

P99/D-113

wild and scenic river study  
september 1979

# GUNNISON RIVER



COLORADO

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11/17/2003

The Heritage Conservation and Recreation Service (formerly the Bureau of Outdoor Recreation) conducted the field investigations for this study and prepared the formal draft report. Following reassignment of this study in March of 1978, the report was finalized and reprinted by the National Park Service.

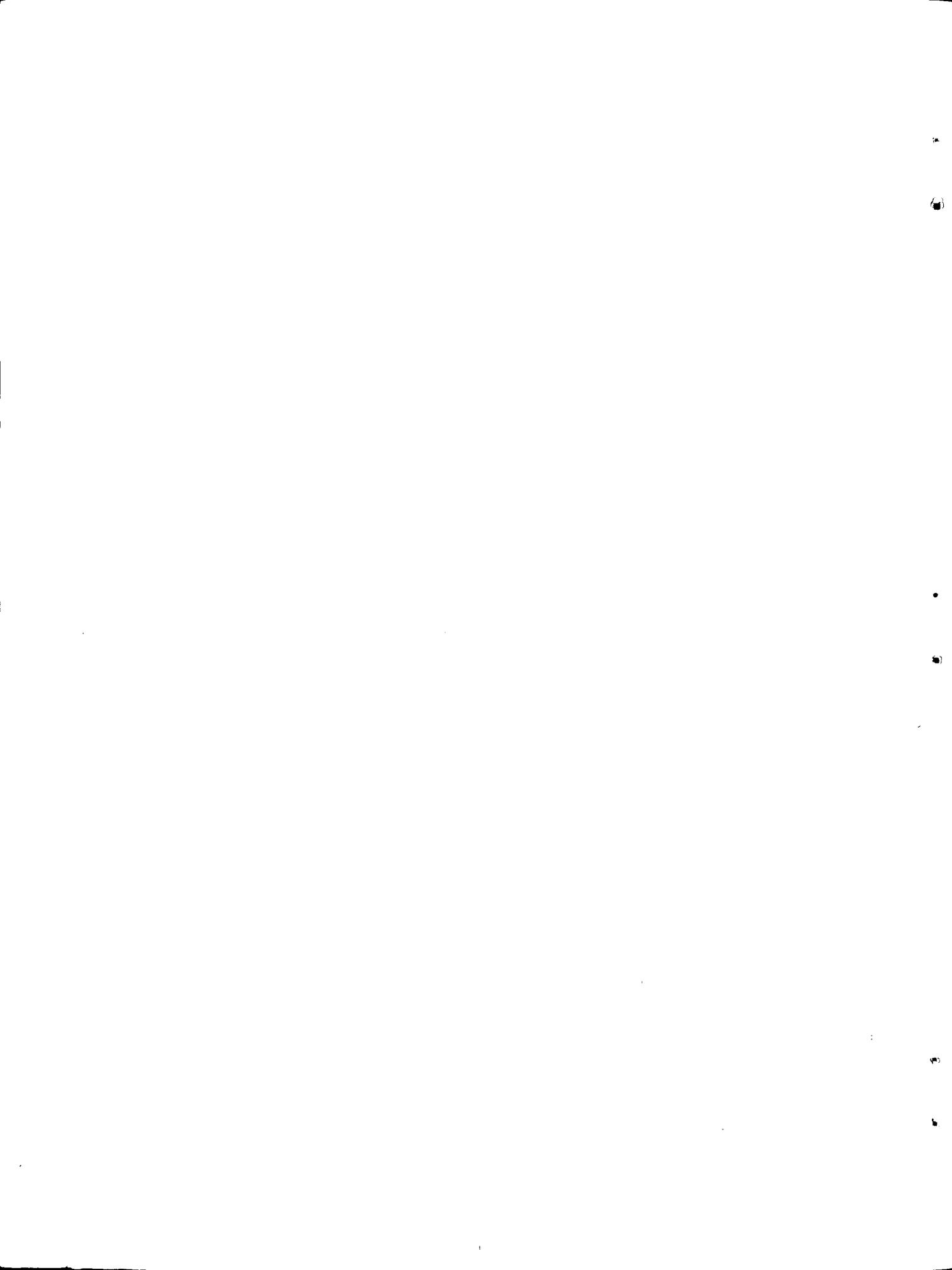
UNITED STATES DEPARTMENT OF THE INTERIOR

WILD AND SCENIC RIVER STUDY

GUNNISON RIVER

Prepared by  
National Park Service

in cooperation with  
The Colorado Department of Natural Resources



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## P H O T O   C R E D I T S

National Park Service--Pages 43, 62 upper, 88, 98 lower, 104.  
 U.S. Geological Survey--62 lower, 67, 68 upper, 75.  
 Bureau of Land Management--65, 112.  
 Colorado Division of Wildlife--68 lower, 98 upper.  
 Heritage Conservation and Recreation Service--71, 101, 110, 112.

## S U M M A R Y   O F   F I N D I N G S A N D   R E C O M M E N D A T I O N S

The segment of the Gunnison River evaluated by this study, as shown in figure I-1, extends approximately 29 miles (47 km) from the upstream (southern) boundary of the Black Canyon of the Gunnison National Monument downstream to the confluence with the North Fork. Some of the more important considerations affecting this study are summarized in this section.

### FINDINGS

Existing management of the Gunnison River study area under the administration of the National Park Service and Bureau of Land Management primarily addresses outdoor recreation. There is a small amount of land adjoining the lower end of the study segment, comprising about 10 percent of the total study corridor, in private ownership and used mainly for agriculture.

#### Eligibility and Classification

Based on criteria specified in the Wild and Scenic Rivers Act (as amended) and joint Interior-Agriculture Guidelines,<sup>1</sup> 26 miles (42 km) of the upper study corridor were found to qualify for designation as a wild river. The Gunnison is free-flowing; its

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1. Guidelines for Evaluating Wild, Scenic, and Recreational River Areas Proposed for Inclusion in the National Wild and Scenic Rivers System Under Section 2, Public Law 90-542. February 1970.

length is sufficient to provide a "meaningful experience"; it has an adequate volume of high quality water; its watershed and shoreline are primitive and relatively inaccessible; and its environs possess outstandingly remarkable scenic, geologic, recreational and wildlife values.

### Principles and Standards Analysis

Socioeconomic evaluations conducted for the study indicate that both environmental quality and national economic development objectives will be maximized by designation of the eligible river corridor. Except for the loss of peaking power potential within the eligible segment, electric power and domestic water supply needs can probably be satisfied at less cost by water resources development projects located outside the eligible study segment.

### Legislative Mandates

Numerous executive and legislative mandates affect the federally owned or controlled lands in the study area. Those applying to lands in the Gunnison River corridor include the Antiquities Act of 1906, the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, Executive Order 11593, and the Endangered Species Act of 1973.

The monument segment of the study corridor was established as part of the National Park System on March 2, 1933, by Presidential Proclamation No. 2033. Most of the river corridor through Black Canyon of the Gunnison National Monument is within an 11,180-acre (4,524-ha) wilderness area designated in 1976 by Public Law 94-567.

Below the monument, the river segment is managed by the Bureau of Land Management within an area established as the Gunnison Gorge Recreation Lands by Public Land Order No. 5261 on October 1, 1972. Since this designation was initiated by the Secretary of the Interior, it lacks the statutory protection afforded the monument segment. The Federal Land Policy and Management Act of 1976 (P.L. 94-479), however, requires that areas of outdoor recreation and scenic values, such as exist along the river in the Gunnison Gorge Recreation Lands, be identified and inventoried, and that priority in this endeavor be given ". . . to the designation and protection of areas of critical environmental concern."

#### Other Considerations

The American peregrine falcon and bald eagle, which are on the Federal list of endangered species, and the river otter, which is on the Colorado state list, inhabit the study area. Peregrine falcons were last seen in the area in 1974, but both the monument and gorge contain excellent falcon habitat. Numerous bald eagles winter in the region. River otters have been sighted in 1974 and 1975, and this endemic population is being increased by an ongoing Colorado Division of Wildlife reintroduction program.

There are several species of endangered, threatened, or sensitive plants located in the regional area. Their presence within the river corridor, however, has not been verified by any systematic inventory.

Although there are many historic and archeologic sites in the study area, none is listed on the National Register of Historic Places at present. There are no National Historic, Natural, or Environmental Education Landmarks in the area under study.

The study area contains no known mineral resources in sufficient quantity to permit their extraction for commercial purposes. No prospecting or mining, however, is permitted in the monument.

Gunnison River water is a prime regional energy resource being considered for possible development. Conditional decrees in the study corridor have been awarded by the water courts of Colorado to the Colorado-Ute Electric Association, Pittsburg and Midway Coal Mining Company, and the City of Delta. Because of the limited amount of available water and the fact that, in some cases, the proposed water development projects associated with these decrees overlap, it is likely that only one, or possibly two, of the projects could be developed.

#### RECOMMENDATIONS

Approximately 26 miles (42 km) of the 29-mile (47-km) Gunnison River study segment are eligible for inclusion in the National Wild and Scenic Rivers System as a wild river. The eligible river segment and its immediate environment of about 12,900 acres (5,200 ha) extend from the upstream (southern) boundary of the Black Canyon of the Gunnison National Monument to about 1 mile (1.6 km) below the confluence with the Smith Fork River. The recommendation of the U.S. Department of the Interior and the Colorado Department of Natural Resources is that the eligible segment be designated a component of the national system by amendment of the Wild and Scenic Rivers Act and be classified as a wild river.

Management of the river will continue under the administration of the National Park Service and Bureau of Land Management. If the river is designated as a component of the national system, the Bureau of Land Management will develop a detailed management plan

for the Gunnison Gorge Recreation Lands. Similarly, the National Park Service will address wild river designation in their existing general management plan for the Black Canyon of the Gunnison National Monument. The respective plans will define the exact boundaries of the river segment and establish policies for its management consistent with the preservation of its outstanding natural values.



# CHAPTER I

## INTRODUCTION

On October 2, 1968, Congress passed the Wild and Scenic Rivers Act (Public Law 90-542). This act created a national policy of preserving certain outstanding rivers or river segments for the enjoyment of present and future generations. To implement this policy, Congress established the National Wild and Scenic Rivers System and designated all or portions of eight rivers as initial components of that system. There are now 27 rivers or river segments in the national system.

Other rivers mentioned in the original act, and in subsequent amendments to it have been or are being studied. The amendment of January 3, 1975, P.L. 93-621, designated 29 additional rivers for study, 12 of which are located in Colorado. Among these potential additions is the 29-mile (46-km) segment of the Gunnison River from the upstream (southern) boundary of Black Canyon of the Gunnison National Monument to its confluence with the North Fork (figure I-1). The legislation required that a report on the river's suitability for inclusion in the national system be submitted to the President for transmittal to Congress no later than October 2, 1979.

### LEGISLATIVE MANDATES

Procedures and criteria for determining the eligibility and classification of a river which may qualify as part of the national system are outlined in the act and in joint guidelines issued in February 1970 by the Departments of the Interior and Agriculture. The information presented in chapters II and III of this report was used to determine the eligibility of the Gunnison River; a discussion of its eligibility and classification is presented in chapter IV.

