\$5 range, and campground cost per occupancy is in the \$3.50-\$4.50 range. It becomes obvious that even the No Action alternative is considerably more expensive per use than operations currently being funded at similar areas.

The relative emphasis of each alternative becomes apparent by looking at the relative costs of boat use, campground use, and day use. Alternative 3 places the greatest emphasis on camping and boating facilities and services while it places the least emphasis on day use and other activities (with the exception of No Action). Alternative 2 places the greatest emphasis on day use and other facilities. All alternatives except No Action provide for adequate boating and camping facilities.

### SOCIOECONOMIC COST ANALYSIS

#### Proposal

The proposal supplies significantly increased and continued recreational benefits to local and regional residents. Development of additional marina facilities is of particular benefit, supporting increasing demand by the local population for boating and providing for overnight and long-term storage of boats.

Expected visitation increases in the north district resulting from proposed development provides an increased economic benefit to communities lying along the approach route to the recreation area.

Regional and special population users (handicapped and Crow) benefit through the development of facility access and group activity facilities.

#### No Action

No significant increases in regional recreational benefits occur. Boating remains constant with no provisions for boat storage, resulting in increased energy requirements for the trailering of craft to and from the recreation area.

Economic benefits to local communities are lower than the proposal. Special population needs are not met, resulting in user frustration.

### Alternative 2

The socioeconomic benefits and costs of this alternative are the same as those of the proposal.

### Alternative 3

The greatest recreational benefits are supplied by this alternative, especially in terms of the amount of facility development. Marina facilities are of particular benefit, although the level of services supplied does cause overuse and congestion on Bighorn Lake at peak use times.

Increased overnight facilities benefit cross-country travelers and north district visitors. Increased economic benefits similar to those of the proposal are derived by local communities.

## ENVIRONMENTAL COST ANALYSIS

The environmental costs of the alternatives are discussed in detail in the text of the environmental statement. The summary below briefly contrasts the alternatives, highlighting major differences in environmental effects.

Alternative 3 has the most severe environmental impacts, largely due to the 60-site campground and large day use area at the Hough Creek site and the 200-site campground on Bighorn River. These developments are placed in riparian zones, which are critically important to wildlife of the surrounding arid country and are generally the most diverse and sensitive ecosystems in Bighorn Canyon. The Hough Creek drainage, due to its very limited size and importance to the wildlife of the area, is the most severely affected.

The proposal, by eliminating development in the Bighorn River riparian zone and reducing the size of the Hough Creek developments, has less severe environmental costs than alternative 3. The Hough Creek development, even though reduced in size, still has significant negative effects on the flora and fauna of the area.

Alternative 2, by eliminating development from Hough Creek as well as the Bighorn River area, is significantly less costly environmentally than the proposal. The significant environmental effects associated with alternative 2 include the complete change in vegetation associated with the campground improvements at Horseshoe Bend and the continued use of the North Fork Trail Creek camping area.

The No Action alternative, by including the campground improvements at Horseshoe Bend, has nearly the same environmental costs as alternative 2. There is no development in the Chain Canyon area, which eliminates the environmental effects that would result from implementation of alternative 2.

## SUMMARY

The various views of analyzing costs, cost-effectiveness, and cost/benefit presented in the preceding sections are summarized as follows:

All alternatives seem to equally satisfy the intent of the legislation establishing the recreation area.

Alternative 2 best satisfies the management objectives related to recreational use and environmental preservation. The proposal satisfies those objectives, but less satisfactorily.

Alternative 3 and the No Action alternative do not adequately satisfy the management objectives.

Based on the facility sizing analysis, alternative 2 best satisfies the sizing criteria evaluated. The proposal calls for facility construction in excess of demand in the south district. Alternative 3 calls for excess facility construction in both the north and south districts. The No Action alternative, by not providing needed campground facilities in the north district, does not adequately satisfy sizing criteria.

The cost effectiveness analysis shows that none of the alternatives considered are cost effective in providing boating and camping facilities and services, based on comparison with other reservoir-based recreation areas. The results of the cost-effectiveness analysis are presented in Table 18, expressed in comparative terms as a multiple of the cost of similar regional facilities.

Table 18  
COST-EFFECTIVENESS ANALYSIS

### Relative Cost Per Use Of Providing Boat Facilities and Services

Similar regional facilities	1.0
Proposal	9.1
No Action	5.3
Alternative 2	8.0
Alternative 3	12.4

### Relative Cost Per Use Of Providing Camping Facilities And Services

Similar regional facilities	1.0
Proposal	14.3
No Action	8.3
Alternative 2	8.8
Alternative 3	22.1

Alternative 2 supplies the highest levels of recreational benefits and provides local economic benefits equal to the proposal. Alternative 3

and the proposal provide recreational benefits at a level somewhat below alternative 2. Alternative 3 provides local economic benefits equal to the proposal. The No Action alternative provides for no increases in recreational benefits. Lack of boat storage in the recreation area and adequate camping in the north district are notable. The local economic benefits of No Action are lower than other alternatives.

Alternative 2 and the No Action alternative have the least severe environmental effects from facility development and visitor use. The proposal has more severe environmental costs, particularly those associated with development of Hough Creek. Alternative 3 has the most severe environmental effects, due to large developments in and near the riparian zones at Hough Creek and Bighorn River.

The table below ranks the alternatives from best (1) to worst (4) for each of the criteria. No weighting of the criteria is included.

	<u>Proposal</u>	<u>No Action</u>	<u>Alternative 2</u>	<u>Alternative 3</u>
Legislative intent	1	1	1	1
Management objectives	2	3	1	4
Facility sizing	2	3	1	4
Cost-effectiveness	3	1	2	4
Socioeconomic costs	2	4	2	1
Environmental costs	3	1	2	4

## APPENDIX C

### CULTURAL RESOURCE BASIC DATA

#### ARCHEOLOGICAL RESOURCES

##### Time Periods

The following is a brief description of the time periods represented in the Bighorn Canyon/Pryor Mountain area, the people who occupied this area, and their lifeways.

Early Prehistoric Period (10,000 B.C. to 4000 B.C.): This period corresponds roughly to what is elsewhere called the Paleo-Indian or early Hunter period. It is hypothesized that people lived in small bands and wandered freely and widely, in response to the movements of large game animals. It is speculated that these early North Americans depended equally as much upon plant resources for their survival as they did on animal products. Archeological evidence of their existence is limited to kill or butcher sites, temporary occupation sites used to gather or process plant foods, and/or occasionally rock-shelters or cave sites.

At the end of the Pleistocene, about 10,000 years ago, the glaciation of the northern portions of North America subsided, and for reasons that are not totally clear, many species of animals became extinct. For whatever reasons, about 8000 B.C. man gradually had to adapt to a new set of environmental variables. Throughout North America, man in the late Early Prehistoric and early Middle Prehistoric periods developed broad-based diversified subsistence strategies, exploiting a wide variety of modern biotic and abiotic resources.

Middle Prehistoric Period (4500 B.C. to A.D. 500): During this time period, the Middle or "Archaic" period, hunters were forced to adapt to new climatic and environmental conditions. More numerous and more specialized archeological sites and artifacts appeared for the first time. Archeological evidence from early in this period, in the form of grinding tools and different species of faunal remains, points to an increased reliance on gathering and processing of plant foods and smaller game. It appears that later in this period, as the climate once again became moist and more stable, the seasonal round adaptation pattern practiced by small bands of nomadic hunters and gatherers became the major subsistence strategy for people of the high plains. These people presumably moved within a defined territory, seasonally taking advantage of available plants, animals, and other key resources. The techniques of killing bison by means of a driveline, jump site, and a surround apparently were developed at this time. Tipi rings evidenced by circles of cobbles or small boulders also appeared at this time.

Late Prehistoric Period (A.D. 500 to A.D. 1650): During this period, the high plains enjoyed a favorable climate, which supported lush vegetation, on which the bison and other grazing animals such as antelope, mule deer, and Bighorn sheep flourished. The hunters and gatherers took advantage of the larger herds with increasing efficiency

throughout the Late Prehistoric period. Bison hunting reached the peak of its development with the addition of large organized communal drives. The bow and arrow and small side-notched projectile points were introduced at this time. The use of dog travois for transportation and the remainder of the more characteristic archeological traits and artifacts of the Northwest Plains came into being during this time, including conical timber lodges, pictograph and petroglyph sites, rock cairns, and well-developed ceramic traditions.

Proto-historic Period (A.D. 1650 to A.D. 1800): Until the middle or late 17th century, life remained essentially unchanged for the hunters and gatherers of the Northwest Plains. At or about 1650, the people of the Bighorn Canyon area exchanged or raided for European goods from the south and northeast. The horse was introduced from the Spanish settlements in the desert southwest to the Bighorn Canyon area about 1730; firearms, metal utensils, and other luxury goods arrived via French and English traders and their Native American middlemen from the north and east about the same time. While other European goods such as beads, iron projectile points, or other artifacts may have arrived at or before the horse and gun, none had the influence that these two items had. The combined innovation of the horse and gun produced dramatic changes in the Crow social and economic patterns, particularly in the areas of transportation, warfare, and migratory range.

#### Seasonal Transhumance Model

Based on historic documentation, ethnohistorical data, and models of seasonal settlement patterns applied in other regions of the northwest, Loendorf devised a model of a hunting and gathering existence for prehistoric and prehorse historic groups existing in the Bighorn Canyon/Pryor Mountain area.

According to Loendorf:

The winter months were spent in immovable dwellings (caves and wooden huts) in the sandstone canyons, well-protected from the elements. A ready fuel supply for winter warmth was available. Furthermore, it is probable that the winter habitation was a central base to which people returned annually. Archeologically, this central base is represented by Husted's continuously occupied caves along the Bighorn River (Mangus, Sorenson, and Bottleneck Caves). It is also believed that Mummy Cave to the west of the Pryors and Pictograph Cave to the north represent central base occupation. . . .

Spring sites (March through June) are represented by small impermanent sites in several environmental zones. With the arrival of spring weather, people must have left their well-protected winter sites and moved into other zones to hunt and collect edible plants. Bitterroot was collected along the limestone ridges, and sego lilies were collected in the sandstone and grassland zones.

It is significant that tipi rings, thought to represent a movable dwelling, are most often found in the limestone, sandstone, and grassland zones. Their location would indicate that the time of use of movable dwellings may coincide with the differential ripening times of various plants. By June and through August the mountain tops of the Pryors have lost their snow cover and present an ideal living place. During the summer months, prehistoric peoples took advantage of the quarrying materials and the good hunting on the tops of the mountains. The alpine sites . . . represent this summertime occupation. Men would have been hunting and chipping new tools, while women would have been collecting some edible berries and plants and perhaps making new tipi poles from the nearby pine trees (Loendorf 1973).

Elsewhere Loendorf adds the rest of the model for August through November when the prehistoric people spent their time in the grasslands region--gathering annually for the communal bison hunt, meat and hide processing and preservation, and engaging in many social and ceremonial activities. Besides the bison, wild and edible berries were ripening and collected at this time of the year. After the communal bison drive and associated activities, the various groups split up and returned to their central low elevation bases to hold up for the winter.

### Archeological Sites

Occupation Sites: This category represents the most abundant sites encountered in the Bighorn Canyon area. It refers to those sites at which there are culturally produced stone tools, flakes and/or cores scattered on the ground. Occupation sites have been found in all areas of the recreation area and in the Pryor Mountains.

Tipi Rings: This is the second most frequent feature or group of features found in the Bighorn Canyon area. Characteristically these features consist of 20 to 25 boulders and field stones, each weighing approximately 20 pounds, placed at intervals to form circles from about 6 to 30 feet in diameter. Presumably these stone circles are the former pitching locations for a conical-shaped habitation structures. The stones were used to hold down hide skins, which covered the pole lodge frame. These sites have been found most frequently in the grasslands and juniper breaks zone.

Cave Sites: Caves included in this category are rock-shelters (overhangs), grottos, and caverns. Generally, rock-shelters and overhangs are found in the lower foothills and limestone grottos or caves situated in the mountain canyons. Generally, cave and rock-shelter sites are associated with other archeological features, such as rock art, fortifications, and/or occupational debris.

Rock Art Sites: This category includes both painted designs on rock surfaces called pictographs and incised, pecked, or abraded designs

worked into rock surfaces called petroglyphs. Zoomorphic, anthropomorphic, geometric, and composite figures and symbols are depicted. Generally, pictographs are drawn or painted onto harder limestone surfaces, and petroglyphs are carved into softer sandstone surfaces.

Quarry Sites: Sites in the Bighorn Canyon/Pryor Mountain area that have been classified as quarry sites are locations of naturally occurring outcrops of cryptocrystalline silicates (cherts), which are suitable for tool/weapon manufacture. Generally, these locations are in mountainous areas.

Wooden Structures: These are unique sites on the Northwest Plains. They are usually characterized by a horizontal cribbed log construction, having four or five sides, and are found in coniferous forest zones in what seem to be concealed locations. Some have a central hearth and a few lithic artifacts while others do not. Some archeologists have guessed them to be hunting lodges, war lodges, or temporary encampments. Three examples of these sites are found on NPS lands.

Vision Quest Sites: These are rock structures that have been built specifically for the vision quest ritual. They are low-walled oval enclosures or "U" shaped enclosures with their opening generally to the rising sun. They are always found on high commanding view ridges or mountaintops. Occasionally, wood is incorporated into the structure as wall or wind-breaking material. Few vision quest sites have been identified within the boundaries of the recreation area; the majority are situated within the mountains to the east and west.

Rock Alignments: This category can include rock cairns, rock piles, miscellaneous rock structures, rock enclosures, and miscellaneous alignments of stone. These piles of boulders or field stones have been hypothesized to be as follows: (1) boundary markers left by sheepherders to demarcate pasture boundaries, (2) trail landmarks for both prehistoric and historic travelers, (3) offering piles, and (4) functionless piles of stone built by sedentary sheepherders to while away spare time. The Bad Pass Trail (24CB853) cairns within the recreation area are superior examples of this phenomenon.

Fortification Sites: These are either cave/rock-shelters or tipi ring sites that have been positioned and/or augmented with breastworks in such a way that they appear to be retreats or fortresses ready for battle. Usually they are on high ridges or erosional remnants.

Often low rock walls or deadfall logs are incorporated into a breastwork fortification and surround or enclose a site to make it appear defensible. Loendorf suggests that they may be fortified locations built by trespassing Indians, who were hunting bison or scouting in Crow territory, and were constructed as possible retreats in case of discovery (Loendorf 1969). At the present time, both examples of fortified sites are situated on Crow lands within the recreation acre.