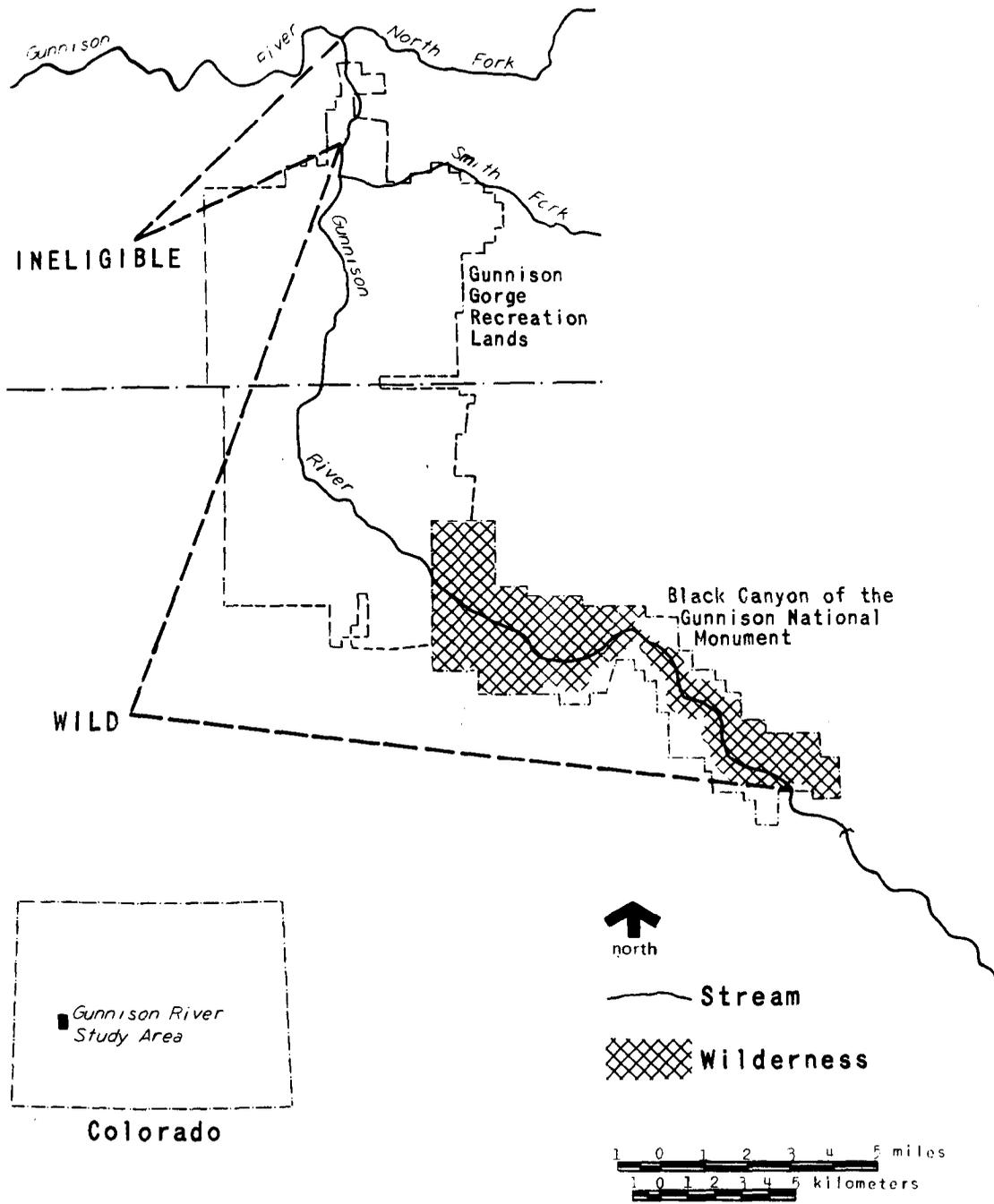


Figure 1-1  
**PROPOSED GUNNISON  
 RIVER DESIGNATION**  
 GUNNISON WILD AND SCENIC RIVER

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Since wild and scenic river studies involve decisions concerning future use of water and related land resources, each study must include a socioeconomic analysis of the effects that may result from designating the river as part of the national system. Procedures for making such an analysis were developed by the Water Resources Council and published in the Federal Register September 10, 1973 (volume 38, number 174). The process, known as Principles and Standards analysis, is presented in chapter V.

As required by the National Environmental Policy Act (NEPA) of January 1, 1970 (P.L. 91-190), an evaluation was made of environmental impacts associated with the proposed action. This evaluation is presented in the environmental statement, a separate document displaying all the impacts of the proposal so that environmental effects may be fully considered.

## THE STUDY

A joint federal-state study team was organized in January 1976 to conduct the Gunnison River study. Leadership responsibilities for the study were shared by the Bureau of Outdoor Recreation (since renamed the Heritage Conservation and Recreation Service) and the Colorado Department of Natural Resources (represented by the Colorado Water Conservation Board). Other member agencies of the study team included the Bureau of Land Management, National Park Service, and U.S. Fish and Wildlife Service.

Assisting the study team was a work group composed of numerous federal and state agencies that wrote and reviewed various parts of the study report and environmental statement. In addition, individuals called auditor/consultants were elected by the public, met with the study team on several occasions, and otherwise participated in the study. Direct public input was solicited through

the formal review process and at three series of public meetings held in Hotchkiss, Delta, Montrose, Grand Junction, and Denver, Colorado.

Basic information used in developing the study report and environmental statement was obtained from a variety of sources, including those referenced in the bibliography. Other information was supplied by study team or work group members having special expertise in the subjects covered.

Before making the determination of eligibility and classification presented in chapter IV, a field reconnaissance was conducted by members of the study team and work group, as well as by auditor/consultants, representatives of private industry, and interested organizations.

An important part of the Principles and Standards analysis involved meeting with representatives of private industry to obtain pertinent information and plans on water resource development projects proposed for the study corridor.

#### MAJOR ISSUES AND CONCERNS

There are several water resource development projects within the Gunnison River study segment which are discussed in the "Water Resources" section of chapter III. There are also endangered wildlife species, including the American peregrine falcon, bald eagle, and river otter, in the study area. One major issue is the potential conflict between construction of any water development project and protection of endangered species and other river resource values.

In addition to the corridor's outstanding scenery, geology, recreation, and wildlife, future investigations may identify endangered, threatened, or sensitive plant species--known to occur in the area--within the study corridor. There are also a number of historic sites in the study corridor that may qualify for inclusion on the National Register of Historic Places. There are no known mineral deposits of commercial value in the study corridor; but there is always the possibility that some may be located here, and mining activity in the gorge could conflict with river values. (Prospecting and mining are prohibited in the monument.) The Gunnison Wild and Scenic River Study brings all of these concerns into focus.

#### ACKNOWLEDGEMENTS

Although the Bureau of Outdoor Recreation (Heritage Conservation and Recreation Service) and later the National Park Service shared leadership responsibility for the study with the Colorado Department of Natural Resources (Colorado Water Conservation Board), including the decision on a final recommendation, it was a comprehensive effort dependent upon the assistance of numerous other participating agencies, organizations, and individuals. Major parts of the study, including the Principles and Standards analysis, conduct of public meetings and field trips, and collection of basic data were accomplished by the Bureau of Land Management. Also of considerable importance was the assistance provided by the National Park Service (prior to transfer of study responsibility to NPS) and by the U.S. Fish and Wildlife Service.

Public input was vital in guiding and directing the study team in those areas of greatest concern. Without such participation it would have been difficult to adequately treat the major issues affecting the study. The divergent viewpoints expressed by the

public throughout the study led to the development of the wide range of alternative plans considered in the Principles and Standards analysis. More than 400 people attended public meetings, giving both oral and written comments; nearly 100 letters were received representing a full range of views. The majority of feelings expressed to the team favored some form of preservation for the river.

## CHAPTER II

### GUNNISON RIVER REGION

The Gunnison River rises among the high peaks of the Sawatch Range and flows generally west for about 250 miles (402 km), joining the Colorado River near the city of Grand Junction (see figure 2-1). The Gunnison and its tributaries drain parts of the Sawatch, West Elk, and San Juan Ranges, as well as the Uncompahgre Plateau, totaling some 3,000 miles (4,828 km) of channel. The natural environment is extremely diverse within the Gunnison basin.

#### NATURAL ENVIRONMENT

The region described in the following text corresponds to the Gunnison River basin located in southcentral Colorado. The basin encompasses about 8,020 square miles (20,772 km<sup>2</sup>), or approximately 8 percent of the entire state of Colorado. At its greatest dimensions, the region is some 145 miles (233 km) across from east to west and 95 miles (153 km) wide from north to south.

#### Physiography and Geology

The region ranges in elevation from approximately 4,550 feet (1,387 m) at Grand Junction to about 14,300 feet (4,359 m) at Uncompahgre Peak in northwest Hinsdale County. Mountain ranges in the eastern part of the region are composed mostly of Precambrian metamorphic and igneous rocks that have been uplifted, except for the West Elk and Elk Mountains.

The West Elks are composed of thick volcanic piles and several uplifted structures that were formed by Tertiary igneous



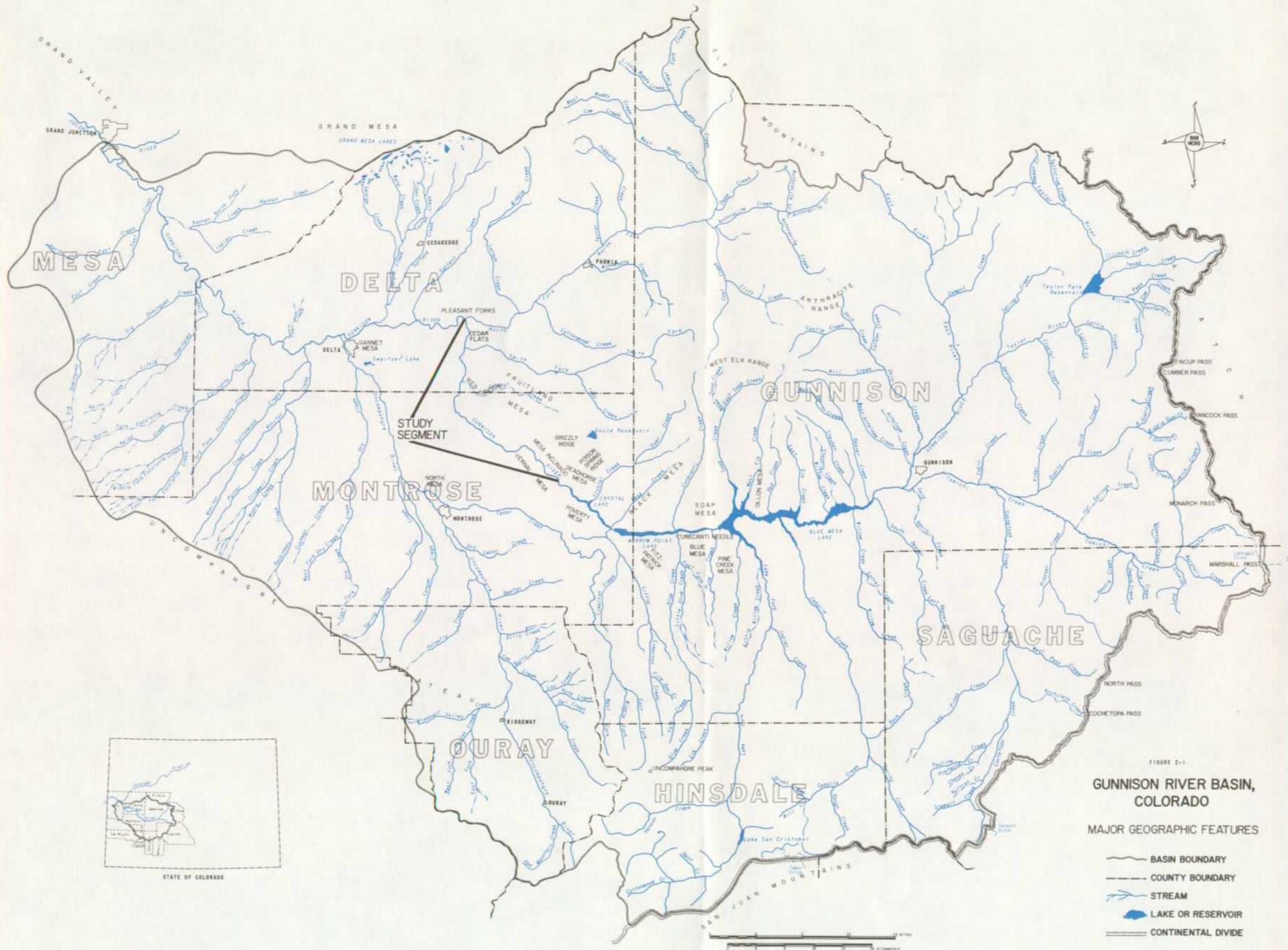
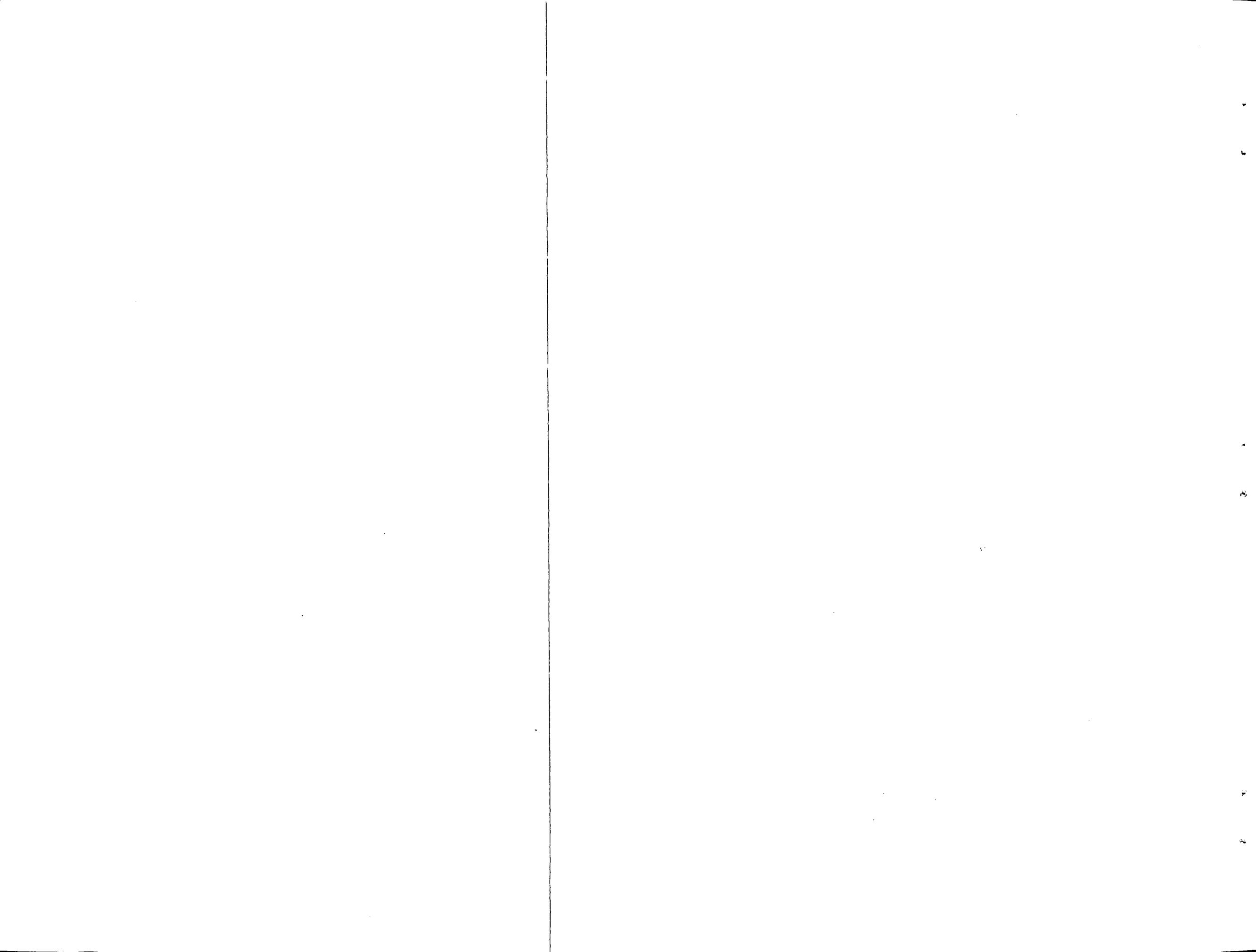


FIGURE 2-1  
**GUNNISON RIVER BASIN,  
 COLORADO**

- MAJOR GEOGRAPHIC FEATURES
- BASIN BOUNDARY
  - - - COUNTY BOUNDARY
  - STREAM
  - LAKE OR RESERVOIR
  - == CONTINENTAL DIVIDE

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intrusions. The Elk Mountains are composed mostly of folded and faulted sedimentary rocks. In the western part of the region, several thousand-foot-thick beds of sedimentary rocks, chiefly of the Paleozoic and Mesozoic ages, rest on the Precambrian basement. In the southern part of the region, the San Juan Mountains consist chiefly of volcanic rocks. The basin's geology is illustrated in figure 2-2.

### Mineral Resources

The eastern mountains rimming the region, particularly in the southeast, lie partly in the Colorado mineral belt (see figure 2-3). Large amounts of precious and base metals, as well as significant amounts of uranium, tungsten, manganese, molybdenum, iron, and titanium, have been produced in the Gunnison River basin.

Records of the Grand Junction office of the Department of Energy (formerly the Energy Research and Development Administration) show that as of January 1, 1977, 10 properties within the region have produced 414,500 tons (376,032 metric tons) of uranium ore having an average grade of 0.27 percent  $U_3O_8$ . Considered to be high grade, the ore contained 2,266,400 pounds (1,028 metric tons) of uranium oxide. Nearly all of the ore was processed at a Gunnison, Colorado, mill which operated from February 1958 to April 1962 with a capacity of 200 tons (191 metric tons) of ore per day.

### Energy Resources

Coal, oil, and gas are the primary fossil fuels found in the region. In addition, there are a number of both thermal and hydropower electric generation facilities. Although there are some geothermal

resources in the region, they have limited values for recreation, space heating, and other minor uses. As mentioned in the "Mineral Resources" section, uranium is another important energy source found in the region.

Fossil Fuels. Most of the fossil fuel resources are concentrated in the western half of the region. The Uinta coal region, which overlaps the lower part of the study area, contains the largest deposits of any of Colorado's eight coal regions.<sup>1</sup> Coal fields in this region occur on moderately-to-steeply-dipping flanks of the Piceance basin, a southeastward extension of Utah's Uinta basin.

Much of the region is not favorable for oil and gas occurrence due to a lack of potential source rocks. Broad areas are underlain by igneous rock, or by Precambrian rocks at or near the surface. The remaining sedimentary areas of the region have not yet been fully explored. Only Delta, Mesa, and Montrose Counties are known to have oil or gas resources. There were 34 producing wells in Mesa County and none in Delta or Montrose Counties at the close of 1976. Total accumulative production to date for Mesa County is 16,646 barrels of oil and 61.4 million cubic feet (1.74 million cubic meters) of natural gas.

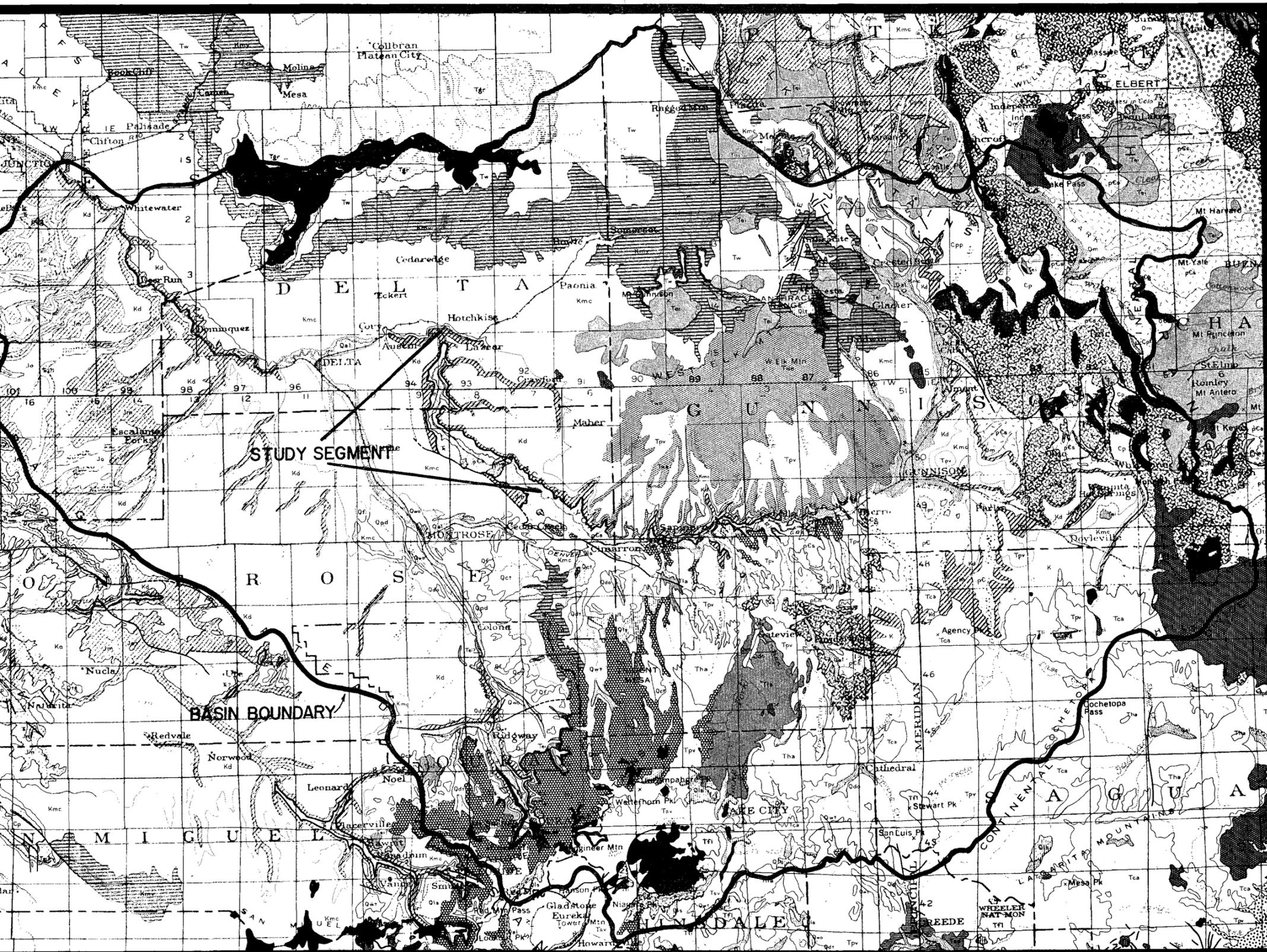
Electric Power Sources. Facilities for producing electric power in the region are depicted in figure 2-3. Except for a few small plants built by electric utilities as single-purpose power projects, hydroelectric power resources in the region have been developed mainly by the Bureau of Reclamation as part of the Curecanti

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1. Hornbaker, A. L. and Holt, Richard D. 1972 Summary of Coal Resources in Colorado, Special Publication No. 3, Colorado Geological Survey, Department of Natural Resources, 1973, p. 14.