Buffalo Jump Sites: This term collectively refers to all those archeological features that appear to be related to bison procurement,

including bison drives, bison falls, and buffalo pounds. The majority of these sites are found in the moist northern grasslands of the recreation area in areas owned by the Crow tribe.

A typical Northwest Plains buffalo jump has the following five basic characteristics:

- A buffalo jump contains a grazing area where the animals are gathered.
- Two or more rock alignments of small field stones are often arranged in a "V" pattern converging at the cliff edge or cutbank.
- A cliff edge or cutbank from which the fall or jump is initiated can be anywhere from 15-250 feet high.
- A bone deposit at the base of a cliff or arroyo may contain lithic artifacts left behind by prehistoric or historic hunters.
- An associated encampment or occupation site established to process the bison meat, hide, and bone may reveal artifacts, lithic debris, fire hearths, and boiling pits.

Burials: At the present time, this term refers to Native American burials. Only a few examples of single burials have been found within or near Bighorn Canyon National Recreation Area. However, two groups of burials or cemeteries of unidentified cultural affiliation have been identified in the Fort Smith area. They have been suggested to be Cheyenne, Sioux, or Crow burials. These cemeteries are not conventional cemeteries by Anglo standards, but rather are hogback formations that have been used to bury the dead.

Medicine Wheel: At the present time only one such feature is known to be within the recreation area; it is called the Fort Smith medicine wheel. Archeological phenomena called medicine wheels occur sparsely throughout the Northwest Plains. They characteristically consist of central piles of stones or a rock cairn from which rows of stone extend outward as in the spokes of a wheel. Efforts to interpret the function or meaning of these sites has been limited. According to Crow tradition, the Fort Smith medicine wheel was built about A.D. 1850 by a Crow named Scarface or Burnt Face; his reasons for doing so are not entirely clear (USDI, NPS 1970).

It is important to note that although each of these site types is represented somewhere within the legislated boundaries of Bighorn Canyon National Recreation Area, there is a differential distribution of sites between NPS-owned lands to the south and Crow tribal lands to the north. Often times better examples of certain sites (in particular, vision quest sites, rock art sites, cave/rock-shelters, and wooden structures) exist on adjacent federally owned or allotted lands than can be found within the boundaries of the recreation area. Consequently it is important to identify, evaluate, and understand all the sites and the behaviors they represent from a regional perspective.

Table 19  
 CHRONOLOGICAL SUMMARY OF ARCHEOLOGICAL INVESTIGATIONS

DATE OF WORK	INVESTIGATOR	RESEARCH/AREA
August & September 1941	Nels C. Nelson (American Museum of Natural History)	Testing and excavation in Sage Creek Canyon, Pryor Creek Canyon, and Pryor Valley
August 23-26, 1946	Wesley L. Bliss and Jack T. Hughes (Smithsonian Institution)	Reconnaissance survey of upper (southern) end of the proposed reservoir and from U.S. 14A to Dryhead Ranch
July 30 - August 19, 1950	Robert L. Shalkop & Franklin Fenega (Smithsonian Institution)	Reconnaissance survey of upper (southern) end of reservoir
July 15-28, 1951	Franklin Fenega & J. Mett Shippee (Smithsonian Institution)	Reconnaissance survey of upper (southern) end of reservoir
1962, 1963, & 1964 field seasons	Wilfred Husted (Smithsonian Institution)	Reconnaissance survey, testing and excavation in upper (southern) end of reservoir
June 18 - September 7, 1962	Lionel A. Brown (Smithsonian Institution)	Reconnaissance survey, testing and excavation in lower (northern) end of reservoir from dam site to Dryhead Creek
1964 - 1967	Stuart Conner and members of Billings Archeological Society	Reconnaissance of general Bighorn Canyon/ Pryor Mountain area
1968 field season	Lawrence L. Loendorf (University of Montana)	Extensive and intensive survey of southwestern corner of Pryor Mountains (Big Pryor Mountain)
1969 field season	Lawrence L. Loendorf (University of Missouri)	Extensive and intensive survey of south side of Pryors to west rim of Bighorn Canyon from Crooked Creek drainage to the boundary of Big Horn County, Montana
1970 field season	Lawrence L. Loendorf (University of Missouri)	Extensive and intensive survey of Sage Canyon area on north slope and western slope of Pryor Mountains

DATE OF WORK	INVESTIGATOR	RESEARCH/AREA
1971 field season	Lawrence L. Loendorf (University of Missouri)	Extensive and intensive surveys of phase I, transpark road, from Horseshoe Bend to Devil Canyon
	Loendorf	NPS, Crow, and USFS lands
	Loendorf	Ok-A-Beh developed area
	Loendorf and Kent N. Good (University of Montana)	Tested and excavated 8 previously identified sites
1972 field season	Loendorf and Good (University of North Dakota)	Extensive and intensive surveys of Crow lands survey, Scott Creek drainage north and east of the Pryors
	Loendorf and Good	Grapevine drainage, phase III & IV of transpark road
1973 field season	Loendorf	Testing and excavation of Bad Pass Trail cairns and Pretty Creek site
1974 field season	Alan Carmichael and Loendorf (University of North Dakota)	Testing and excavation of selected sites within phase V of transpark road
	Loendorf and Good	Excavation of portions of Pretty Creek site
	Good and James Dahlberg (University of North Dakota)	Intensive survey of Hough Creek developed area
1975 field season	Alan Carmichael and Gary Scott (University of North Dakota)	Excavation of a burial, Fort Smith area
1976 field season	Alan Carmichael	Monitoring and testing of sites along phase II of transpark road
1977 field season	Robert K. Nickel (Midwest Archeological Center, NPS)	Survey of American Colloid Co. bentonite mining area
1978 field season	Thomas Thiessen (Midwest Archeological Center, NPS)	Survey within Yellowtail Dam Afterbay area
1979 field season	Robson Bonnischsen (University of Maine) and David Young (University of Alberta)	Survey and test excavation of 3 cave/rock-shelters in Crooked Creek drainage

## CROW RESOURCES

The following is a brief description of the Crow way of life and history. It is not intended to be specific, rather a general overview for planning and management purposes.

In addition to its use for bison hunting and war, the horse in Crow culture was basic to the "philanthropic system of the tribe" (Medicine Crow 1939). The horse as a highly valued possession became a medium of exchange for the brideprice, for personal gifts, and for paying debts, such as to a shaman for his healing services. Crow philanthropy was expressed in the "give-away complex" in which nothing was too valuable to give away; the most prized possessions were the things given, especially horses (Medicine Crow 1939). Wealth was not measured by excessive accumulation but by the "quality of individual virtue involved" in the acquisition and redistribution of goods and horses (Medicine Crow 1939).

In Crow traditional prereservation culture, there were clearly defined duties of men and women in the division of labor. Men's duties included trapping, making tools and weapons, hunting, fighting, and educating boys. The overall duties of women included tipi-making, cooking, making clothes, keeping the tipi in good repair, decorating clothes, preparation of food for storage, looking after children, and educating girls. Children, however, were pretty much a group responsibility and not so much an individual one (Medicine Crow 1939).

Crow boys grew up to be hunters, and, above all, warriors. Once a warrior, a man aspired to be a chief. In seeking this honor, certain feats (counting coup) were required: capturing a prized horse tied in an enemy camp, encountering an enemy warrior in hand-to-hand combat and taking his weapon, being the "first to touch the body of the first enemy felled," and leading a successful war party (Medicine Crow 1939). Having passed the four tests of chieftainship, a Crow warrior became a member of the Council of Chiefs, the function of which was to direct the movements of the tribe and to advise on hunting and war parties. The Council of Chiefs also selected one of the men's military societies for police duties during the communal bison hunt.

Membership in the military societies was voluntary, by personal request or by invitation of the society, with nine such societies described by Lowie (1935). Both men and women could belong to the Tobacco Society, which had a more elaborate, formal initiation procedure. This group was entrusted with the ritual and physical care of the sacred tobacco plant for the welfare of the entire tribe (Lowie 1935).

The Crow are a matrilineal society and trace their descent through the mother's line. Among the Crow, every individual is a member of a given matrilineage, 13 of which existed in the first third of this century (Lowie 1935) and 10 of which survive today (USDI, NPS 1979f).

Visions were basic to the Crow traditional way of life. By fasting and undergoing exposure to the elements, an individual sought supernatural contact for guidance and good fortune in future endeavors (McGinnis and Sharrock 1972).

[For example, among the Crow] a lad grew up constantly hearing that all success in life was derived from visions; hence, being eager for horses and for social recognition, an adolescent would go out to fast, praying for rich booty, for a chance to strike a coup, or for some other benefit. A mature man or woman would seek a vision . . . [for] a special cause. . . . (Lowie 1954).

Human beings and other mammals, as well as birds, reptiles, and insects, may be representatives of the source of power given by the First Maker or Great Creator to a Crow individual through a vision (Lowie 1935, 1954).

Crow and other Indian tribes utilized the Bighorn Canyon area until the first European contact. This contact occurred with the arrival of fur traders, miners, cattle ranchers, farmers, and the U.S. Army. Through their contact with fur traders, Crow and other tribes gradually became accustomed to Euro-American goods (Billington 1974).

Increasing numbers of non-Indians entered the Northwest Plains due to westward expansion in the 1800s. The Bozeman Trail, which branched northward from the Fort Laramie region in Wyoming and crossed the Powder River avoiding the Bighorn Mountains, provided access to gold-mining fields in Montana. The Teton Dakota and the Northern Cheyenne response to the Bozeman Trail was "all-out hostility" (Greene 1972), and Fort C.F. Smith, constructed in 1866 to help protect the trail, became a prime target. The Crow were not hostile but cooperated with the U.S. Army against their Dakota and Cheyenne neighbors, who were encroaching on Crow lands.

The demise of the plains horse complex and the accompanying way of life was marked in general by the extinction of the great bison herds around 1884 (Russell 1893), competition for grazing lands from cattle ranchers (McGinnis and Sharrock 1972), and the end of intertribal warfare, as well as the establishment of Indian reservations (Ewers 1955).

From 1868 to 1883, the Crow were being gradually surrounded by cattlemen using the open range and farmers segmenting the land. The few initial homesteading farmers with small numbers of cattle grew to the point that by 1894 there were "fences lining the creeks" (USDI, NPS 1970).

The first Crow Reservation was established by treaty with the U.S.

Reservation were granted to a "few neighboring cattlemen" in 1884 (USDI, NPS 1970), starting the trend of non-Indian use of Indian land that continues to present time in the form of grazing and mineral leases.

The Crow adapted to the U.S. Government's encouragement of farming, and "by 1886, there were 509 separate farms on the reservation, all

occupied by Crow families" (McGinnis and Sharrock 1972). In 1920 the Crow Allotment Act was passed, dividing up much of the reservation into individually allotted lands (Medicine Crow and Press 1966, McGinnis and Sharrock 1972). In 1926, the act was amended to permit the issuance of patents in fee simple to Indians labeled "competent" by the Bureau of Indian Affairs. This gave certain individuals complete control of their acreage, enabling them to lease or sell it outright, and resulting in the loss of much land for the Crows.

Other actions of the U.S. Government also resulted in land loss for the Crow. After the first Treaty of Friendship in 1825, there were a series of other treaties, agreements, and acts of Congress (1851, 1868, 1891, 1904, and 1937), which reduced the amount of land reserved for the Crow tribe from 38,531,174 acres in 1851 to 1,554,253 acres today (U.S. Department of Commerce 1974).

In the reservation period, a significant event occurred that had a lasting impact on Crow values. Due to a lack of available land for rancher-leased grazing on the Crow Reservation (in the 1920s), the U.S. Government forced the Crow to sell their relatively vast herd of horses, generally at prices below market value (McGinnis and Sharrock 1972). This impacted the Crow adversely because of the importance of the horse to their culture.

By the time [the Crows] settled down in the [present] reservation in 1884, they had hundreds of horses. Along with farming, their primary interest was still in their horses, which increased rapidly, and by 1920 the hills were full of horses, numbering approximately 30,000 (Medicine Crow 1939).

In 1939, the Crow began to acquire horses again to use for breeding and in farming (Medicine Crow 1939), and at the present time, the Crow have large herds of horses (McGinnis and Sharrock 1972).

The Crow remain a matrilineal people and have retained many other aspects of their traditional culture "so that the Crow way is not lost" (McGinnis and Sharrock 1972). One aspect of the Crow religion that survives is the vision quest ritual (McGinnis and Sharrock 1972), symbolized and represented by the Pretty Eagle and Eye of the Eagle sites on Crow lands. The sharing attitude is still operative, and material things are given freely, with each individual assuming responsibility for his relatives' welfare (McGinnis and Sharrock 1972).

The present Crow tribal government stems from a 1949 written constitution, which established a general council known as the Crow Tribal Council. This council consists of "all male members of the tribe 21 and over, and all female members of the tribe 18 and over" (U.S. Department of Commerce 1974). One hundred members present at a meeting constitutes a quorum, and officers (chairman, vice-chairman, secretary, and vice-secretary) of an executive committee are elected biennially by popular vote of the general council (McGinnis and Sharrock 1972).

Today the Crow operate their own elementary and secondary schools, participate in stock raising and farming, maintain some tribally run businesses, and work to some extent off of the reservation. Negotiations are in progress with the National Park Service to revise the 1967 Memorandum of Agreement, which included Crow lands within Bighorn Canyon National Recreation Area for recreational development. Crow reservation lands within the recreation area are not included in this plan and will not be subject to NPS planning without permission of the Crow Tribal Council and the secretary of the interior.

## HISTORIC RESOURCES

Detailed historic accounts begin for the immediate area in the writings of the fur-trading era pioneer, Francois Antoine LaRocque, who visited the canyon mouth in 1805. Fur traders such as LaRocque, John Colter, Wilson Hunt, Edward Rose, and Manuel Lisa were active in the Bighorn region. Some of these fur-traders became mountain men, such as Jim Bridger, who by 1833 had acquired a thorough knowledge of most of the Bighorn region. Around 1825, Bridger attempted to navigate the Bighorn Canyon on a small raft: "He succeeded, performing a feat unequalled in western travels except by Ashley's descent of the Green River and John Wesley Powell's voyage much later down the Green and Colorado" (USDI, NPS 1970). The Lewis and Clark expedition bypassed this region by a wide margin.