# GUNNISON RIVER BASIN, COLORADO

## SEDIMENTARY, IGNEOUS, AND METAMORPHIC ROCKS



### SEDIMENTARY ROCKS

- Alluvium
- Landslides and talus
- Wisconsin glacial outwash
- Moraines
- Durango glacial outwash
- Cerro till
- Green River formation
- Ohio Creek conglomerate
- Mancos shale
- Dakota sandstone
- Older Jurassic undivided
- Cutler and Rico formations undivided
- Permian and Pennsylvanian undivided
- Ordovician and Cambrian undivided
- Landslides and mud flows
- Wisconsin till
- Post-Durango deposits
- Durango till
- Florida gravel
- Telluride conglomerate
- Wasatch formation
- Mesaverde group of Colorado River Valley
- Cretaceous undivided
- Morrison formation
- Triassic undivided
- Pennsylvanian undivided
- Mississippian and Devonian undivided

### SEDIMENTARY, IGNEOUS, AND METAMORPHIC ROCKS

- Undivided metamorphic and igneous rocks
- Slate, quartzite, and conglomerate
- Granite and related rocks
- Schist and gneiss

### EXTRUSIVE IGNEOUS ROCKS

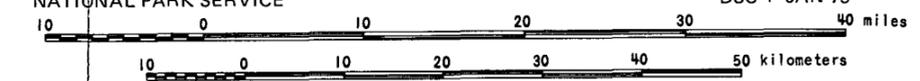
- Andesite-basalt and rhyolite
- Fisher latite-andesite
- Volcanic rocks undivided
- Sunshine Peak rhyolite
- West Elk breccia
- Andesite and basalt
- Piedra rhyolite (youngest), Huerto andesite, Alboroto quartz latite, Sheep Mountain andesite, and Treasure Mountain quartz latite (oldest)
- Conejos andesite
- San Juan tuff
- Lake Fork andesite

### INTRUSIVE IGNEOUS ROCKS

- Late Tertiary intrusive rocks
- Early Tertiary intrusive rocks
- Intrusives of pre-Fisher latite-andesite age

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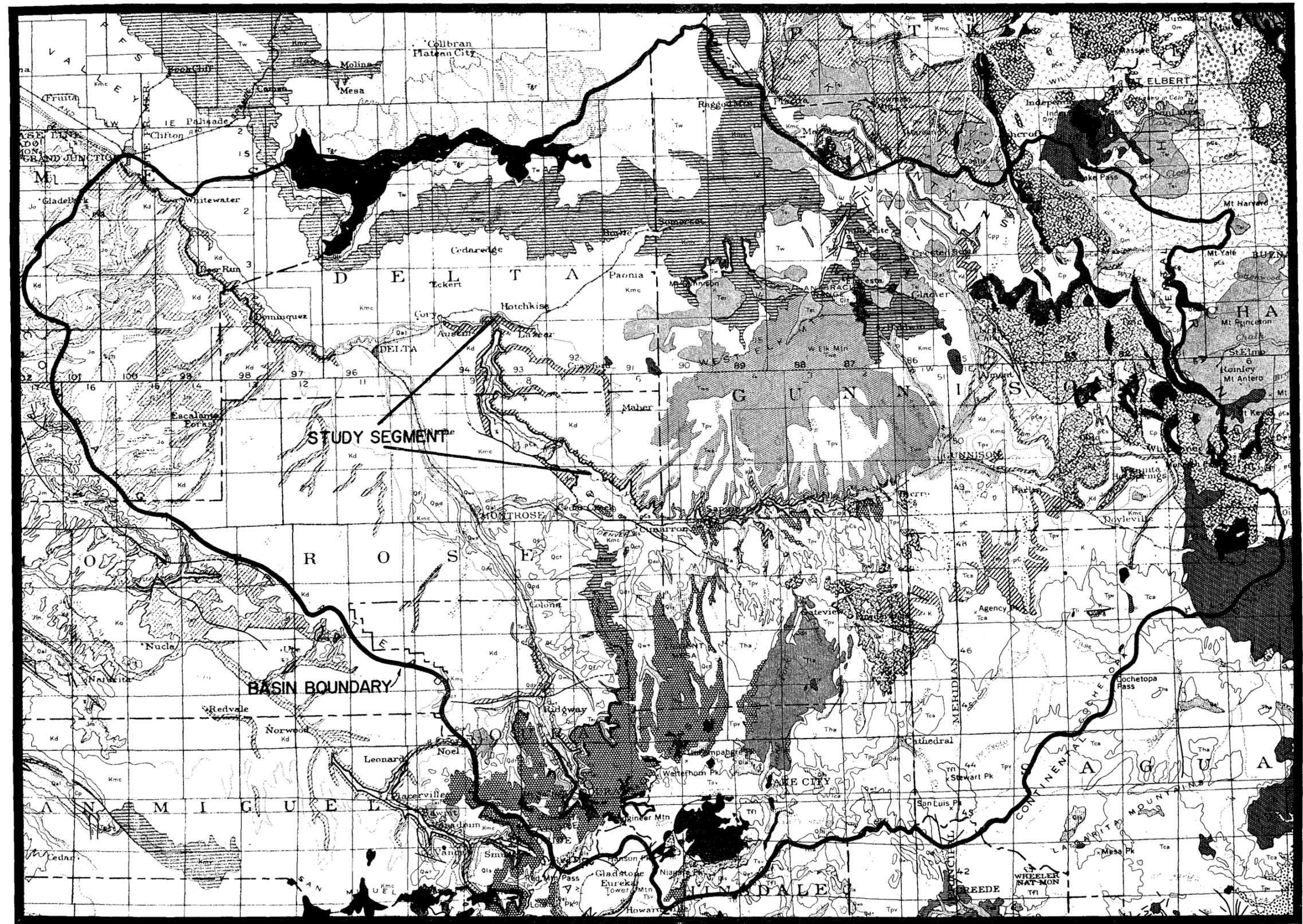


Source: U. S. Department of the Interior, Geological Survey

FIGURE 2-2

# GUNNISON RIVER BASIN, COLORADO

## SEDIMENTARY, IGNEOUS, AND METAMORPHIC ROCKS



### SEDIMENTARY ROCKS

- Alluvium
- Landslides and talus
- Wisconsin glacial outwash
- Moraines
- Durango glacial outwash
- Cerro till
- Green River formation
- Ohio Creek conglomerate
- Mancos shale
- Dakota sandstone
- Older Jurassic undivided
- Cutler and Rico formations undivided
- Permian and Pennsylvanian undivided
- Ordovician and Cambrian undivided
- Landslides and mud flows
- Wisconsin till
- Post-Durango deposits
- Durango till
- Florida gravel
- Telluride conglomerate
- Wasatch formation
- Mesaverde group of Colorado River Valley
- Cretaceous undivided
- Morrison formation
- Triassic undivided
- Pennsylvanian undivided
- Mississippian and Devonian undivided

### SEDIMENTARY, IGNEOUS, AND METAMORPHIC ROCKS

- Undivided metamorphic and igneous rocks
- Slate, quartzite, and conglomerate
- Granite and related rocks
- Schist and gneiss

### EXTRUSIVE IGNEOUS ROCKS

- Andesite-basalt and rhyolite
- Fisher latite-andesite
- Volcanic rocks undivided
- Sunshine Peak rhyolite
- West Elk breccia
- Andesite and basalt
- Piedra rhyolite (youngest), Huerto andesite, Sheep Mountain andesite, and Treasure Mountain andesite
- Conejos andesite
- San Juan tuff
- Lake Fork andesite

### INTRUSIVE IGNEOUS ROCKS

- Late Tertiary intrusive rocks
- Early Tertiary intrusive rocks
- Intrusives of pre-Fisher latite-andesite age

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10 0 10 20 30 40 50 kilometers

Source: U. S. Department of the Interior, Geological Survey

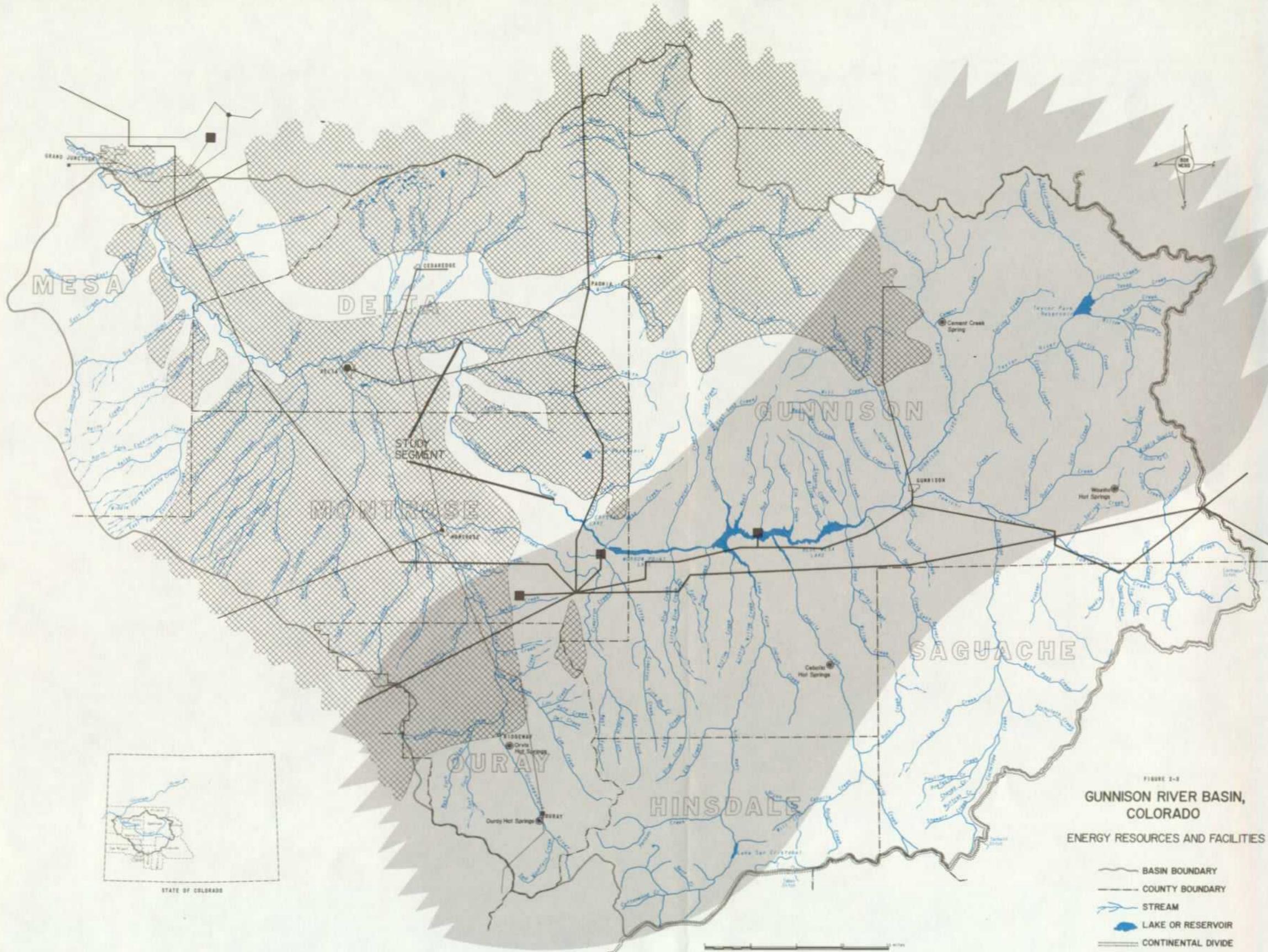


FIGURE 2-3  
**GUNNISON RIVER BASIN,  
 COLORADO**  
 ENERGY RESOURCES AND FACILITIES

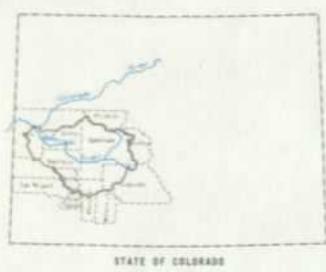
- BASIN BOUNDARY
- COUNTY BOUNDARY
- STREAM
- LAKE OR RESERVOIR
- CONTINENTAL DIVIDE
- COLORADO MINERAL BELT
- COAL RESOURCES
- THERMAL SPRINGS AND WELLS



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- | ELECTRICAL POWER FACILITIES |         |
|-----------------------------|---------|
| ●                           | FEDERAL |
| ●                           | PUBLIC  |
| ●                           | PRIVATE |