Successive generations of trappers, explorers, and traders seldom found the interior of the present recreation area to be attractive, and most of their activity was concentrated on the Yellowstone itself, further down the Bighorn and off in the Clark's Fork country. Most trading parties entered and departed from the Bighorn Basin by way of the Clark's Fork route, with some using the Bighorn/Beauvais/East Pryor/Pryor Gap route. A few did brave the difficult "Bad Pass" route. For either group, the area at the mouth of the canyon and downstream for several miles proved much more attractive.

In 1858, prospectors began to leave California and look northward and westward for gold. In the 1860s, the need to supply some of these gold-mining communities stimulated the blazing of the Bozeman Trail.

It became for a few years the principal migration route into Montana, although it did pass through country belonging to hostile Sioux tribes. The Bozeman Trail prompted the presence of the U.S. Army for protection at Forts Reno, Phil Kearny, and C.F. Smith. The Sioux and Cheyenne response was hostile, and the forts became targets, along with the various military details that had to leave a fort from time to time. The Hayfield fight in 1867 was an example of an Indian attack on a military detail venturing from Fort Smith on a hay-cutting mission. The small detachment of soldiers and armed civilians were victorious as a result of their superior arms and discipline. The site of the Hayfield fight is not exactly known. Fort C.F. Smith was built in 1866 and abandoned in 1868 because of supply problems and limited manpower.

Range cattle first arrived in the Bighorn Basin in 1879. The M-L Ranch at the southeastern boundary of the recreation area was established in 1884. From this point on, the marginal grazing at the southern end of the recreation area was exploited as far as possible by the various range cattle outfits in this corner of the basin.

Bighorn range cattle ranchers were in competition with other settlers, such as farmers with small herds of cattle and sheepmen. One example of the smaller scale ranch holdings in the vicinity of Bighorn Canyon was the Sorenson (Ewing-Snell) Ranch located in the interior of the present recreation area. Erastus Ewing came to the Bighorn area in 1896 prospecting for gold and remained in the area as a farmer and rancher. Because the interior of the present recreation area was effectively cut off from practical routes to the markets until the arrival of truck transportation, through most of this period the Sorenson Ranch was the only operation of economic consequence in the area.

The Bighorn Canal Headgate was constructed from 1893 to 1904, in order to irrigate the relatively arid region for farming and grazing purposes. The work was all done by the Crow with the exception of a project engineer and three foreign masons. Remains of the headgate are found west of the present town of Ft. Smith.

Dr. G. William Barry acquired land within the area sometime before 1907. He came originally in search of gold but remained in the area promoting a variety of other ventures, including the raising of English hackney horses, boat building, farming, and dude ranching. Barry is recognized as the one who first exploited the recreational potential of the area at his ranch, Hillsboro.

## APPENDIX D

### CARRYING CAPACITY ANALYSIS

The concept of visitor capacity is simply limiting the use of any natural resource according to the ability of that resource to support a given level of use without degradation of the resource or the visitor experience.

Application of the practice is currently limited in the outdoor recreation management field but is gaining interest among park and recreation professionals and managers. Part of the problem associated with establishing visitor capacities for outdoor recreation areas, in addition to measuring and predicting visitor impact on physical and biological resources, is estimating the effect on visitor experience. Inasmuch as the quality of the various visitor experiences offered in the park is a product of the methods used by park personnel to perpetuate the natural and human environment in which those experiences take place, this phase of recreation capacity management is extremely important.

Under ideal conditions, the determination of an optimum carrying capacity should be conducted at a site- or park-specific level to identify the sensitivities of both the visitor and the resource to use in a particular time and space. However, the ideal conditions were limited in the determination of a Bighorn Canyon recreation carrying capacity by both time and funding. Therefore, an approach to the problem had to be found which was both rational and expedient.

In 1977, the Bureau of Outdoor Recreation published Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity (based on available carrying capacity literature as well as original research and field survey interviews). These guidelines presented an approach that was applied to Bighorn Canyon National Recreation Area. The document presents 55 recreation activities for which optimum capacity ranges are given, based on the experience and perception of resource managers, recreation participants, and physical resource conditions relating to the activity.

The task for this effort was to first identify the pertinent sites and activities for which capacities would be developed. For each activity, BOR's suggested resource and visitation criteria for the activity were used to systematically analyze the characteristics of each site. The activity criteria included such factors as the size of the site, the vulnerability of the site, the heterogeneity or homogeneity of users, the degree of site privacy, proximity to conveniences, etc. Each criterion affected the site's carrying capacity such that the Bighorn Canyon carrying capacity for a particular activity and site varied from the BOR average but fell within the optimum range.

Presented in table 20 are the one-time optimum carrying capacities for recreation activities at the sites in Bighorn Canyon.

Of critical importance to both visitors and management of the recreation area is the carrying capacity of boating use on Bighorn Lake. The

Table 20  
ONE-TIME CARRYING CAPACITIES

<u>Site</u>	<u>Activity</u>	<u>Resource Capacity Factor</u>	<u>Total Site Capacity</u>
Kane Causeway	picnicking	11.9 tables/acre	N/A
	bank fishing	131.9 people/mile	65 people
Horseshoe Bend	picnicking	9.6 tables/acre	5 sites
	swimming	504 sq ft/party	138 parties
	camping	7 sites/acre	N/A
Crooked Creek	picnicking	9.6 tables/acre	22 sites
	bank fishing	116.8 people/mile	140 people
Hough Creek	picnicking	11.9 tables/acre	31 sites
	camping	5.3 sites/acre	158 sites
	hiking	3.2 groups/mile	8 groups
North Fork Trail Creek	picnicking	3.4 tables/acre	11 sites
North Fork Trail Creek Point	picnicking	13 tables/acre	8 sites
Hillsboro	hiking	3.5 groups/mile	6 groups
Barry's Landing	bank fishing	147 people/mile	15 people
Chain Canyon Cove	bank fishing	242.5 people/mile	136 people
	hiking	2.7 groups/mile	27 groups
	horseback riding	4.8 groups/mile	48 groups
Afterbay	picnicking	9.5 tables/acre	57 sites
	camping	10.4 sites/acre	132 sites
	bank fishing	365 people/mile	1,237 people
	boat fishing	4.3 boats/acre	579 boats

optimum capacity of the lake was identified as one boat per 14 acres (see table 21), or a total of 472 boats at one time over 6,000 acres of surface water available during the peak use periods. If all boats launched on the lake distributed themselves evenly over the lake surface, a launch and marina capacity of this magnitude (472 boats per day) would provide for a high quality experience. Generally, though, a greater number of boats tend to cluster near launch sites, and use decreases the further away one travels. To present a realistic picture of lake use against which the carrying capacity could be compared, the distribution of boats from the three launch sites had to be estimated.

Bighorn Lake was divided into nine segments that contain principal destination sites or effective barriers to travel (visitors with Wyoming fishing licenses would not travel into Montana to fish). The percentage of boats that would end their journey in each segment was then estimated (based on launch site, travel distance, boat speed, and segment attractiveness), and also the percentage of boats that would travel through each segment destined for more distant segments. These percentages were then totalled and applied to the projected number of total daily boat launches to estimate how many boats would be present in each segment sometime during the day.

If, as projected, the peak weekend launch rate is 292 boats per day by the year 2000 (see visitation analysis, appendix B), this use would distribute itself as shown in table 21. The surface area and optimum carrying capacity of each segment are also presented in table 21.

Based on this analysis, at the projected launch rate and the expected distribution, there are areas of the lake where use exceeds the optimum carrying capacity. The level of facility development proposed in the General Management Plan that supports boating use of this magnitude is analyzed further as it relates to the lake's carrying capacities in the cost-effectiveness analysis (see appendix B). It should be emphasized that these estimates of use distribution and carrying capacity are based on the best available data. As the phasing of proposed development occurs, it should be based on an in-depth Bighorn Canyon-specific visitor use carrying capacity study. Estimates of use distribution are being refined by the visitor use monitoring program being implemented in the recreation area. Carrying capacity data needs to be improved by a study programmed prior to development.

Table 21  
CARRYING CAPACITY AND EXPECTED USE  
BIGHORN LAKE<sup>1</sup>

<u>Segments</u>	<u>% of Total Daily Launches</u>	<u>Boats Present in Segment</u> <sup>2</sup>	<u>Surface Acres in Segment</u>	<u>Capacity of Segment</u>
Horseshoe Bend to state line	43%	126	943	67
State line to Devil Canyon	36%	105	206	14
Devil Canyon to midway <sup>3</sup>	19%	56	244	17
Midway to Barry's Landing	11%	32	329	23
Barry's Landing to Medicine Creek	23%	67	283	20
Medicine Creek to Deadman Creek	12%	35	372	27
Deadman Creek to Bull Elk basin	16%	47	1,621	116
Bull Elk basin to Black Canyon	34%	99	1,508	108
Black Canyon to Yellowtail Dam	14%	129	1,120	80

1 Based on identified carrying capacity of 14 acres/boat

2 Based on peak weekend daily launches of 292 boats

3 Midway between Horseshoe Bend and Barry's Landing

For interpretive facilities and programs, carrying capacities were developed based on absolute physical capacity (auditorium seating, for example) or extrapolated from parking capacity using 3.5 people per vehicle as a multiplier. Capacities for guided walks were based on the maximum number that could be accommodated without a decrease in quality or safety.

Presented in table 22 are the interpretive capacities and also the present and projected use levels for facilities and programs. By the year 2000, capacities are not expected to be exceeded for any of the proposed facilities.

Table 22  
CARRYING CAPACITY ANALYSIS  
INTERPRETATION

<u>Facility or Activity</u>	<u>One-Time Carrying Capacity (People)</u>	<u>Present Use (Average)</u>	<u>Projected Use (2000)</u>
Kane/Lovell Area			
Bighorn visitor center	80/hr	20/hr	41/hr
M-L Ranch (self-guided)	140	N/A	40
Horseshoe Bend Area			
Amphitheater	236	60 - 80	90 - 150
Auto caravan	25	3 - 5	6 - 10
Fossil walk	30	5 - 12	16
Hough Creek Area			
Amphitheater	75	N/A	75
Barry's Landing Area			
Hillsboro (guided walk)	25	3 - 5	6 - 10
Afterbay Area			
Yellowtail Dam visitor center	80/hr	46/hr	66/hr
Amphitheater	150	0 - 85	140
Environmental education walk	40	2 - 4	5
Interpretive pullout	1,300	N/A	300
Information station	1,300	N/A	300

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\* Number of visitors/day or trip unless otherwise indicated

## APPENDIX E

### PUBLIC MEETINGS: SUMMARY OF TESTIMONY AND RESPONSES

Public meetings on the draft general management plan and public hearings on the wilderness proposal were held in four locations on June 17-20, 1980. Meetings were on June 17 in St. Dennis Parish Hall, Crow Agency, MT; June 18 in Hardin High School Cafeteria, Hardin, MT; June 19 in Bighorn Canyon Visitor Center at Lovell, Lovell, WY; and June 20 in Room 121, Liberal Arts Building, Eastern Montana State College, Billings, MT. Presentations were given by National Park Service personnel explaining the general management plan and the wilderness proposal. The following is a summary of comments and responses from these meetings.

DRAFT GENERAL MANAGEMENT PLAN  
AND  
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Cultural Resources

Comment:

What archeological sites will be affected by this plan? Will there be any Bad Pass Trail cairns disturbed by the proposals?

Response:

There will be eight archeological sites affected by the proposals. Most of these have been ranked as of trivial scientific value by a qualified professional archeologist. Every effort has been made to avoid sites ranked as critical scientific value, and any site proposed for development will be thoroughly surveyed and excavated prior to construction activities. A qualified professional archeologist will be on hand during construction, and work will be halted if cultural resources are found. This plan will not disturb any of the Bad Pass Trail cairns.

Development Proposals

Comment:

Are there any proposals to develop on Crow Reservation land?

Response:

No. Crow Reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to National Park Service planning without permission of the Crow Tribal Council and the secretary of the interior.

Comment:

How successful do you think the planting of shade trees will be at Horseshoe Bend?

Response:

This has been done successfully in other arid areas, such as Glen Canyon National Recreation Area. The trees will be planted and a drip irrigation system will be installed in the campground at Horseshoe Bend.

Comment:

Why are there ranger residences proposed for Horseshoe Bend?

Response:

The facilities proposed for Horseshoe Bend will be built by the National Park Service and leased to concessioners. Because of the size of the federal investment in the marina facility, it was felt that a resident protection force should be provided. It is a considerable distance from this development to the nearest existing protection facility.

Comment:

Why isn't there a more direct route provided from the Horseshoe Bend campground over to Crooked Creek?

Response:

There will be a trail from the Horseshoe Bend campground to Crooked Creek, but no road will be constructed. Due to the high cost of road construction, the general management plan has included a minimum of paved roads, usually where dirt or gravel roads already exist. Another reason for not building a road from Horseshoe Bend to Crooked Creek would be that the two uses of the area are incompatible. Crooked Creek is designed as a day use area, and the Horseshoe Bend campground is for overnight use. Providing two entrances to the campground would reduce management control and contribute to a law enforcement and fee collection problem.

Comment:

Why don't you build a road from Crooked Creek to the lake for ice fishermen?

Response:

Because of off-road vehicle regulations, this proposal would involve construction of a road. As previously mentioned, this general management plan attempted to keep new road construction to a minimum. There are trails provided for bank fishing at Chain Canyon Cove near Barry's Landing. Access to the lake for ice fishermen is presently available at Horseshoe Bend, Yellowtail Wildlife Habitat Area, and along the eastern shoreline off of the old John Blue Road. Also, as ice fishermen represent only a fraction of total visitation to the recreation area, the funds required to construct such a road have been used elsewhere to benefit a larger number of visitors.

Comment:

If money were to be used to construct a dam at the narrows above Horseshoe Bend, a constant-level lake would be created that would offer a wide range of possibilities for recreation.

Response:

The National Park Service's mandate at Bighorn Canyon National Recreation Area was to provide for recreational opportunities created by the construction of the Yellowtail Dam. This proposal for a checkdam at the narrows was presented to the Water and Power Resources Service after the public workshops in 1977. Their response was negative because of the cost estimates.

Comment:

The proposal to abandon facilities in the Wyoming portion of the lake and the absence of any plans to develop the Wyoming portion is to me a betrayal of the interests of local people.

Response:

Developments were planned on a suitability analysis which included such factors as existing road access and utilities, topographic considerations, and protection of historical, archeological, and wilderness values, regardless of geographical location. Proposals for the Wyoming portion of Bighorn Canyon National Recreation Area include construction or expansion of developments at Horseshoe Bend, Crooked Creek, and Kane Causeway. The abandoned Kane Bridge development site will be

removed, but it is anticipated that the Kane Causeway development will be used as a replacement.