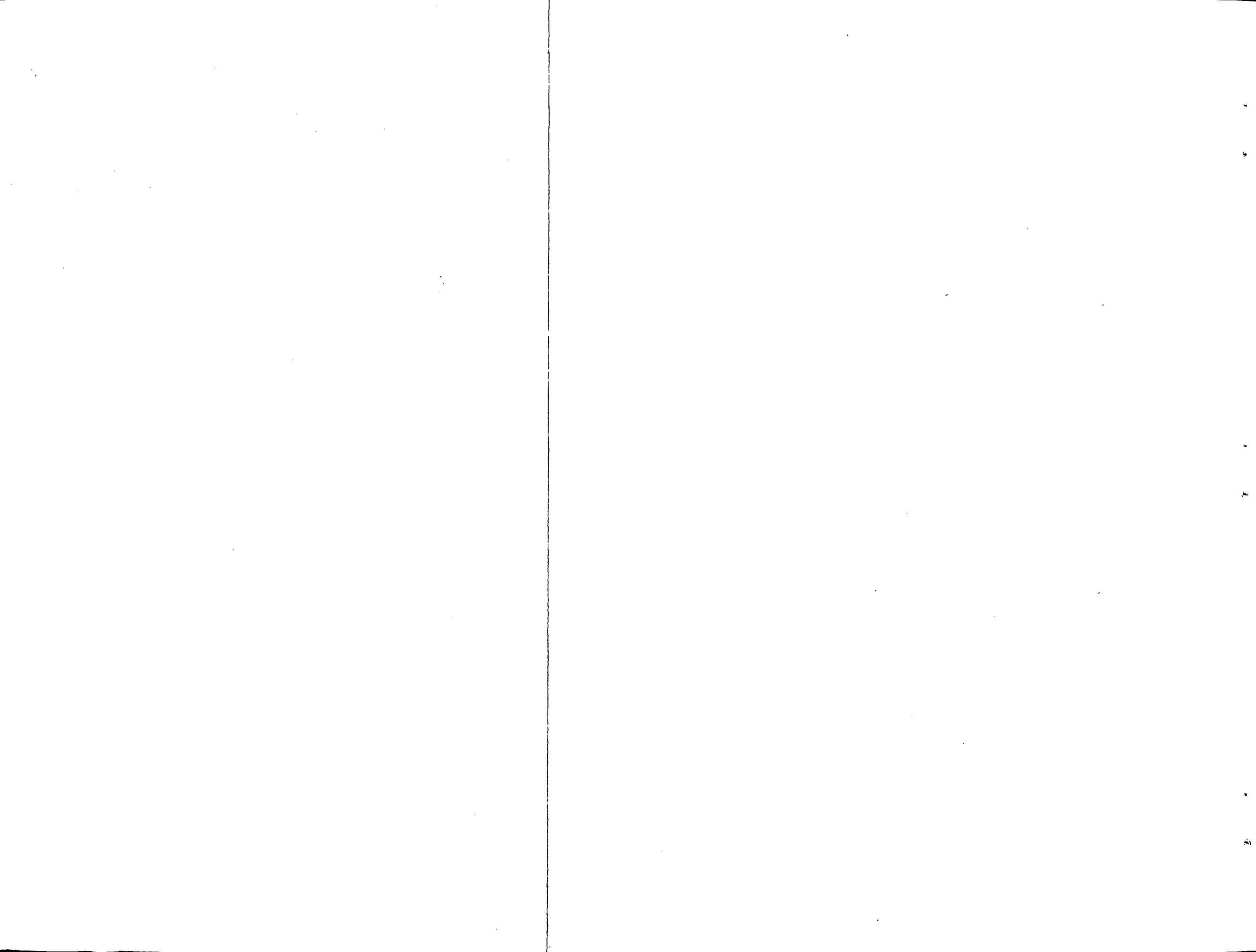


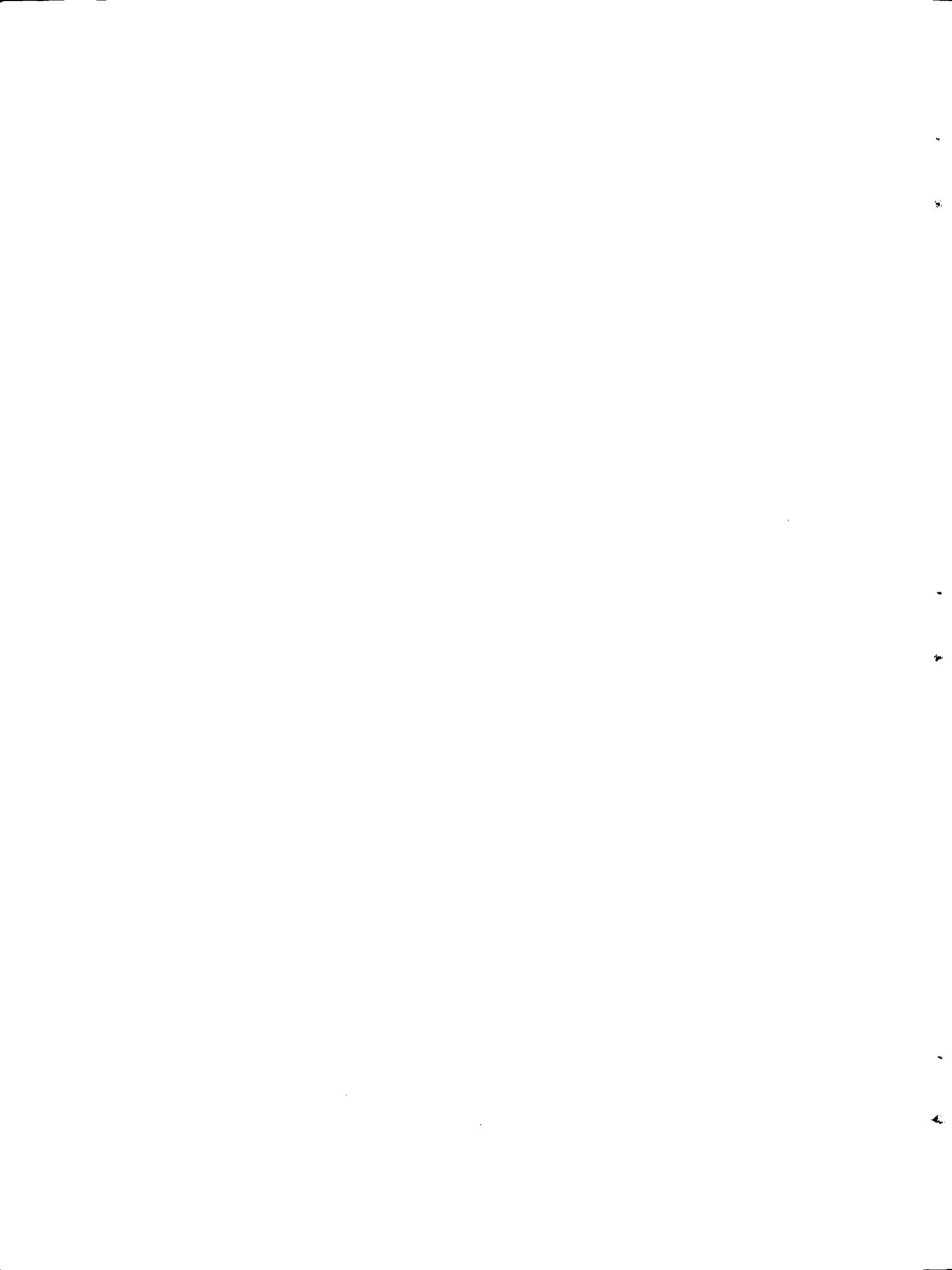
TABLE 2-1

Gunnison River Region<sup>1</sup>

## SOILS

Soil Map Unit	Occurrence	Elevation feet (meters)	Where Formed	Precipitation inches (centimeters)
Typic Cryoboralf - rock outcrop	Mountainous areas. Timbered and mountain slopes, high plateaus, mesas, sparsely vegetated escarpments, and rock outcrops - over a broad area in the region.	7,500 - 11,500 (2,286 - 3,505)	In materials weathered from a variety of crystalline and sedimentary rocks.	20 - 40 (51 - 102) Mostly snow
Typic Cryoboralf - loamy	Mountainous areas. (Northeast corner of region.) Mountain slopes, glacial moraines, till plains, and alluvial fans.	9,000 - 11,500 (2,743 - 3,505)	In materials weathered in place or locally transported from a variety of crystalline and sedimentary rocks.	15 - 25 (38 - 63)
Typic Haplargid - loamy	Irrigated croplands. (Major portion of this unit.) Majority in private ownership. Confined mainly to narrow bands north and west of the river study area. Occupies mesas, high terraces, and alluvial fans.	5,000 - 6,000 (1,524 - 1,829)	- -	10 - (25)
Ustollic Haplargid - loamy - rock outcrop	Mesas, high benches, and mountain slopes; narrow canyons through the lower portion of the river study corridor and to the west.	5,000 - 8,000 (1,524 - 2,438)	In materials weathered residually or locally transported from sedimentary rocks, predominantly sandstone.	10 - 15 (25 - 38)
Typic Calcicrothid, Skeletal-Ustic Torriorthent - loamy	Northwest corner of the region. Mesas, benches, ridges, hillcrests, and high fans and terraces.	5,000 - 6,000 (1,524 - 1,829)	In materials weathered residually from shale and sandstone and in calcareous, cobbly alluvium from weathered basalt and sandstone.	8 (20)
Typic Torrifluvent - silty	Nearly level flood plains, alluvial fans, and narrow alluvial valleys such as occur only in a very limited area just east of the river study corridor.	4,800 - 6,500 (1,463 - 1,981)	In silt alluvium from alkaline shales.	10 (25)
Typic Torriorthent - clayey	Immediately to the west of the river study corridor. Hills, ridges, and shale breaks.	4,500 - 7,500 (1,372 - 2,282)	In materials weathered in place from saline shale.	10 (24)
Lithic Ustic Torriorthent - loamy - rock outcrop	Vicinity of river study corridor. Low hills, upland breaks, and colluvial slopes.	3,500 - 7,500 (1,067 - 2,286)	In materials weathered in place from sandstone and shale.	10 - 15 (25 - 38)
Pergelic Cryumbrept, Pergelic Cryochrept - skeletal - rock outcrop	Mainly along the eastern and southern periphery of the region. Comprised of alpine areas, most of which straddle the Continental Divide from north to south. Soils in this unit occupy slopes in alpine meadows where there are massive mountain peaks, rock outcrops, and rock slides.	11,000 - 14,500 (3,353 - 4,420)	In material weathered in place or locally transported largely from crystalline rocks.	30 - 50 (76 - 120)
Aridic Argiboroll - clayey; Aridic Haploboroll - clayey	Mostly on mountain slopes, mesas, and benches.	6,000 - 9,000 (1,829 - 2,743)	In material weathered in place from shale and sandstone.	15 - 25 (38 - 63)
Typic Cryoboroll - loamy - rock outcrop	Scattered throughout the extreme eastern and southern parts of the region. They occupy subalpine mountain slopes, mesas, and upland benches, and old high terraces and fans.	8,000 - 10,500 (2,438 - 3,200)	In a wide variety of materials consisting of glacial till and outwash, weathered sandstone, shale, disintegrated granite, and stony and cobbly coarse-textured alluvium.	15 - 20 (38 - 51)
Typic Cryoboroll - clayey; Typic Cryoboralf - skeletal	In several isolated areas in the eastern and southern half of the region.	7,000 - 11,500 (2,134 - 3,505)	In materials largely weathered in place from shale and sandstone at lower elevation and from igneous and metamorphic rocks at higher elevations.	15 - 25 (38 - 63)
Typic Cryoboroll - clayey; Typic Cryorthent - clayey	Occupy benches, mountain slopes, and alluvial fans mainly along the western border of the region.	8,000 - 10,000 (2,438 - 3,048)	In materials weathered in place from shale or sandstone.	15 - 20 (38 - 51)
Argic Cryoboroll - loamy; Typic Cryoboroll - loamy	On benches, mountain slopes, high terraces, hills, ridges, fans, till plains, moraines, and valley side slopes in the eastern central part of the region.	8,000 - 11,000 (2,438 - 3,353)	In residuum from a variety of crystalline and sedimentary rocks, glacial outwash, and colluvial-alluvial material.	15 - 30 (38 - 76)
Lithic Haploboroll - skeletal - rock outcrop	Located only in a very limited area on the eastern border of the region. Occupy mountain slopes, foothills, and ridges (hogbacks) formed by uplifted sedimentary rocks and colluvial materials from these rocks. Igneous and metamorphic rocks are the most common throughout most of the area where these soils occur.	5,500 - 8,000 (1,676 - 2,438)	- -	15 - 24 (38 - 61)

<sup>1</sup>Based on the Bulletin No. 566 S., *Soils of Colorado*, Colorado State University Experiment Station, Fort Collins (1977). Prepared in cooperation with the Soil Conservation Service, U. S. Department of Agriculture.



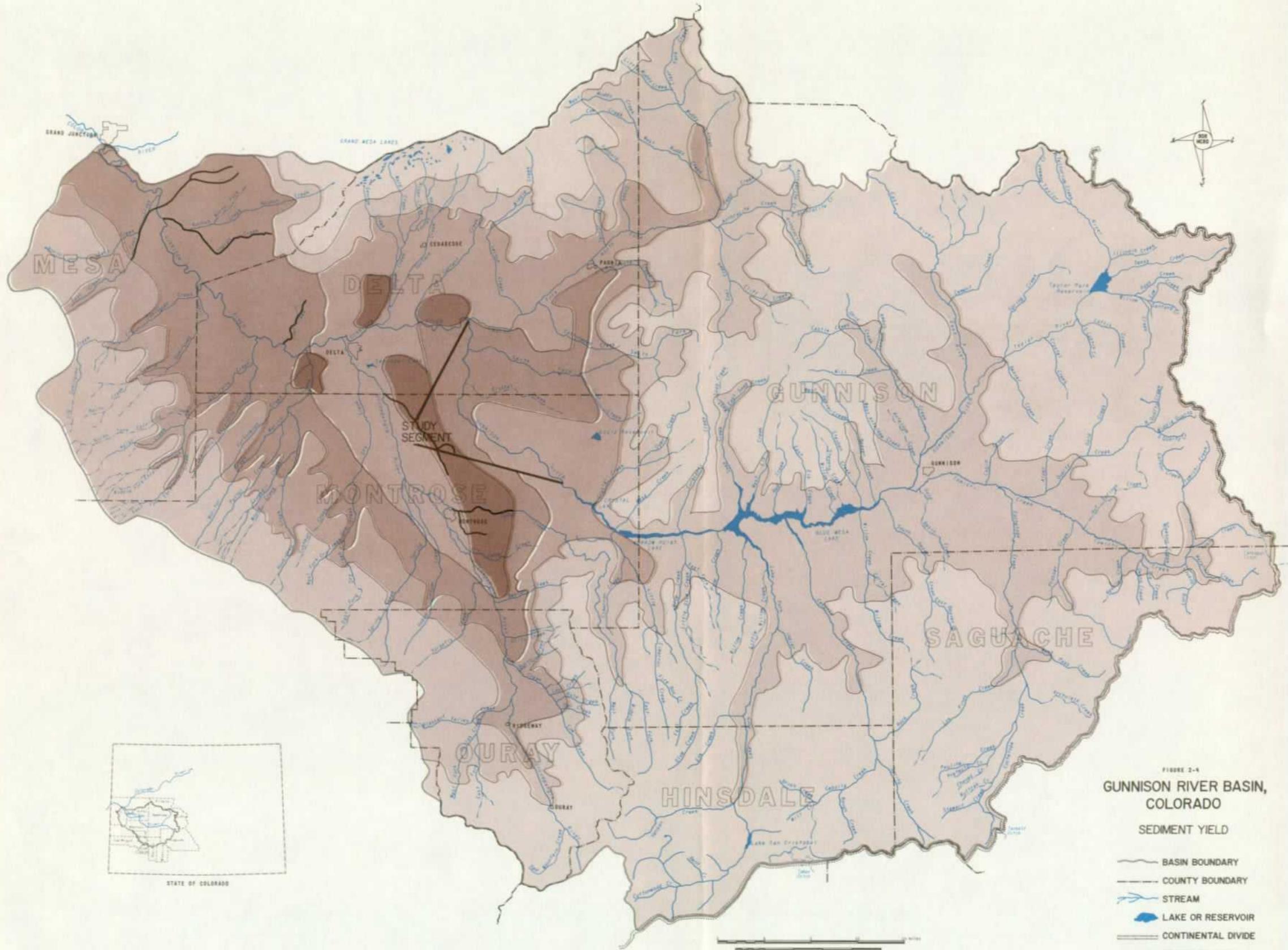


FIGURE 2-4  
 GUNNISON RIVER BASIN,  
 COLORADO

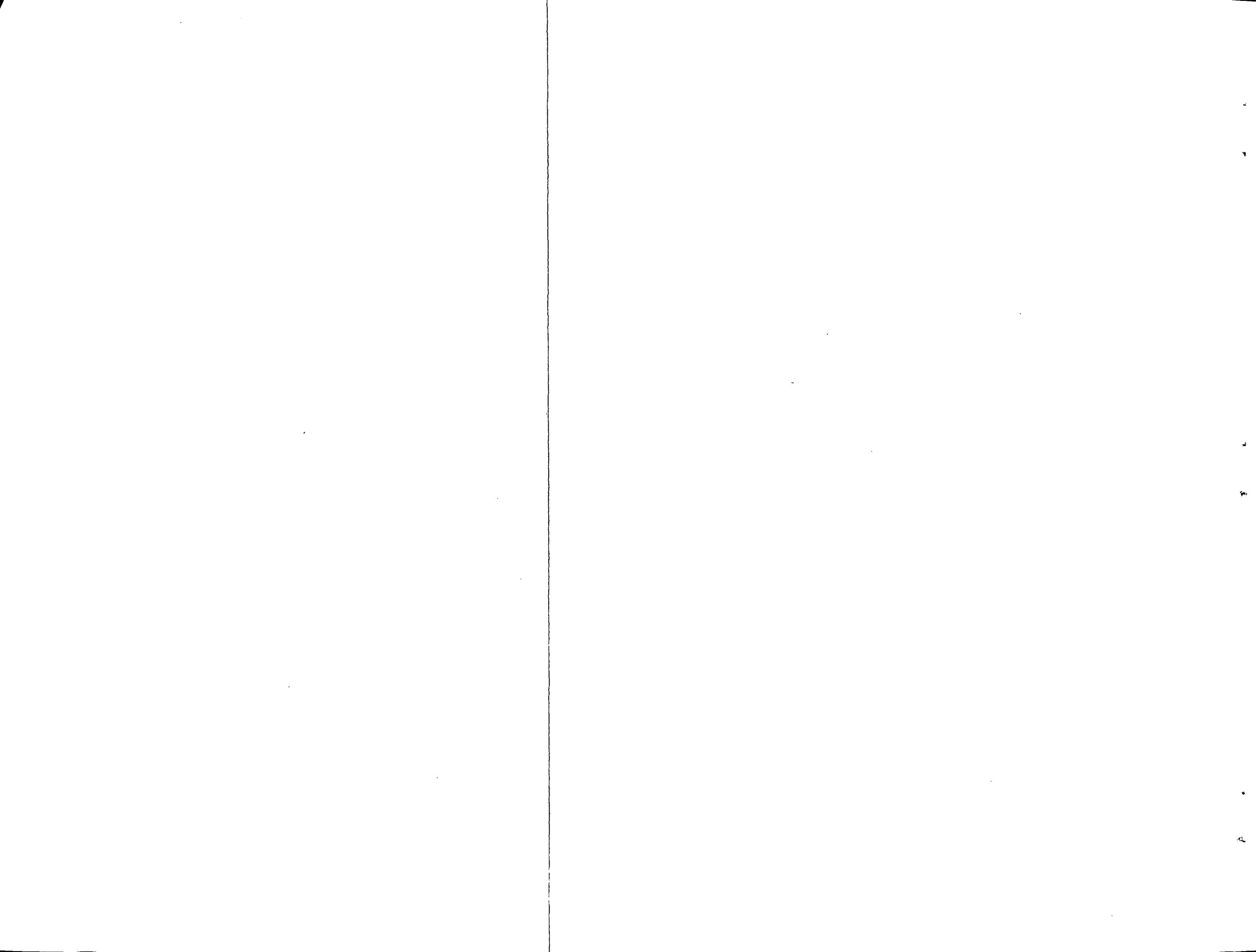
SEDIMENT YIELD

- BASIN BOUNDARY
- COUNTY BOUNDARY
- STREAM
- LAKE OR RESERVOIR
- CONTINENTAL DIVIDE
- SEVERE EROSION
- VERY HIGH YIELD
- HIGH YIELD
- MODERATE YIELD
- LOW YIELD
- VERY LOW YIELD

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Source: Colorado Land Use Commission

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Project. The installed capacity of the project's three existing reservoirs (Blue Mesa, Morrow Point, and Crystal) total 208 megawatts (MW). The installed capacity of the two remaining developed hydropower facilities in the region (Ouray and Redlands) is about 2 MW. The Ouray plant was struck by lightning in 1974 and has been out of operation since then.