Comment:

Will there be any vegetation planted at the Afterbay?

Response:

Yes. Development plans for the campground include planting of trees and shrubs. The Water and Power Resources Service has recently planted 2,100 trees in the Afterbay area.

Comment:

Is there going to be a swimming area in the Afterbay?

Response:

A swimming facility is proposed near the campground at the Afterbay. Swimming in the Afterbay itself was ruled out because of the cold temperatures and the problems in meeting public health standards.

Comment:

The best fishing areas are in Montana, and Montana has consistently refused to cooperate in developing tourist facilities that are accessible only from Wyoming.

Response:

The Bad Pass Road at this time extends as far north as Barry's Landing, a development which is in Montana and is accessible only through Wyoming.

Comment:

Will there be any overnight facilities at the docking areas?

Response:

Marina developments will be managed by the concessioners. Rental slips will be available at Horseshoe Bend, and rental slips are planned for the Ok-A-Beh marina. The slips at Barry's Landing are designed mainly for overnight tie-ups, not long term use.

Comment:

What proposals are there for backcountry use?

Response:

There are a number of trails proposed within the recreation area. One would run from Medicine Creek to the Dryhead area, and another would run from Hough Creek to the Pryor Mountains through the proposed wilderness area. There are no provisions for backcountry campgrounds, and the only proposal which would approach this type of experience would be the 10-site walk-in campground at Hough Creek.

## Development Schedule

### Comment:

What is the timetable for proposed development?

### Response:

There is a considerable amount of site planning which must be performed before any of these developments are constructed. After these site plans are approved, comprehensive design and construction drawings are prepared. Once these are completed, construction can occur. However, all areas within the National Park Service compete for a share of construction funding, and the project needs to be ranked for priority before the area can be developed. Because of the economic situation at the present time, development funding for new construction is severely limited. The earliest that any of these projects could be constructed would be fiscal year 1982. This general management plan is a 20-year plan, and the proposals have been divided into ten year segments. Proposed for construction within the first ten years would be developments at Horseshoe Bend, Crooked Creek, Afterbay, Yellowtail Dam, Ok-A-Beh, and Frozen Leg. Developments proposed for 1990-2000 include Hough Creek, Chain Canyon Cove, Barry's Landing, Medicine Creek Cove, M-L Ranch, and Kane Causeway.

### Comment:

There are very few opportunities at the present time for non-waterbased recreation. Since you are providing for this with the Hough Creek development, why is it so far down the road?

### Response:

In addition to being a day use development, Hough Creek will serve as an expansion area for the Horseshoe Bend campground. Development of the Hough Creek campground will be delayed until Horseshoe Bend is at capacity, which is projected to be between 1990-2000.

## Land Acquisition

### Comment:

Does the National Park Service intend to purchase any land near Frozen Leg?

### Response:

Prior to the Secretary's moratorium ordered in 1977 on development on Crow-added lands, the National Park Service did have purchase authority. Some lands were purchased before the moratorium, and one tract of undeveloped land owned by the Yellowtail Development Corporation is now in court under friendly condemnation procedures. There are no plans to purchase any other private land in the Crow-added portion of the recreation area. A land acquisition plan for Bighorn Canyon National Recreation Area was approved on April 18, 1980 and contains further details.

Comment:

They are purchasing land in Glacier National Park. Why are things different in Bighorn Canyon National Recreation Area?

Response:

Private lands being purchased at Glacier National Park were originally included in the Congressionally established boundaries. Because of the Secretary of Interior's moratorium on development on lands added to Bighorn Canyon's Congressionally established boundaries by the Crow Tribe, the National Park Service would purchase no land unless the memorandum of agreement is renegotiated. This does not apply to private lands in Carbon County, Montana and Big Horn County, Wyoming--lands which fall within the Congressionally established boundary. The approved land acquisition plan contains further details.

Visitor Use and Interpretation

Comment:

How much of the visitor use and interpretation program is in effect now?

Response:

The visitor centers are in operation; campground talks are offered; and guided walks and boat tours are available. The wayside exhibit plan is in preparation at the present time.

Comment:

Will there be any cave tours given?

Response:

Because most of the caves in Bighorn Canyon National Recreation Area are either on Crow-added or private land, there will be no scheduled cave tours given. When the memorandum of agreement is renegotiated and approved, consideration will be given to resuming cave tours. Boundary adjustments in the vicinity of Bighorn Caverns are being considered by the Crow Tribe.

Presentation of Marion E. Tippetts at National Parks hearing,  
Lovell, Wyoming, June 19, 1980.

I would like to begin by reviewing some of the history of this area before the dam was built. The territory was settled by hard-working pioneer folk, who took an arid, forbidding land that was shunned by the Indians, who even today refer to it as the "Stinking Water", and by hard work cleared it of brush and other useless vegetation; constructed canals, and turned this area into a productive agricultural center.

All this was accomplished with only hand-powered tools and horse-drawn implements, and with very little if any aid from the U.S. government. Lovell was at one time the largest town in the basin.

Since the construction of the dam, the volume of business in Lovell has decreased to the point that it is now virtually at a standstill.

The loss of agricultural income to the area is now estimated to be in the area of three million dollars per year. Tourism has not replaced this loss, largely because not enough effort has been expended to develop facilities to attract it.

For several years the canyon was blocked by driftwood; construction of access road and viewing areas for the wild horse area has been blocked; the best fishing areas are in Montana, which state has consistently refused to cooperate in developing tourist facilities that are accessible only from Wyoming.

In fact, interest seems to be concentrated only in establishing more wilderness areas, which would withdraw more and more land from public and private use.

The National Park Service has not cooperated with private enterprise in establishing necessary facilities. The Crow Indians have not cooperated, in spite of the fact that large sums of federal money have been used to develop facilities for them.

The proposal to abandon facilities in the Wyoming portion of the lake, and the absence of any plans to develop the Wyoming portion is to me a betrayal of the interests of local people; it is a repudiation of the promises that were made to us by those pushing the construction of the dam: that tourism would replace the loss.

Our land has been taken by federal agencies, and is now a barren, wasted mud-flat--an eyesore that brings tears to the eyes of those who once lived there, whenever they see it.

I see now that the proposal is to buy more private land to add to the recreation area. This can only result in more loss of income for the town of Lovell, and the adjacent area. Private interests are already providing as much recreation area as the park service would--by maintaining buffalo herds, etc. I fail to see how withdrawal of more grazing land from the B.L.M., and the purchase of more private land will add to recreation possibilities.

On the other hand, if this money were to be used to construct a dam at the narrows above Horseshoe Bend, a constant-level lake would be created that would offer a wide range of possibilities for recreation.

It would provide more control of the debris that comes down the river in time of flood, fish propagation would be improved, boating and sailing would increase, a beautiful two-mile beach would be available for swimming, and the cost would not be more than the afterbay at the dam cost.

It seems to me that we should be striving to create USE for wasted areas, rather than creating more WASTE from USEFUL areas.

## WILDERNESS PROPOSAL

### Comment:

Interest seems to be concentrated only in establishing more wilderness areas, which would withdraw more and more land from public and private use.

### Response:

The wilderness proposal was only one portion of the total plan for Bighorn Canyon. There are plans to develop most existing areas within the recreation area to provide more opportunities for visitors. Wilderness designation will not withdraw land from public and private use, but there are restrictions on motorized access. Any grazing rights will continue to be honored, provided that the access restrictions are observed.

### Comment:

How do areas get to be considered for wilderness designation?

### Response:

The Wilderness Act of 1964 required all federal agencies to evaluate their lands for wilderness potential. The National Park Service evaluated lands within Bighorn Canyon National Recreation Area for wilderness values in a wilderness study. Public meetings were held on this study October 11-14, 1977. As a result of this study, the wilderness proposal presented in the June 17-20, 1980 public hearings was selected. A wilderness recommendation will be submitted to Congress along with a hearing officer's report on the public meetings for their consideration. Wilderness designation requires an act of Congress.

### Comment:

Will the written statements from people not present at the meetings count as much as the people who are here?

### Response:

Yes. All comments will become a part of the official record and will receive equal consideration.

### Comment:

Are there any Crow Reservation lands included within the wilderness area?

### Response:

No. Crow Reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to National Park Service planning without permission of the Crow Tribal Council and the secretary of the interior.

### Comment:

Are there any roads in the wilderness area?

### Response:

No. One of the criteria used in determining which lands would be included in the wilderness study was that there would be no roads.

Comment:

How do you get into the wilderness area?

Response:

Access to wilderness areas would be by foot or horseback. Motorized vehicles are not permitted in a wilderness area.

Comment:

Does the alignment proposed for the old transpark road cross the wilderness area?

Response:

No. None of the alignments for the formerly proposed transpark road are within the proposed wilderness area.

Comment:

What is the difference between a wilderness designation and classification of the area as a natural area as far as protection of that land?

Response:

Compatible uses for the area are the same under both classifications. They both include lands of the same caliber--natural and free from human disturbance. Because wilderness designation is an act of Congress, it requires another act of Congress to revoke that status. Zoning as a protected natural area can be changed without an act of Congress.

Comment:

What criteria were used to evaluate lands in the wilderness study?

Response:

Land to be considered for wilderness designation fit the following description. They were areas of outstanding natural value, without previous human disturbance. There were no roads or structures in the area, and there had to be outstanding ecological, geological or other features of scientific, educational, or historic value.

APPENDIX F

WRITTEN COMMENTS AND RESPONSES

Comments and associated responses delineated in this appendix relate specifically to the environmental impact statement and wilderness proposal. Comments on the general management plan are not responded to in this document. These comments were considered in the evaluation and preparation of the final general management plan.

COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

## memorandum

DATE: AUG 23 1980

REPLY TO  
ATTN OF:

Environmental Quality

SUBJECT: Draft Management Plan, Development Concept Plans, Wilderness Proposal  
and Draft Environmental Statement for Bighorn Canyon National Recreation  
Area (DES 80/34)TO: Regional Director  
National Park Service  
Denver, CO 80225

From: Office of the Area Director, Bureau of Indian Affairs

This office has reviewed the subject documents and has no comments to submit from either a jurisdictional or special expertise standpoint.

We are, however, pleased to read that "Crow Reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to NPS planning without permission of the Crow Tribal Council and the Secretary of the Interior". Due to the disagreement concerning the 1967 Memorandum of Agreement between the Crow Tribe and the NPS we believe that this method of operation, along with continued negotiations with the Crow Tribe, will serve to satisfy the intent of the Secretary of the Interior's letter of December 5, 1977. This letter in part stated that renegotiation of the 1967 Memorandum of Agreement should occur at the field level.

We appreciate the opportunity to have reviewed this document and look forward to reviewing the final statement.



Acting Area Director



Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

OPTIONAL FORM NO. 10  
(REV. 7-76)  
GSA FPMR (41 CFR) 101-11.6  
5010-112



# United States Department of the Interior

IN REPLY REFER TO

1793 (922)

BUREAU OF LAND MANAGEMENT  
State Office  
P. O. Box 1828  
Cheyenne, Wyoming 82001

Memorandum

FEB 20 1980

ER 80-34

To: Regional Director, Rocky Mountain Region, National Park  
Service, P.O. Box 25287, Denver, Colorado 80225

From: State Director, Wyoming

Subject: Review of Draft EIS, Management Plan and Wilderness Proposal

We have reviewed the subject documents with respect to programs and lands administered by Wyoming BLM offices and have no comments to offer. We feel that the draft environmental document reflects a quality effort to assess the situation.

We appreciate the opportunity to review these documents and would like a copy of the final EIS for our files when it is released.

*Maxwell T. Anderson*

cc:  
Worland, DM  
Cody RAH  
WO (202-B)



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE

Billings Area Office  
Federal Building, Room 3035  
316 North 26th Street  
Billings, Montana 59101

IN REPLY REFER TO:

ES

August 1, 1980

MEMORANDUM

TO: Regional Director, NPS, Rocky Mountain Regional Office,  
Denver, CO

FROM: Area Manager, USFWS, Billings, MT (ES)

SUBJECT: Draft General Management Plan, Development Concept Plans,  
Wilderness Proposal and Draft Environmental Statement for  
Bighorn Canyon National Recreational Area

We reviewed the subject drafts and found them to be well written and comprehensive.

We have the following specific comments:

Page 26 - Monitoring the breeding success of the peregrine falcon is indentified as a research need. We suggest the Park Service facilitate recovery of the peregrine by determining how the Recreation Area can be managed to encourage peregrine use. } 1

Page 93(7) - Although no plants are presently listed or proposed for listing as threatened or endangered, this situation may change. We suggest the following sentence be added: } 2

"Any plants which are listed or proposed for listing as threatened or endangered in the future will be afforded the conservation and protection required by the Endangered Species Act."

Page 137 n - The peregrine falcon (a threatened and endangered species should read ". . . (an endangered species)." } 3

Page 185 and 186 - An error was noted in that the Forest Service is an agency of the United States Department of Agriculture. } 4

Thank you for the opportunity to review and comment on this report in the early stages of planning.

Sincerely,

  
Wally Steucke  
Area Manager

cc: Director, Wyoming Game and Fish Department, Cheyenne, WY  
Director, Montana Department of Fish, Wildlife, and Parks,  
Helena, MT  
Regional Director, USFWS, Denver, CO (ENV)  
FWS/OEC, Washington D.C.  
(ATTN: Noreen Clough)  
Endangered Species, USFWS, Billings, MT

1. A thorough survey of the recreation area to determine the occurrence and document potential habitat of the peregrine falcon has been identified as a research need in the natural resources management plan.
2. The text (page 86) has been revised to include this information.
3. The indicated change has been made on page 126.
4. The error on page 171 has been corrected by deletion of the Forest Service from the list of Department of the Interior agencies.



# United States Department of the Interior

GEOLOGICAL SURVEY  
RESTON, VA. 22092

JUL 25 1980

DES-80/34

## Memorandum

To: Regional Director, National Park Service  
Denver, Colorado

Through: *fa* Assistant Secretary--Energy and Minerals *H.R. Smith* JUL 31 1980

From: Director, Geological Survey

Subject: Review of general management plan, development concept plans, wilderness proposal, and draft environmental statement for Bighorn Canyon National Recreation Area, Montana and Wyoming

We have reviewed the subject document as requested in your memorandum of May 19.

The environmental statement should address the topic of ground-water resources and the possibility of future hydroelectric development. These concerns are discussed in the enclosure.