Several other hydropower generation facilities have been proposed for development in the region; one is currently under study. The Bureau of Reclamation is investigating the feasibility of installing an additional generator on the outlet works at Blue Mesa Dam. This would produce 50 MW of additional peaking power (total annual power output would remain the same). If this proposal is implemented, it would have no effect on flows through the study segment.

There are four thermal-electric power facilities in the region. Two of these plants, Oliver and Jim Bullock, are steam-electric and owned by the Colorado-Ute Electric Association, Inc. While they have a combined capacity of 13 MW, only the Jim Bullock plant (10 MW) is presently in operation. The Delta plant is an internal combustion facility of about 5 MW installed capacity owned by the Delta Municipal Light and Power Company. The only existing industrial power facility in the region is a steam-electric generation plant of 2.5 MW capacity at Delta which is owned by the Holly Sugar Corporation.

It is estimated that total electrical generation from all sources was about 716,400 megawatt-hours (MWH) in 1975. Loads partially served by these facilities are located primarily in Arizona, Colorado, and Utah.

## Climate

Average annual precipitation varies from more than 40 inches (102 cm) at the higher elevations to less than 10 inches (25 cm) in the lower valleys. Annual precipitation at Montrose and Gunnison averages about 9.5 and 11.2 inches (24.2 and 28.5 cm), respectively.

Temperatures also vary considerably. The record official low temperature in Colorado occurred within the region on February 1, 1951, at Taylor Park Dam north of Gunnison when it dropped to -60°F (-51°C). Summer temperatures in the lower basin occasionally exceed 100°F (38°C). Average annual temperatures at Montrose and Gunnison are 49.1°F and 37.7°F (9.5°C and 3.2°C), respectively.

## Soils

Fifteen general soil map units occur in the region (see table 2-1). These units represent areas containing more than one kind of soil which are closely associated and characteristically found together within a particular type of landscape setting. Soil map units having good potential for such uses as camping, picnicking, hiking, and development of recreation facilities include two types--the Ustollic Haplargid unit, which is noted for the scenery associated with it; and the Aridic Argiboroll-Aridic Haploboroll unit, which has wildlife development potential, particularly for deer and grouse. These units, as well as the Lithic Ustic Torriorthent unit, are found in the study corridor.

Sediment yield, the mass of sediment transported per unit area per unit time, is very minor in the higher zones where most of the runoff is snowmelt and vegetative cover conditions are generally

good. Sediment yield classification parameters are defined in the following table:

SEDIMENT YIELD	
<u>TYPE OF EROSION</u>	<u>DEFINITION</u>
Severe	Stream banks or gullies with average depth of 5 feet (1.5 m) or more and having a sediment yield of 1.0-2.0 acre feet/bank mile/year (770-1530 m <sup>3</sup> /bank km/year)
Very High	1.0-3.0 acre feet/square mile/year (480-1430 m <sup>3</sup> /km <sup>2</sup> /year)
High	0.5-1.0 acre feet/square mile/year (240-480 m <sup>3</sup> /km <sup>2</sup> /year)
Moderate	0.2-0.5 acre feet/square mile/year (100-240 m <sup>3</sup> /km <sup>2</sup> /year)
Low	0.1-0.2 acre feet/square mile/year (50-100 m <sup>3</sup> /km <sup>2</sup> /year)
Very Low	less than 0.1 acre feet/square mile/year (less than 50 m <sup>3</sup> /km <sup>2</sup> /year)

Naturally high yields have been increased by overgrazing in the lower zones, and the arid climate has inhibited regeneration of the vegetation cover. As shown in figure 2-4, areas of both moderate and high sediment yield exist in the study corridor.

### Vegetation

A wide range of cover conditions exists, making this an area of great ecological diversity. In addition to irrigated and dry farmland, there are five major vegetative types present (see figure 2-5). Of these, approximately 52 percent of the pinyon-juniper-sagebrush, 37 percent of the salt desert shrub, 10 percent of the ponderosa pine-scrub oak, and 1 percent of the spruce-fir types have been converted to irrigated farmland. These altered lands



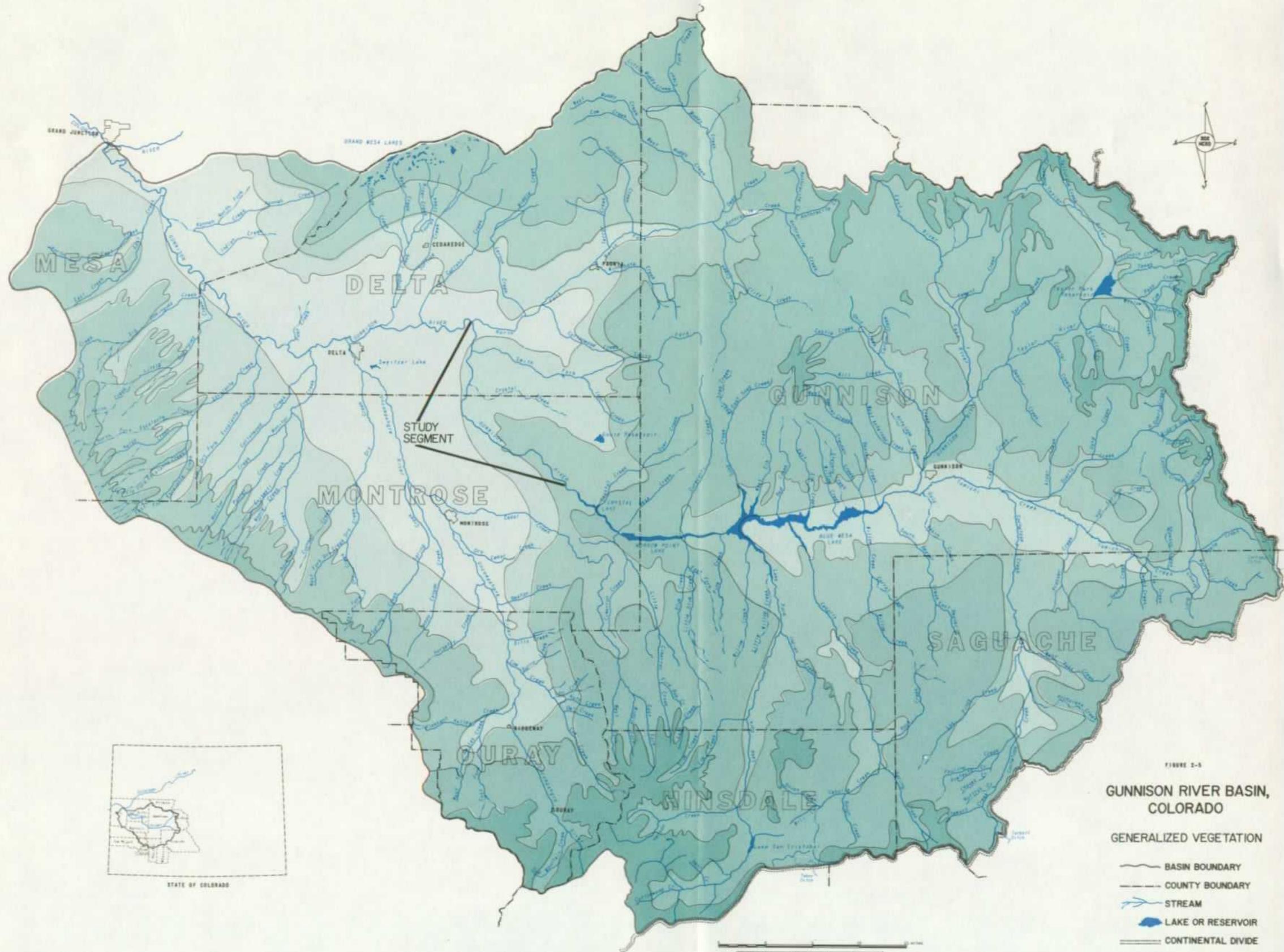
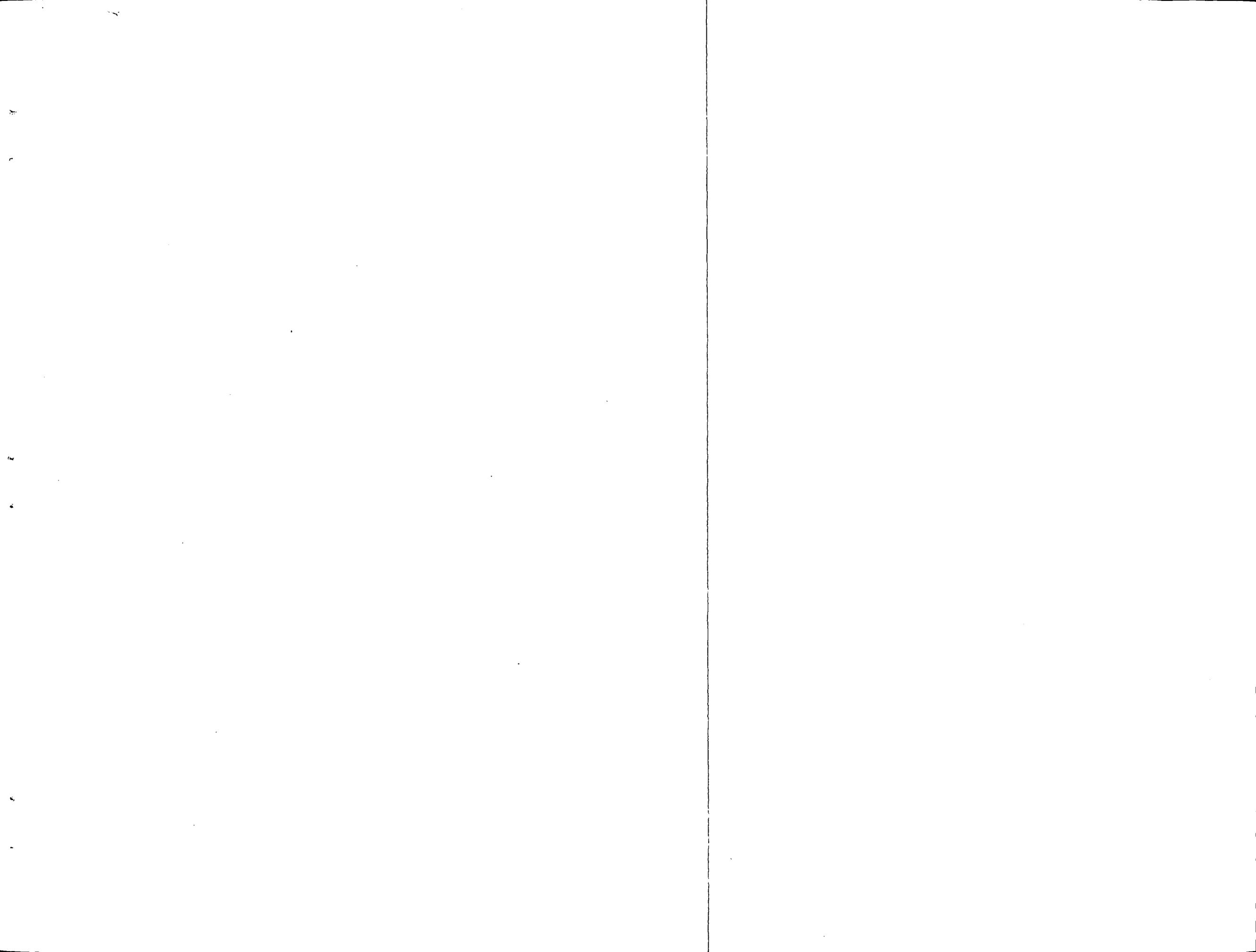