*H. William Menard*  
*fa* H. William Menard

Enclosure



*One Hundred Years of Earth Science in the Public Service*

The environmental statement should summarize pertinent features of the occurrence, quality, availability, and use of ground water, which is to be used for most water supplies in the National Recreation Area. Procedures to ensure good-quality drinking water should be addressed, e.g., care to be taken in the location and construction of wells, and planned frequency and type of water analysis.

5

There is land within the project area that is reserved to protect its waterpower and water storage value. The land is variously included in Power Site Reserves 115, 172, 420, 647, and 650, which are all a matter of public record.

Portions of the reserved land are inundated by Yellowtail Reservoir, and most of the remaining reserved land is located adjacent to the reservoir. The shoreline property has value for waterpower or water storage purposes if Yellowtail Dam is raised.

The waterpower potential of portions of the reserved land could be developed if a pumped-storage project was constructed along the Bighorn River. There are several locations within the subject recreation area where an upper reservoir could be constructed, which would result in a static head of approximately 1,000 feet between the upper reservoir and Yellowtail Reservoir.

6

In view of the renewed interest in the development of hydroelectric power, we suggest that the environmental statement include a discussion concerning the possibility of future studies which could lead to hydroelectric project construction that would have an impact on the Bighorn Canyon National Recreation Area.

5. A general description of groundwater resources and the impacts of development on them can be found on pages 89, 90, 127, and 128. The further detail which you suggested will be addressed at the design stage. Exact locations of wells, etc. have yet to be determined, and full environmental analysis is infeasible at the present time.
  
6. Waterpower and water storage purposes are administered on Bighorn Lake by the Water and Power Resources Service under the authority of P.L. 85-523 of July 15, 1958 and P.L. 89-664 of October 15, 1966. Any hydroelectric project study and construction such as you suggest would be considered by that agency. If a decision is reached to change the present operating conditions, the responsibility for environmental compliance would rest with the Water and Power Resources Service.



United States Department of the Interior  
HERITAGE CONSERVATION AND RECREATION SERVICE  
MID-CONTINENT REGION  
POST OFFICE BOX 25387  
DENVER FEDERAL CENTER  
DENVER, COLORADO 80225

IN REPLY REFER TO:

JUL 25 1980

MEMORANDUM

To: Regional Director, National Park Service, Rocky Mountain Region, Denver, Colorado

From: Assistant Regional Director, Land Use Coordination

Subject: Draft General Management Plan, Development Concept Plans, Wilderness Proposal and Draft Environmental Statement for Bighorn Canyon National Recreation Area (DES 80-34)

With the exception of the sites listed on the National Register of Historic Places, no areas associated with programs administered by the Heritage Conservation and Recreation Service are located within the Bighorn Canyon National Recreation Area. In addition, the plan includes measures which should provide excellent protection and interpretation of the archeological and historical resources of the recreation area. Therefore, we have no suggestions for additions to or improvements of the document.

*for Robert F. Stewart*  
Robert J. Arkins



United States Department of the Interior

WATER AND POWER RESOURCES SERVICE  
~~BUREAU OF RECLAMATION~~

Upper Missouri Region  
P.O. Box 2553  
Billings, Montana 59103

IN REPLY  
REFER TO: UM-150

7061 1980

Memorandum

To: Regional Director, National Park Service, Denver, CO

From: *Acting* Regional Director, Billings, MT

Subject: Draft General Management Plan, Development Concept Plans,  
Wilderness Proposal and Draft Environmental Statement for  
Bighorn Canyon National Recreation Area (DES 80-34)

References to the Bureau of Reclamation (pages 54, 57, 59 and 117) should be changed to Water and Power Resources Service, and references to the "Bureau" should be changed to "Service." } 7

The first sentence on page 57 should be revised as follows: "The Water and Power Resources Service is studying installation of a generator in the afterbay dam. No changes are contemplated in operation of the afterbay." At this time we have no plans for interpretive facilities at the generator site. } 8

*James M. Verzul*  
James M. Verzul

cc: Commissioner, Attention: 150  
Director, Office of Environmental Project Review, Office of the  
Secretary, Department of the Interior, Washington, D.C. 20240

7. The indicated changes have been made on pages 52, 55, and 108. This correction was also made throughout the text of the final environmental statement.
8. The statement on page 52 has been revised as suggested.



REPLY TO  
ATTENTION OF:

DEPARTMENT OF THE ARMY  
OMAHA DISTRICT, CORPS OF ENGINEERS  
6014 U.S. POST OFFICE AND COURTHOUSE  
OMAHA NEBRASKA 68102

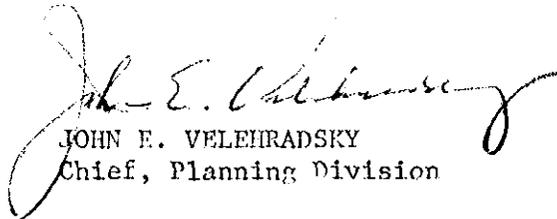
MROPD-A

Regional Director  
National Park Service  
Rocky Mountain Regional Office  
655 Parfet Street  
P.O. Box 25287  
Denver, CO 80225

Dear Sir:

We have reviewed the Draft General Management Plan, Development Concept Plans, Wilderness Proposal and Draft Environmental Statement for Bighorn Canyon National Recreation area in the States of Montana and Wyoming, and wish to advise you that the plans, as presented, will have no impact on any existing or proposed Corps of Engineers projects.

Sincerely,

  
JOHN E. VELEHRADSKY  
Chief, Planning Division



**UNITED STATES DEPARTMENT OF COMMERCE**

**The Assistant Secretary for Policy**

Washington, D. C. 20230

JUL 29 1980

Harold P. Danz, Regional Director  
U.S. Department of the Interior  
National Park Service  
Rocky Mountain Regional Office  
655 Parfet Street  
P.O. Box 25287  
Denver, Colo 80225

Re: D18 (RMR) DP  
xL48

Dear Mr. Danz:

Secretary Klutznick has asked me to respond to your letter of May 19, 1980 requesting comments on the Draft General Management Plan, Development Concept Plans, and Environmental Statement for the Bighorn Canyon National Recreation Area.

The Department of Commerce has no objection to the management and development concept plans for Bighorn Canyon outlined in the draft document.

Thank you for the opportunity to comment on these proposals.

Sincerely,

A handwritten signature in cursive script that reads "Frederick T. Knickerbocker".

Frederick T. Knickerbocker  
Deputy Assistant Secretary  
for Industry Policy



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
REGIONAL/AREA OFFICE  
EXECUTIVE TOWER - 1405 CURTIS STREET  
DENVER, COLORADO 80202

June 23, 1980

REGION VIII

Mr. James B. Thompson  
Regional Director  
Rocky Mountain Region  
National Park Service  
Lakewood, Colorado 80215

Dear Mr. Thompson:

Thank you for the opportunity to review and comment on the draft Environmental Impact Statement (EIS) for the Bighorn Canyon National Recreation Area, Montana-Wyoming.

Your draft EIS has been reviewed with specific consideration for the areas of responsibility assigned to the Department of Housing and Urban Development (HUD). The review considered the proposals' compatibility with local and Regional comprehensive planning and impacts on urbanized areas. Within these parameters, this statement is adequate for our purposes.

If you have any questions regarding these comments please contact Mr. Carroll F. Goodwin, Area Environmental Clearance Officer at 837-3102.

Sincerely,

*Raymond D. McKinney*

Raymond D. McKinney  
Director  
Program Planning and Evaluation



AUG 6 1980

Ref: 8MO

Mr. James B. Thompson  
Acting Regional Director  
Rocky Mountain Region National Park  
Service  
Box 25287, 655 Parfet Avenue  
Denver, Colorado 80215

Dear Mr. Thompson:

Thank you for the opportunity to review your agency's draft environmental impact statement on Bighorn Canyon. The projects described in the EIS should have minimal environmental impacts, although they will draw more people to the area. As stated previously in our comments on the previous EIS, the major impacts of the Park Service plans for the Bighorn area will be associated with the upgrading and construction of the major access road.

According to EPA's rating system for draft impact statements, this EIS is rated LO-1 (lack of objections - sufficient information).

If you have further questions, please call Mr. Gene Taylor in our Montana Office, Helena, Montana, at (FTS) 585-5486.

Sincerely yours,

*Olue A. Lucero, Deputy*  
for Roger L. Williams  
Regional Administrator

FEDERAL ENERGY REGULATORY COMMISSION  
WASHINGTON 20426

IN REPLY REFER TO:

August 1, 1980

Mr. Harold P. Danz  
Regional Director  
National Park Service  
655 Tarfet Street  
P.O. Box 25287  
Denver, CO 80225

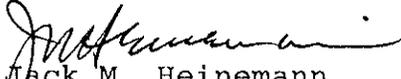
Dear Mr. Danz:

I am replying to your request of May 19, 1980 to the Federal Energy Regulatory Commission for comments on the Draft Environmental Impact Statement for the General Management Plan of Bighorn Canyon. This Draft EIS has been reviewed by appropriate FERC staff components upon whose evaluation this response is based.

This staff concentrates its review of other agencies' environmental impact statements basically on those areas of the electric power, natural gas, and oil pipeline industries for which the Commission has jurisdiction by law, or where staff has special expertise in evaluating environmental impacts involved with the proposed action. It does not appear that there would be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken.

Thank you for the opportunity to review this statement.

Sincerely,

  
Jack M. Heinemann  
Advisor on Environmental Quality



OFFICE OF THE SECRETARY OF TRANSPORTATION

WASHINGTON, D.C. 20590

10 JUN 1980

Mr. Harold P. Danz  
Regional Director  
Rocky Mountain Region  
U.S. Department of the  
Interior, National Park  
Service  
655 Parfet Street  
P.O. Box 25287  
Denver, CO 80225

Dear Mr. Danz:

This is in response to your letter to Secretary Goldshmidt of the Department of Transportation on your Draft General Management Plan, Development Concept Plans, Wilderness Proposal and Draft Environmental Impact Statement for Bighorn Canyon National Recreation Area in Montana and Wyoming.

We have no comment to offer. However, we are forwarding your materials to the Secretary's Regional Representative in Denver for further review. Any comments the Regional Representative may have will be sent directly to you.

Thank you for the opportunity to review these documents.

Sincerely,

Martin Convisser  
Director, Office of  
Environment and Safety



It's a law we  
can live with.

State of Montana  
Office of The Lieutenant Governor  
Helena 59601

TED SCHWINDEN  
LIEUTENANT GOVERNOR

Superintendent  
Big Horn Canyon National Recreation Area  
P. O. Box 458  
Fort Smith, Montana 59035

Dear Sir:

Members of my staff have reviewed this plan and, at your request, have the following suggested comments for the National Parks Service.

The legislation establishing the Big Horn Canyon National Recreation Area outlined what the administration of the area should provide:

1. For public outdoor recreation benefits,
2. For conservation of scenic, scientific, historic, and other values contributing to public enjoyment, and
3. For management, utilization, and disposal of renewable natural resources in a manner that promotes, or is compatible with, and does not significantly impair, public recreation and conservation of scenic, scientific, historic, or other values contributing to public enjoyment.

The State of Montana has been involved in the history of the management of the Big Horn Canyon for several years. (Specifically, with the trans-park road proposals and the fish and wildlife management within the area's Montana boundaries.)

The Big Horn Canyon National Recreation Area is an important recreational resource. The National Park Service should consider the following "energy situation" trends.

1. An expected growth of communities involved with energy development in southeastern Montana and a subsequent need for outdoor recreation facilities.
2. An expected increase in regional visitation due to the rise in fuel costs.
3. A possible decrease in non-regional visitation due to the rise in fuel costs. (Note the visitation decreases at Yellowstone and Glacier National Parks in the summer of 1979.)

9

The proposed management plan includes the establishment of a wilderness area within the National Recreation Area. Wildlife within the 7,645 acres of the Pryor Mountains west of the Bad Pass Road would benefit from the restriction of motorized vehicles, however, the benefits would not be that significant. Since the lands in the wilderness proposal have been included in the natural zone of the management zoning proposal, the alternatives to establishing these lands as wilderness would not change the management of the area except to provide a less permanent management criteria.

←  
← So  
have  
wild  
managers

The proposed general management plan for the Big Horn Canyon National Recreation Area appears to be workable. Through continued cooperation with other involved agencies and the Crow Tribal Council, the National Parks Service should be able to implement this plan to provide outstanding recreational opportunities for the area's visitors. The State of Montana intends to cooperate fully to provide for the use and enjoyment of the Big Horn Canyon's recreation resource.

Sincerely,

TED SCHWINDEN  
Lieutenant Governor

9. The energy situation trends you listed had been considered and can be found in the Visitation Projections section (page 186) of Appendix B: Cost/Benefit Analysis. County population growth was also addressed on page 62 of the final environmental statement.



# MONTANA HISTORICAL SOCIETY

## HISTORIC PRESERVATION OFFICE

225 NORTH ROBERTS STREET • (406) 449-4584 • HELENA, MONTANA 59601

July 10, 1980

Regional Director  
Rocky Mountain Region, National Park Service  
655 Parfet Street  
P.O. Box 25287  
Denver, CO 80225

Re: Draft of general management  
plan for the Bighorn Canyon  
National Recreation Area

Dear Director:

Our office has reviewed the above mentioned document. Although the draft adequately addresses impacts to the cultural environment, further evaluation of previously located sites is recommended for your final analysis. } 10

As the plan acknowledges, we strongly recommend that, prior to development and construction activities, areas of impact should be inventoried in order to locate all properties which appear to be eligible for listing on the National Register of Historic Places. If eligible properties are located within proposed project areas Section 106 procedures of the National Historic Preservation Act, as prescribed in your Memorandum of Agreement with the Advisory Council, should be followed.

Thank you for the opportunity to comment.

Sincerely,

  
Marcella Sherfy  
Deputy SHPO

SAS/MS/det

10. The cultural resources management plan will include detailed mitigation measures. Section 106 compliance procedures have been initiated.



WYOMING  
EXECUTIVE DEPARTMENT  
CHEYENNE

ED HERSCHLER  
GOVERNOR

July 29, 1980

Regional Director  
Rocky Mountain Region  
National Park Service  
655 Parfet Street  
P.O. Box 25287  
Denver, CO 80225

Dear Sirs:

The Draft General Management Plan, Development Concept Plans, Wilderness Proposal and Draft Environmental Statement for Bighorn Canyon National Recreation Area has been circulated for review by our state agencies. Copies of their comments are enclosed for your consideration and use. Should any additional comments be submitted to my office, they will be forwarded as an addendum to the enclosed. Thank you for the opportunity to review and comment on this document.

Sincerely,

A handwritten signature in cursive script that reads "Dick Hartman".

Dick Hartman,  
State Planning Coordinator

DH:pcd  
enclosures



THE STATE OF WYOMING

AUG 21 1980

ED HERSCHLER  
GOVERNOR

## Game and Fish Department

CHEYENNE, WYOMING 82002

EARL M. THOMAS  
DIRECTOR

August 18, 1980

EIS 158, Big Horn Canyon  
National Recreation Area  
Natural Resources Management  
Plan

Mr. Homer L. Rouse, Superintendent  
Big Horn Canyon National Recreation Area  
P. O. Box 458  
Fort Smith, Montana 59035

Dear Mr. Rouse:

The following comments are offered for your consideration in the development of the final resource management plan and environmental assessment for the Big Horn Canyon National Recreation Area.

1. Neither of the proposed wilderness areas will result in adverse impacts to wildlife.
2. Increased visitation within the M-L Ranch should be limited to the ranch site and surrounding unit roads should not be improved so that riparian woodland in the area will not be further impacted.
3. Fishermen use of the Crooked Creek area in winter could be facilitated if campers and other vehicles were allowed closer to the water, since fishermen must be within 100 feet of their lines. In winter, the ground is frozen and little soil damage should occur.

Thank you for the opportunity to review this management plan. Please contact us if we may be of further help.

Sincerely,

W. DONALD DEXTER, ASSISTANT DIRECTOR  
WYOMING GAME AND FISH DEPARTMENT

WDD:HBM:lm

Cc: Game Division  
Fish Division

JUN 20 1980

TELEPHONES  
(307) 742-2054  
(307) 766-2286



DANIEL N. MILLER, JR.  
DIRECTOR AND  
STATE GEOLOGIST  
DEPUTY DIRECTOR AND  
STAFF GEOLOGIST  
GARY B. GLASS  
STAFF GEOLOGISTS  
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W. DAN HAUSEL  
DAVID R. LAGESON  
ALAN J. VER PLOEG  
TECHNICAL EDITOR  
DAVID A. COPELAND

THE GEOLOGICAL SURVEY OF WYOMING

UNIVERSITY OF WYOMING  
BOX 3008, UNIVERSITY STATION  
LARAMIE, WYOMING 82071

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June 20, 1980

Mr. Dick Hartman  
State Planning Coordinator  
Wyoming State Clearinghouse  
2320 Capitol Avenue  
Cheyenne, WY 82002

Dear Mr. Hartman:

I have reviewed Bighorn Canyon National Recreation Area -  
Draft General Management Plan, Environmental Statement, Wilderness  
Proposal, Development Concept Plan (L. D. No. 80-130) and have no  
comments at this time.

If your office or another agency would like us to reexamine any part  
of this document for any purpose, please feel free to ask.

Sincerely,

Rodney H. De Bruin  
Staff Geologist

RHDB:eb



## Wyoming State Highway Department

P. O. BOX 1708

CHEYENNE, WYOMING 82001

### M E M O R A N D U M

June 24, 1980

TO: Mr. Dick Hartman, State Planning Coordinator  
Wyoming State Clearinghouse  
2320 Capitol Avenue, Cheyenne, Wyoming 82002

FROM: William P. King, P. E., Environmental Services Engineer *WPK*

SUBJECT: Draft Environmental Impact Statement  
Big Horn Canyon National Recreation Area  
National Park Service

State I. D. Number 80-130

This is a very concise and easy to read report. Early coordination should be made with Mr. G. A. Brown, District Engineer, Wyoming Highway Department, P. O. Box 351, Basin, Wyoming, 82410, Phone 568-2425 concerning revisions or modifications to the State Highway System. This would include access points, turnouts, rest areas, etcetera.

The additional traffic generated by these proposed improvements should not have a detrimental effect on the State Highway System, but as the report states could affect the highway routes in the adjoining towns.

WPK/FKS:lt



*Department of Environmental Quality*  
*Water Quality Division*

933 MAIN

LANDER, WYOMING 82520

TELEPHONE 307-332-3144

MEMORANDUM

TO: Robert E. Sundin, Director DEQ

FROM: Robin Collins, District Engineer  
*M. Robin Collins*  
Water Quality Division

DATE: July 23, 1980

SUBJECT: Environmental Assessment for Bighorn  
Canyon National Recreation Area

The aforementioned project appears feasible and I do not feel water quality will be adversely affected by its completion.

As a reminder, any construction of or modification to a wastewater disposal facility or public water supply should obtain prior approval from this department.

cc: DEQ/WQD - Cheyenne

THE STATE



OF WYOMING

JUL 30 1980

ED HERSCHLER  
GOVERNOR

# Wyoming Recreation Commission

604 EAST 25TH STREET

CHEYENNE, WYOMING 82002

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**DAN MADIA**

1017 Victoria  
Sheridan 82801

JAN L. WILSON

Director

777-7695

July 29, 1980

Mr. Dick Hartman  
State Planning Coordinator  
2320 Capitol Avenue  
Cheyenne, Wyoming 82002

RE: 80-130: Bighorn Canyon National  
Recreation Area--Draft General  
Management Plan

Dear Mr. Hartman:

Thank you for the opportunity to review and comment on this project.

I have enclosed recommendations concerning historical clearance of the project and concur with them.

I have also enclosed comments relating to recreational concerns which this agency has with the draft EIS.

If you have any questions, please feel free to contact this office.

Sincerely,

John F. Carlson, Chief  
Resources Division and  
Deputy SHPO

FOR:

Jan L. Wilson, Director and  
State Historic Preservation Officer

JFC:klm  
Encls.



WYOMING RECREATION COMMISSION  
STATE HISTORIC PRESERVATION OFFICE

REVIEW AND COMPLIANCE

*Interdisciplinary Staff Comments*

*Archeology • History • Historical Architecture • Recreation Planning*

TO: John F. Carlson, Chief  
FROM: Susan L. McMillen, Review and Compliance Officer *Sm*  
DATE: July 25, 1980  
RE: National Park Service - Draft General Management Plan, Environmental Statement, Wilderness Proposal, Development Concept Plan for Bighorn Canyon National Recreation Area (80-130)

Although cultural resources received fair consideration in this draft management plan and environmental statement, the report revealed most of the historically significant structures indentified as part of the environment will be unfavorably impacted or will receive unavoidable adverse effects by further development of the area. Mitigation of these impacts upon historic structures was discussed briefly in the section entitled, "Mitigation of Impacts on Cultural Environment." The Cultural Resources Management Plan, to be prepared in the near future, should alleviate the shortcoming. } 11

11. Please refer to response 10.



WYOMING RECREATION COMMISSION  
 STATE HISTORIC PRESERVATION OFFICE

REVIEW AND COMPLIANCE

*Interdisciplinary Staff Comments*

*Archeology • History • Historical Architecture • Recreation Planning*

TO: John F. Carlson, Chief  
 FROM: John Keck, *JK*  
 DATE: July 28, 1980  
 RE: Draft Environmental Impact Statement, Big Horn Canyon National Recreation Area

The impact statement for the Bighorn Canyon Recreation Area thoroughly covers the various elements of recreation for the area. It does not, however, provide any analysis of the economic effect increased visitor use will have on the surrounding communities. No information is provided which details what effect the proposed alternatives will have on the Crow Indian Reservation, Lovell, Wyoming, Hardin, Montana, or any other nearby communities. The statement also provides no information as to the potential revenue from the concessions agreement.

} 12  
 } 13

12. The impacts of increasing visitation on regional residents was described in a qualitative manner. This was done because, as outlined in the visitation projection, visitation increases are not "alternative" dependent. The proposal will be responding to visitation trends rather than initiating visitation increases itself.
  
13. Detailed analysis of the concession agreement was not performed for this study. An economic feasibility study which would include the information you suggested will be prepared prior to any concession contract.



# CROW TRIBAL COUNCIL

Crow Country

FOREST HORN, Chairman  
ANDREW BIRDINGROUND, Vice Chairman  
THEODORE (Ted) HOGAN, Secretary  
RONALD LITTLE LIGHT, Vice Secretary  
PHONE: Area Code (406) 638-2993 - 2942

July 8, 1980

Superintendent  
Big Horn Canyon National Recreation Area  
P. O. Box 458  
Fort Smith, MT 59035

Dear Sir:

The Crow Tribe of Indians of Montana wishes to make the following comments on the Big Horn Canyon National Recreation Area Draft General Management Plan.

Initially, the draft general management plan is subject to the Crow Tribe making an agreement with the National Park Service. The 1967 Memorandum of Agreement was declared invalid by Tribal Resolution 76-32. Until a new Memorandum of Agreement is reached with the National Park Service the context of this general management plan could change. } 14

One such item included in the Memorandum of Agreement yet to be executed deals with the development of the water base facilities. The Crow Tribe maintains a right on the water base facilities even though a Memorandum of Agreement may never be reached. } 15

If you have any questions concerning these comments, please feel free to contact me.

Sincerely yours,

Forest Horn  
Chairman  
Crow Tribe of Indians

14. On December 5, 1977, the secretary of interior indicated in a letter to the Crow Tribal Council that Interior Department acceptance of Resolution 76-32 would leave an operational void at Bighorn Canyon, and that renegotiation of the 1967 Memorandum of Agreement should occur at the field level. Further, the secretary responded that until such time as the memorandum is renegotiated, the original memorandum of agreement will be considered legally binding by the Department of the Interior. Until this issue is resolved, however, the National Park Service has been instructed to place a moratorium on any further development of Crow lands within the recreation area.

Recognizing the existing differences between the National Park Service and the Crow over the 1967 Memorandum of Agreement, the future development included in this planning effort is confined to the area within the boundaries of Bighorn Canyon National Recreation Area set by Congress in P.L. 89-664 on October 15, 1966. Crow reservation lands within Bighorn Canyon National Recreation Area are not included in this plan and will not be subject to NPS planning without permission of the Crow Tribal Council and the secretary of interior. It is recognized by the National Park Service that renegotiation of the 1967 Memorandum of Agreement could alter sections of this general management plan. However, this general management plan will be in effect until such time as a new memorandum of agreement is approved.

15. The following statement from page 109 of the final environmental statement recognized this right. "At Ok-A-Beh and Barry's Landing this will be of particular importance to the Crow Tribe because they hold the first right of refusal on concession operations in the Montana portion of the recreation area."

555 17th St  
Denver, Colorado 80202  
Telephone 303 575 7577

AUG 7 1980



J. R. Mitchell  
Public Lands Coordinator

August 4, 1980

Superintendent  
Bighorn Canyon National Recreation Area  
P. O. Box 458  
Fort Smith, MT 59035

RE: Bighorn Canyon National Recreation Area

Dear Sir:

Atlantic Richfield Company appreciates the opportunity to provide the National Park Service with our comments regarding the Draft Environmental Impact Statement (DEIS) on the Wilderness Proposal and General Management Plan for the Bighorn Canyon National Recreation Area located in Montana and Wyoming.

Atlantic Richfield endorses the concept of multiple-use for our nation's public lands. The exploration for and development of alternate energy sources will expand our domestic energy supply, thereby improving local and national economies, and help to reduce U. S. dependence on foreign oil supplies. We feel the public interest is best served when ecologically sound and economically prudent exploration and production activities are allowed to coexist with other land users.

We are primarily concerned about the National Park Service's omission of any reference in the DEIS regarding the possibility of energy resources being present in the Bighorn Canyon area and the absence of any provisions which would allow for appropriate development of these potential resources. Specifically, we are concerned with the National Park Services failure to recognize the low temperature geothermal resource potential that is known to exist in the Madison limestone found in the area. An example of this resource potential is Little Sheep Mountain Spring, located along the Big Horn River in Section 17, Township 55 North, Range 94 West, which flows warm water (18 to 20° Centigrade) from the Madison Formation. This low temperature geothermal resource could prove valuable as an energy resource for local uses within this area.

} 16

Exploration for geothermal resources has very little immediate impact and essentially no residual adverse environmental affects. We, therefore, recommend that the Park Service include in its management plan provisions allowing for the multiple use of the Bighorn Canyon National Recreation Area which include the exploration for and development of geothermal resources.

Superintendent  
Page Two  
August 4, 1980

Again we appreciate this opportunity to provide the National Park Service with our comments. If any additional information is required, please don't hesitate to contact us.

Sincerely,

J. R. Mitchell

JRM/CMM/al

16. The Organic Act of 1916 stated that ". . . The (National Park Service) shall promote and regulate the use of (parks), by such means and measures as to conform to the fundamental purpose of said (parks), which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." Public Law 89-664, October 15, 1966, stated in Sec. 3.(a): "The Secretary shall coordinate administration of the recreation area with the other purposes of the Yellowtail project so that it will in his judgement best provide . . . (3) for management, utilization, and disposal of renewable natural resources in a manner that promotes, or is compatible with, and does not significantly impair, public recreation and conservation of scenic, scientific, historic, or other values contributing to public enjoyment." Unless these acts are amended by Congress, energy development of non-renewable resources would not be considered an acceptable use of the lands within Bighorn Canyon National Recreation Area.



July 29, 1980

Mr. Homer L. Rouse  
Superintendent  
Bighorn Canyon National  
Recreation Area  
P.O. Box 458  
Fort Smith, Montana 59035

Dear Homer:

The following constitutes the National Parks and Conservation Association's comments pertaining to the Draft General Management Plan, Bighorn Canyon National Recreation Area. These are to be included in the record of public comments.

Bighorn Canyon National Recreation Area, located in southeastern Montana and north-central Wyoming, includes approximately 120,000 acres, 12,700 of which comprise Bighorn Lake. The lake is created by the Yellowtail Dam, constructed on the Bighorn River in 1965 as a part of the Missouri River Basin Project. The area is of great cultural and natural significance. Bighorn Canyon is a dramatic documentary of our geological past as well as a documentary of our human past. The Bighorn Basin has hosted several waves of human immigrants and has been continuously occupied for over 10,000 years. Its latest inhabitants, the Crow Indians, occupy a large reservation adjacent to the recreation area. These qualities and factors make Bighorn Canyon of great interpretive value to the public and thus a critical part of our shared common heritage.

The legislative history of the area includes an Agreement (1967) with the Crow Indians authorizing the inclusion of a segment of their land within the Recreation Area to be administered by the NPS with all previous rights retained by the tribe. A Master Plan for the Recreation Area was approved in 1971. This plan included terms for a transpark road to extend from the end of Wyoming State Highway 37 near Horseshoe Bend, northward on the west side of Bighorn Canyon for 50 miles to Fort Smith, Montana. This plan raised the ire of both the Crow Indians and local and national conservation organizations. The first segment extended from Horseshoe Bend to Devil Canyon. In 1973 the Crow Tribal Council called for renegotiation of the agreement. They claimed the Park Service had broken the agreement by proposing 15 invalid alterations including the construction of a road through their territory. The local conservation organizations also attempted to prevent the construction of the road which they considered detrimental to the pristine character of the region. From 1974-1976 further construction was prevented by a court injunction, but in 1976 this was lifted and construction for the second segment of the road was authorized and completed in 1977 (Devil Canyon-Barry's

Superintendent Rouse  
July 29, 1980  
Page Two

Landing). After this decision the Crow Indians indignantly withdrew all the tribal lands formerly included in the Recreation Area and totally rejected the 1967 Memorandum of Agreement. The NPS placed a moratorium on any further development of these lands. Currently no further construction is planned and the road exists in a half finished condition.

The NPCA believes, as do the local conservation organizations, that the construction of the transpark road has seriously altered the character of the recreation area from pristine backcountry, with only slight development, to a semi-commercial establishment. The self-generated increase in visitation has made it necessary for the NPS to devise a more comprehensive management plan as well as to expand current development.

The NPCA views the proposed amount of development with hesitation. Our philosophy regards the NPS as the guardian of the spiritual and aesthetic values which are found in nature. It is NPS's duty to protect the natural environment and the special character of Bighorn Canyon Recreation Area. Yet the reality is that with the installation of the road the area has become more accessible to the public and therefore, some level of development is called for. Our complaint is not against public access, but against the degraded quality of the visitor experience implicitly invited with excessive development. The remainder of these comments consist of an analysis of the proposal and presents suggestions in an attempt to preserve the quality of the Recreation Area while simultaneously allowing for necessary expansion.

Existing development at Bighorn Canyon National Recreation Area has been primarily oriented toward water-based recreation at Ok-A-Beh, Barry's Landing, and Horseshoe Bend. The proposed development plan will expand these existing major sites and create two new major sites. These will be located at Afterbay and Hough Creek and will provide opportunities for land-oriented recreation. While the bulk of the proposed new development is low-key, NPCA feels that the development at Hough Creek is superfluous and could be avoided. NPCA further believes that some facets of development in the other areas are necessary. Development could be less obtrusive and the burden on NPS's heavily constrained budget could be alleviated. Currently only the most significant projects are receiving funding--a degree of selectivism is required.

We propose combining several of the components of Alternative Two with the recommended proposal. Our preference for portions of Alternative Two is illustrated in a table (p. 226, GMP). Only the sections of the table comparing the proposal with Alternative Two are presented here.

The table below ranks the alternatives from best (1) to worst (4) for each of the criteria.

	<u>proposal</u>	<u>Alternative 2</u>
legislative intent	1	1
management objective	2	1
facility sizing	2	1
cost-effectiveness	3	2
socio-economic costs	2	2
environmental costs	2	2

This alternative was rejected, perhaps in the belief that greater development than originally projected would occur. Yet the crux of the matter appears to revolve around the pattern of park usage and the NPS's inability to deal with it:

Due to the large differences in weekday versus weekend visitation at Bighorn Canyon, it becomes difficult to make rational decisions on sizing of campground facilities.  
(p. 205, GMP)

Alternative Two maximizes the use of facilities, but causes serious management problems during peak weekends. The proposal provides for peaks, but results in an average occupancy rate near 40%, rather than 80% indicated by comparison to other areas. By sizing the campgrounds to accommodate these weekend peaks, the average occupancy during the visitor season is low, therefore the cost per site is extremely high. The NPCA considers this approach to be off-base. Facilities should be utilized to near maximum capacity. Catering to weekend peaks is both expensive and wasteful. This should be established during the early stages of management planning in order to prevent a worsened future situation. The character of the park should be molded by well-planned management--weekday use should be encouraged.

Assuming the above were heeded, then the extent of development outlined in the proposal would not be necessary. In consideration of this the NPCA proposes that the following components of Alternative Two be combined with the proposal from the Draft GMP:

- 1) No camping facilities nor development should be implemented at Hough Creek.

Demand analysis indicates that the additional Hough Creek opportunities are not required except for occasional peak weekends that are likely to occur around the year 2000. Additional camping at Horseshoe Bend could be substituted if demand dictates additional facilities. (p. 197, GMP)

Superintendent Rouse  
July 29, 1980  
Page Four

- 2) No development at Barry's Landing--no boat slips, sales building, nor marina. This would reduce the impacts on trout spawning and would also help alleviate potential problems with exceeding lake capacity.
- 3) No Landscaping at Horseshoe Bend. This is both unnecessary and costly.

In support of the present proposal NPCA commends NPS for the following:

- 1) An active, comprehensive management plan.
- 2) Increased interpretation.
- 3) Limited expansion of the existing areas.
- 4) High quality structures (no prefabricated structures)

Under this scenario costs would be reduced, the environment would receive maximum protection, pristine qualities would be preserved, and only necessary development would occur.

We respectfully request that these suggestions be considered in your implementation of the final general management plan at Bighorn Canyon.

Sincerely,



T. Destry Jarvis  
Director of Federal Activities

TDJ:11

The following is an explanation of the rationale used to select the preferred alternative:

On the table presented on page 210 of the draft environmental statement and reproduced below, it can be seen that the proposal and alternative 2 best meet the criteria established. The proposal and alternative 2 equally meet the criteria of legislative intent and socioeconomic costs. The differences between the proposal and alternative 2 on facility sizing, cost-effectiveness, and environmental costs are due to the additional development in the proposal.

The proposed marina facilities are reasonably sized considering the strategy to develop the Horseshoe Bend 70-slip marina in three phases (30-20-20) and based on visitor use and future demand. Marina support facilities constitute the major portion of construction, operation, and maintenance costs; these costs increase very slowly as sizing increases. Therefore, differences in sizing of marinas between the proposal and alternative 2 will amount to a very small, if any, difference in cost. The major difference between the proposal and alternative 2 is the provision of a campground at Hough Creek. The campground proposed for Hough Creek was designed to provide a more diversified and pleasant experience for the land-based visitor. At the present time, activities are severely limited for those visitors who do not intend to boat, swim, or engage in other water-based recreation. The Hough Creek campground and the associated day use area at Sorenson Ranch could provide an attractive alternative to the primarily lake oriented development at Horseshoe Bend. The Hough Creek campground is also phased to allow for orderly expansion if necessary. Development of the various phases will also be contingent upon future visitor use and demand. The increased environmental costs in the proposal due to the Hough Creek campground are partially offset by the removal of existing campsites along North Fork Trail Creek. The North Fork Trail Creek is in a sensitive riparian zone. This campground would have remained under alternative 2.

Further description of the methods used for ranking the alternatives and the proposals can be found in the Cost/Benefit Analysis, Appendix B. The impacts of proposed development on the visitor experience were detailed on pages 104-108. Impacts on the visitor experience due to development proposed in the alternatives can be found on pages 150-151 and 162-164.

Varying amounts of development were proposed in each of the alternatives. All of these alternatives were then analyzed for cost and benefit as indicated on pages 181-210 of the final environmental statement for Bighorn Canyon National Recreation Area. For easy reference, the following table was reproduced from page 210 of the draft environmental statement:

	<u>Proposal</u>	<u>No Action</u>	<u>Alternative 2</u>	<u>Alternative 3</u>
Legislative intent	1	1	1	1
Management objectives	2	3	1	4
Facility sizing	2	3	1	4
Cost-effectiveness	3	1	2	4
Socioeconomic costs	2	4	2	1
Environmental costs	3	1	2	4

MAY 20 1980

MINOT, NORTH DAKOTA 58701  
P. O. Box 1802 - Phone 852-4461

BISMARCK, NORTH DAKOTA 58501  
Professional North Office Building  
Rural Route No. 1 - Phone 255-4056

BILLINGS, MONTANA 59104  
P. O. Box 20876 - Phone 656-8100

Schmit, Smith & Rush  
PROFESSIONAL CONSULTING ENGINEERS



May 22, 1980

Reply to: Billings Office

Mr. Homer Rouse, Superintendent  
Big Horn Canyon Recreational Area  
P. O. Box 458  
Fort Smith, Montana 59035

Re: Draft E.I.S. - General Management Plan

Dear Mr. Rouse:

I have just completed a quick review of the above referenced publication. As I will be out of State during the hearings offering the following comments:

NO.	ES&A	Info	Action	Initial	Date
1					5/22/80
2					
3					
4					
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6					
7					
NORTH DISTRICT					
8					
9					
10					
11					
12					
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SOUTH DISTRICT					
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- (1) Page 29, paragraph d. (3)

No mention is made as to the adverse effect of the cold water temperatures of the Afterbay Reservoir. I personally feel that this cold water is unsafe for swimming except for possibly a short time in August. } 17

- (2) Page 25, paragraph (2) 2

The last sentence in this paragraph is incorrect. Extensive flooding occurred downstream from the dam in May of 1978. This was caused by unusually severe rainfall. } 18

- (3) Page 47, paragraph f. (and other spots)

I did not notice reference made to possible guided tours of some of the larger caves, such as the one at frozen leg. Is this a possibility? } 19

- (4) Airport

I found no reference to expansion of the airport facility. In view of the energy situation I am confident of expanded use of the airport. For an example; I can fly round trip to Billings using only 7 gallons of gas. Should this not be taken into consideration? } 20

(5) Utilities

There is no mention of the possibility of replacement of the URD line to Ok-A-Beh. As a consultant to the Big Horn County Electric Cooperative, I have knowledge that the existing URD cable is suffering from extensive "Water Tree" damage. It is my opinion that the cable will have to be replaced in the not too distant future. The existing Park Service - B.H.E.C. contract calls for termination of said contract under these conditions. Not only should the cost be included in your study, but the environmental aspect as well.

} 21

If I can be of further help, please feel free to contact me.

Very truly yours,



Jim Pickens, P.E.  
Schmit, Smith & Rush  
Professional Consulting Engineers

JP/bn

cc: Mr. Duane Portwood, Manager, Big Horn County Electric Cooperative, Inc.

Mr. Charles Sweeney

Mr. Lee Pickens, SS&R

17. There are no plans to provide swimming opportunities in the afterbay. Instead, a swimming facility will be constructed near the proposed campground.
18. Acknowledged. This error has been corrected in the text on p. 22.
19. There are no plans for cave tours because the caves are found on Crow-added or private lands not now under NPS control. Please refer to the final comment on p. 234.
20. There are no plans to expand the existing airport facility at this time.
21. If replacement of the existing underground power line serving Ok-A-Beh becomes necessary because of cable failure, it will be the responsibility of the Big Horn County Electric Cooperative to replace it. Environmental impacts are not required for such maintenance activities. If the National Park Service were to request a change in the electric service outside of the provisions of the contract or specify a change in the location of the underground line, then it is recognized that this would be a Service responsibility. No such change is called for in this plan.



## Jubenville's Comments on General Management Plan

The management plan for Bighorn Canyon Natural Recreation Area is a very complete document. The inventory work is thorough; the environmental impact statement addresses most of the important impacts; and the management zoning proposals seem to fit both the potential of the resources as well as their inherent limitations. If a plan fits those criteria, then the planning effort should be a good one. Your plan meets those criteria.

The foundation on which all this rests is the measurement and projection of the recreation use of the area. After reading the plan, I feel the foundation is not very solid, or there is insufficient information given to judge how well that foundation was developed.

Let me ramble on that subject:

From the management perspective, the most important pages in the plan appear to be pages 7-8, 67, and 195-221. Appendix B-Management objectives and the related description should be the heart of the plan and should be presented earlier, possibly substituted for paragraph C, page 8 (in summary form). There is an inconsistency between existing paragraph C, p. 8, and Appendix B. You indicate that facilities will be developed in proportion to "numerical projections of visitor use" (bottom p. 8); and then concluded, "In summary, most initial development . . . support of camping, water-based recreation, and interpretation." Yet, statistics show only 15-16% of the people camped and boated, and little information is available on what the rest of the people did - only that it was clustered into day-use activity (p. 67). Shouldn't the objectives then be brought forward from the appendix and reflect this need for day-use programs since 85% of use is other than boating and camping.

Furthermore, the plan should help to improve management decision-making by fully developing a monitoring system to continually or periodically update what is happening with the other 85%.

No matter what Appendix B says, I would submit that the real goals of the plan are on p. 9 (last paragraph under C.) Those may not be unreasonable goals, but day use programs (and those activities and facilities that would filter out of that) certainly deserve to be equal partners in the management scheme. Ironically, on p. 224-226 (and without the added emphasis on day-use), the NPS conclusion is that Alternative 2 is the best. Yet, the Proposal (apparently Alternative 1) was chosen without even attempting to justify the choice. With the added emphasis on day use, the choice of Alternative 2 should have been overwhelming.

Visitor-use projections do not seem to be well-documented. There is a discussion of a model - possibly that could have been included in the Appendix. } 22

Problem of peak weekend use is a typical outdoor recreation pattern. The proposed facilities are not very cost efficient but they are still proposed. As a planner, I would want to know why?? You may be able to justify some inefficiency because of terrain, location, etc, but ratios 9.1 and 14.3 seem far out of reason. The first step is to look at the trends for the weekends throughout the summer - possibly they will grudgingly give some answers.

Lastly, how did you arrive at the conclusion that of boating capacity of 14 acres per boat? Will this vary according to width of canyon and type of boating? } 23

22. Discussion of the methods used for visitor use projections can be found in Appendix B: Cost/Benefit Analysis; Visitation Characteristics (page 184); Visitation Projections (page 186); assumptions (page 186); and cost effectiveness (page 189).
23. The boating capacity of 14 boats/acre was obtained from Guidelines For Understanding and Determining Optimum Recreation Carrying Capacity (1977, Urban Research Development Corp., prepared for Bureau of Outdoor Recreation). It was felt that this provided a reasonable range for the purpose of this study. A carrying capacity study was recommended for Bighorn Lake because the team realized that our analysis could vary if site-specific data were available.

JUL 17 1980

maimc:

6 July 1980

I have reviewed ~~the~~ Draft Plan and EIS for Big Horn Canyon  
NRA. ~~It~~ includes no mention of Executive Order 11788  
(May 1977) - Protection of Floodplains. This E.O. must be  
addressed, as it directly impacts many of the proposed  
developments in the Draft Plan. Acquisition and construction  
purposes in floodplains must be reviewed in light of  
the President's Order, and mitigative action taken if  
no alternatives exist.

Thank You.

David Schein  
512 Na-Wa-Ta  
Mt. Prospect, IL 60056

24

THE SCHEINS  
512 NA-WA-TA AVE  
MT PROSPECT, IL 60056

24. Executive Order 11988 "Floodplain Management" was addressed on page 22 of the general management plan.

COMMENTS ON THE WILDERNESS PROPOSAL

Agencies and Organizations Who Reviewed the Wilderness Proposal But Offered No Specific Comments (see previous section for copies of the written responses)

Department of the Interior

Bureau of Indian Affairs

Bureau of Land Management

Fish and Wildlife Service

Geological Survey

Heritage Conservation and Recreation Service

Water and Power Resources Service

Department of the Army, Corps of Engineers

Environmental Protection Agency

Secretary of Transportation

Wyoming Executive Department

Geological Survey of Wyoming

Wyoming Recreation Commission, State Historic Preservation Office

Atlantic Richfield Company

Comments on the Wilderness Proposal



State of Montana  
Office of The Lieutenant Governor  
Helena 59601

TED SCHWINDEN  
LIEUTENANT GOVERNOR

*This letter  
is in  
now  
twice?*

August 6, 1980

Superintendent  
Big Horn Canyon National Recreation Area  
P. O. Box 458  
Fort Smith, Montana 59035

Dear Sir:

Members of my staff have reviewed this plan and, at your request, have the following suggested comments for the National Parks Service.

The legislation establishing the Big Horn Canyon National Recreation Area outlined what the administration of the area should provide:

1. For public outdoor recreation benefits,
2. For conservation of scenic, scientific, historic, and other values contributing to public enjoyment, and
3. For management, utilization, and disposal of renewable natural resources in a manner that promotes, or is compatible with, and does not significantly impair, public recreation and conservation of scenic, scientific, historic, or other values contributing to public enjoyment.

The State of Montana has been involved in the history of the management of the Big Horn Canyon for several years. (Specifically, with the trans-park road proposals and the fish and wildlife management within the area's Montana boundaries.)

The Big Horn Canyon National Recreation Area is an important recreational resource. The National Park Service should consider the following "energy situation" trends.

1. An expected growth of communities involved with energy development in southeastern Montana and a subsequent need for outdoor recreation facilities.
2. An expected increase in regional visitation due to the rise in fuel costs.
3. A possible decrease in non-regional visitation due to the rise in fuel costs. (Note the visitation decreases at Yellowstone and Glacier National Parks in the summer of 1979.)

The proposed management plan includes the establishment of a wilderness area within the National Recreation Area. Wildlife within the 7,645 acres of the Pryor Mountains west of the Bad Pass Road would benefit from the restriction of motorized vehicles, however, the benefits would not be that significant. Since the lands in the wilderness proposal have been included in the natural zone of the management zoning proposal, the alternatives to establishing these lands as wilderness would not change the management of the area except to provide a less permanent management criteria.

The proposed general management plan for the Big Horn Canyon National Recreation Area appears to be workable. Through continued cooperation with other involved agencies and the Crow Tribal Council, the National Parks Service should be able to implement this plan to provide outstanding recreational opportunities for the area's visitors. The State of Montana intends to cooperate fully to provide for the use and enjoyment of the Big Horn Canyon's recreation resource.

Sincerely,

  
TED SCHWINDEN  
Lieutenant Governor

## APPENDIX G

### CORRESPONDENCE WITH U.S. FISH AND WILDLIFE SERVICE ON COMPLIANCE WITH THE ENDANGERED SPECIES ACT

Correspondence with the U.S. Fish and Wildlife Service was initiated on June 25, 1979. A series of letters followed which terminated with a biological opinion from the U.S. Fish and Wildlife Service on September 11, 1980. The opinion concluded that some activities could disrupt peregrine falcon nesting and recommended that potentially disruptive activities be eliminated during the breeding season. Copies of the correspondence between the National Park Service and the U.S. Fish and Wildlife Service are on file in the Rocky Mountain Regional Office, Denver, Colorado, for inspection by qualified individuals.

A memorandum dated March 31, 1981, from the Fish and Wildlife Service indicated that, "Publication of the biological opinion would disclose the location of the falcons and most certainly, would increase the probability of bird loss through human disturbance. Therefore, we fully support the position the National Park Service has taken on this matter. The biological opinion did raise some serious concerns over the possible impacts that proposed development and public use activities would have on the peregrine falcons. These concerns have been resolved through the consultation process, and we are satisfied the General Management Plan for Bighorn Canyon National Recreation Area will not jeopardize the continued existence of the peregrine falcon."

APPENDIX H

COMPLIANCE WITH SECTION 106 OF  
NATIONAL HISTORIC PRESERVATION ACT

# Advisory Council On Historic Preservation

---

1522 K Street, NW  
Washington, DC 20005

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SEP 18 1980

Mr. Harold P. Danz  
Acting Regional Director  
Rocky Mountain Region  
National Park Service  
P. O. Box 25287  
Denver, Colorado 80225

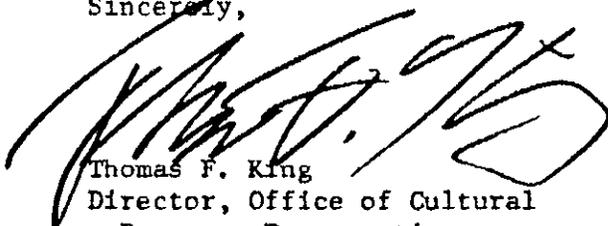
Dear Mr. Danz:

The Memorandum of Agreement for the National Park Service's proposal to neglect the Bighorn Ditch Headgate, Fort Smith, Montana, has been ratified by the Chairman of the Council. This document constitutes the comments of the Council required by Section 106 of the National Historic Preservation Act and completes compliance with the Council's regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800). A copy of the Agreement is enclosed.

In accordance with Sections 800.6(c)(2) and 800.9(e) of the regulations, a copy of this Memorandum of Agreement should be included in any environmental assessment or statement prepared for this undertaking to meet requirements of the National Environmental Policy Act and should be retained in your records as evidence of compliance with Section 106 of the National Historic Preservation Act.

The Council appreciates your cooperation in reaching a satisfactory resolution of this matter.

Sincerely,



Thomas F. King  
Director, Office of Cultural  
Resource Preservation

Enclosure

**Advisory  
Council On  
Historic  
Preservation**

COPY

1522 K Street, NW  
Washington, DC 20005

MEMORANDUM OF AGREEMENT

WHEREAS, the National Park Service (NPS) proposes not to maintain the Big Horn Ditch Headgate in Fort Smith, Montana, allowing it to deteriorate; and,

WHEREAS, NPS, in consultation with the Montana State Historic Preservation Officer (SHPO), has determined that this undertaking as proposed would have an adverse effect upon the Bighorn Ditch Headgate, a property included in the National Register of Historic Places; and,

WHEREAS, pursuant to Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. Sec. 470f, as amended, 90 Stat. 1320) and Section 800.4(d) of the regulations of the Advisory Council on Historic Preservation (Council), "Protection of Historic and Cultural Properties" (36 CFR Part 800), NPS has requested the comments of the Council; and,

WHEREAS, pursuant to Section 800.6 of the Council's regulations, representatives of the Council, NPS, and the Montana SHPO have consulted and reviewed the undertaking to consider feasible and prudent alternatives to avoid or satisfactorily mitigate the adverse effect; and,

WHEREAS, the Bighorn Ditch Headgate has been damaged by a landslide and is constructed of slate which has deteriorated and cannot be repaired without total reconstruction of the Headgate;

NOW, THEREFORE, it is mutually agreed that there are no feasible and prudent alternatives to avoid or satisfactorily mitigate the adverse effects and that it is in the public interest to proceed with the undertaking in accordance with the following stipulations:

Stipulations

1. NPS will record the Bighorn Ditch Headgate so that there will be a permanent record of its existence. NPS will first contact the National Architectural and Engineering Records (NAER) (Heritage Conservation and Recreation Service, U.S. Department of the Interior, Washington, D.C. 20243; 202-343-6217) to determine the level of documentation required. All documentation must be accepted by NEAR.
2. Within 90 days after carrying out the terms of the Agreement, NPS shall provide a written report to all signatories to the Agreement on the actions taken to fulfill the terms of the Agreement.

Page 2  
Memorandum of Agreement  
Big Horn Ditch Headgate  
National Park Service

Robert Sawyer July 8, 1980  
Executive Director  
Advisory Council on Historic Preservation

Lorraine Mintz date 7-29-80  
National Park Service

Marcella Day - Deputy date 8-1-80  
Montana State Historic Preservation  
Officer

Richard H. Jenks date 9-15-80  
Chairman  
Advisory Council on Historic Preservation

# Advisory Council On Historic Preservation

APR 6 1981

Rocky Mountain  
Regional Office

Initial  
& Date

Regional Director	
Deputy Reg. Director	
Administration	
Park Operations	
PLAN & RESOURCE PRES.	
Communications & P.A.	
EEU	
<i>J. Schum</i>	
<i>Whitton</i>	
Arthur Isham	

1522 K Street, NW  
Washington, DC 20005

MAR 31 1981

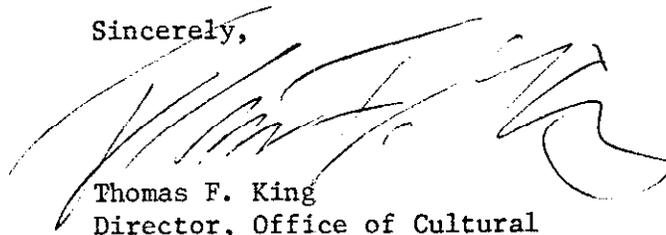
Mr. James B. Thompson  
Acting Regional Director  
Rocky Mountain Region  
National Park Service  
P. O. Box 25287  
Denver, Colorado 80225

Dear Mr. Thompson:

The Memorandum of Agreement for the Bighorn Canyon National Recreation Area General Management Plan as proposed January 20, 1980, submitted for Council consideration under the Programmatic Memorandum of Agreement (PMOA) has been ratified by the Chairman of the Council. This document constitutes the comments of the Council required by Section I.A. of the PMOA. A copy of the Agreement is enclosed.

The Council appreciates your cooperation in reaching a satisfactory resolution of this matter.

Sincerely,

  
Thomas F. King  
Director, Office of Cultural  
Resource Preservation

Enclosure

# Advisory Council On Historic Preservation

1522 K Street, NW  
Washington, DC 20005

## MEMORANDUM OF AGREEMENT

WHEREAS, the National Park Service (NPS), Rocky Mountain Region, proposes to implement the General Management Plan for Bighorn Canyon National Recreation Area, Montana; and,

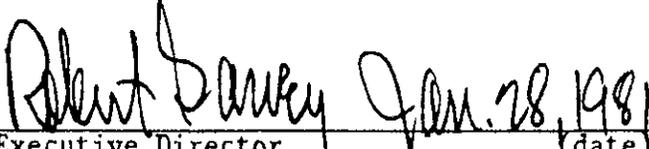
WHEREAS, NPS, in consultation with the Montana and Wyoming State Historic Preservation Officers (SHPO), has determined that this undertaking as proposed, may have an adverse effect on the cultural properties located within the Bighorn Canyon National Recreation Area that are included in or eligible for the National Register of Historic Places; and,

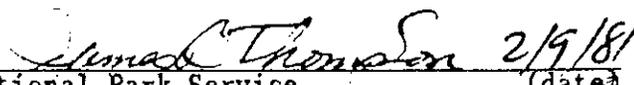
WHEREAS, pursuant to Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. Sec. 470f, as amended, 90 Stat. 1320), Section 2(b) of Executive Order 11593, "Protection and Enhancement of the Cultural Environment," and Section I.A. of the Programmatic Memorandum of Agreement between NPS, the Advisory Council on Historic Preservation (Council), and the National Conference of State Historic Preservation Officers, December 19, 1979, NPS has requested the comments of the Council;

NOW, THEREFORE, it is mutually agreed that the undertaking will be carried out in accordance with the Programmatic Memorandum of Agreement and the following stipulation.

### Stipulation

NPS will provide the Montana and Wyoming SHPO's, as appropriate, with a copy of each "Assessment of Effect" form prior to initiating any action affecting cultural properties. The SHPO(s) will respond within 15 working days if there is any objection to the action.

  
Executive Director (date)  
Advisory Council on Historic Preservation

  
Acting National Park Service (date)  
Rocky Mountain Regional Office



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PLANNING TEAM MEMBERS  
AND CONSULTANTS

PRINCIPALS

Allen R. Hagood - Team Captain - Denver Service Center  
Homer L. Rouse - Superintendent - Bighorn Canyon National  
Recreation Area  
Patrick Bauer - Park Naturalist - Bighorn Canyon National  
Recreation Area  
W. Wayne Gardner - Landscape Architect/Park Planner - Rocky  
Mountain Region  
John Hoesterey - Geographer - Denver Service Center  
Roberta V. Seibel - Interpretive Planner - Denver Service Center  
Dale W. Tomrdle - Ecologist - Denver Service Center  
Christine L. Turk - Environmental Specialist - Denver Service  
Center  
Robert Wemple - Environmental Engineer - Denver Service Center  
Stephen E. Whitesell - Landscape Architect - Denver Service Center

CONSULTANTS

Stuart W. Conner - Attorney - Billings, MT  
Division of Historic Preservation - Rocky Mountain Region  
Richard V. Giamberdine - Former Team Captain - Denver Service  
Center  
Sherry D. Jones - Outdoor Recreation Planner - Denver Service  
Center  
Richard B. Keigley - Biologist - Rocky Mountain Region  
Dr. Lawrence L. Loendorf - University of North Dakota - Grand  
Forks, ND  
Paul Newman - Historical Architect - Denver Service Center  
Park staff - Bighorn Canyon National Recreation Area  
Loren Pinckney - Marina Engineer - Boulder City, NV  
Emma Plume - Indian Liaison and Assistant Specialist - Rocky  
Mountain Region  
John C. Reed - Interpretive Planner - Rocky Mountain Region  
Lee Rentz - Former Environmental Specialist - Denver Service  
Center  
Robert Taylor - Environmental Protection Specialist - Southeast  
Region  
Dr. Larry Van Horn - Cultural Anthropologist - Denver Service  
Center  
Carla Van West - Archeologist - Midwest Archeological Center

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As the nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.