FIGURE 2-5  
**GUNNISON RIVER BASIN,  
 COLORADO**

**GENERALIZED VEGETATION**

- BASIN BOUNDARY
- COUNTY BOUNDARY
- STREAM
- LAKE OR RESERVOIR
- CONTINENTAL DIVIDE
- HINSDALE, WINTERPAC, GALLETTA
- SAGEBRUSH, PLYMOUTH PINE, JUNIPER, INDIAN RICEGRASS, NEEDLE-AND-THREAD, WESTERN WHEATGRASS
- SCRUB OAK, SAGEBRUSH, MOUNTAIN SHRUB, WESTERN WHEATGRASS
- LONGLEAF PINE, ENGLISH SPRUCE, DOUGLAS FIR, ASPEN, THIMBER FESCUE, MOUNTAIN BRASS
- GRASSES, SEDGES, WILLIAMS-BROOK TIMBERLINE

Source: U. S. Department of Agriculture, Soil Conservation Service



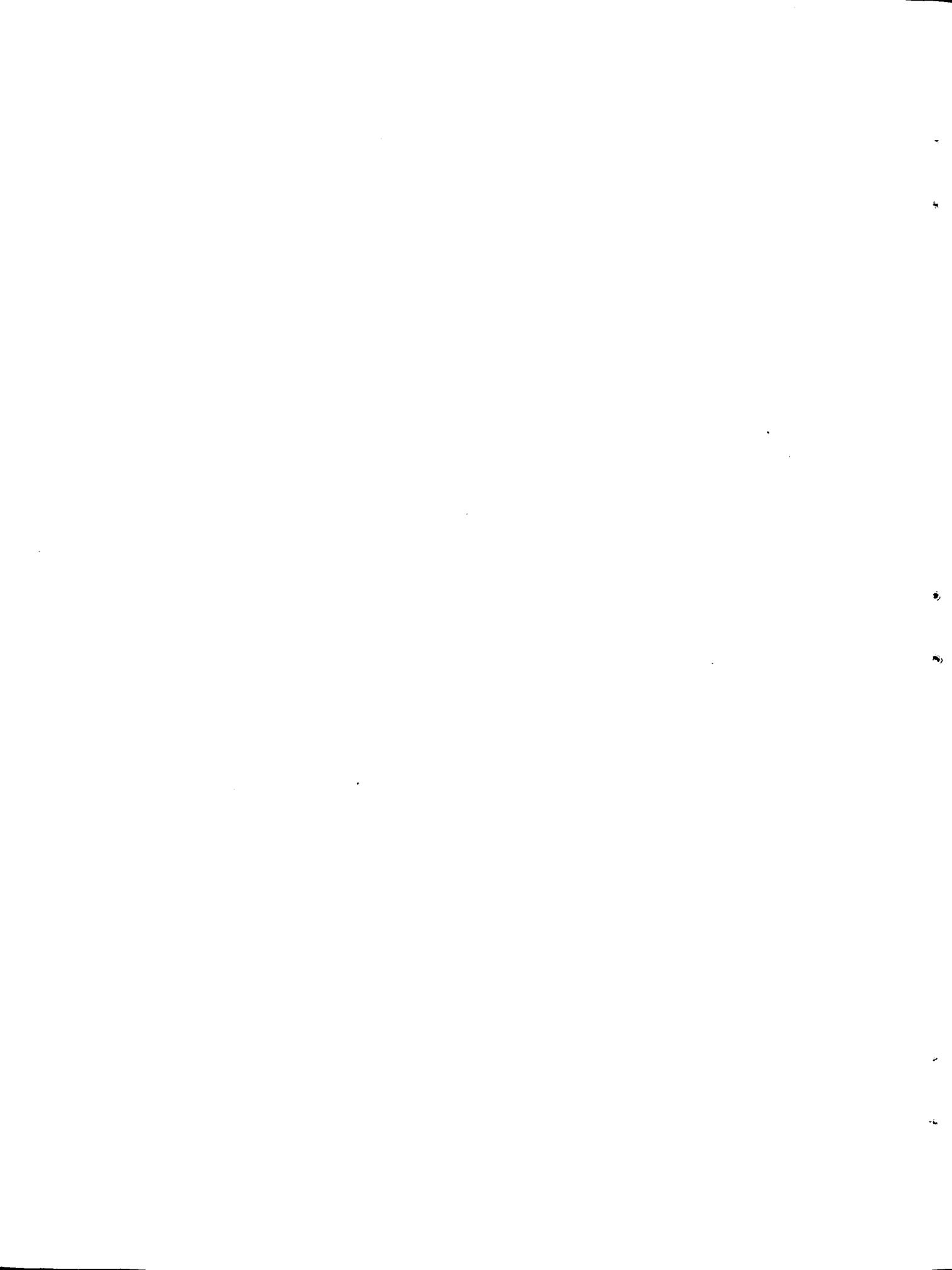
now produce such cash crops as fruit, grass, and alfalfa hay. Less than 1 percent of the pinyon-juniper-sagebrush type has been converted to dry farmland which produces some hay and winter wheat.

### Water Resources

Melting snowpack in the high mountain areas is the region's principal water supply. Water yields to the Gunnison River range from more than 30 inches (76.2 cm) per year of runoff in parts of the Anthracite Range and West Elk and San Juan Mountains, to less than 1 inch (2.5 cm) per year in the low, dry, warmer parts of the region. The drainage area above the study segment accounts for 60 percent of the undepleted flow of the Gunnison River; i.e., the flow that would have existed without the influence of man.

Surface waters of the region are generally of excellent quality and, in most areas, well suited to irrigation. There are a few places in the lower part of the region where return flows from irrigated areas, or inflows from salt or sediment-producing areas, contain undesirable amounts of sediment or dissolved salts. These small flows are rapidly diluted by the larger streams into which they flow. The adverse effects are generally localized, and they have little influence on the quality of the water supply of the region as a whole.

The Gunnison River above the study segment is used for generation of hydroelectric power as well as for municipal, industrial, and irrigation purposes. Small quantities are diverted from the headwaters of the Gunnison to the Arkansas and Rio Grande basins by the Larkspur, Tarbell, and Tabor Ditches. The Gunnison Tunnel, whose intake is located just upstream from the study segment, furnishes water for irrigation to the nearby Uncompahgre



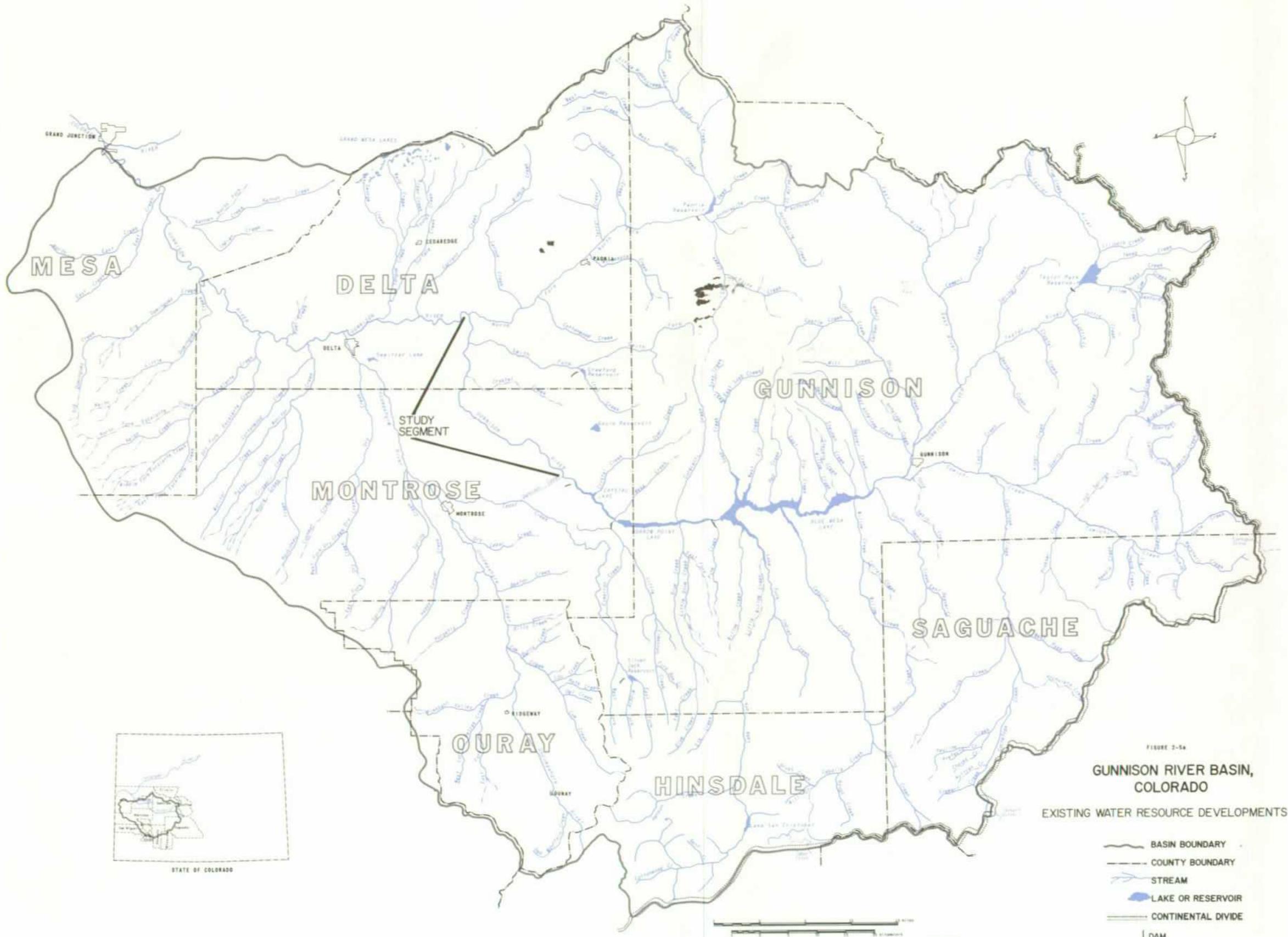
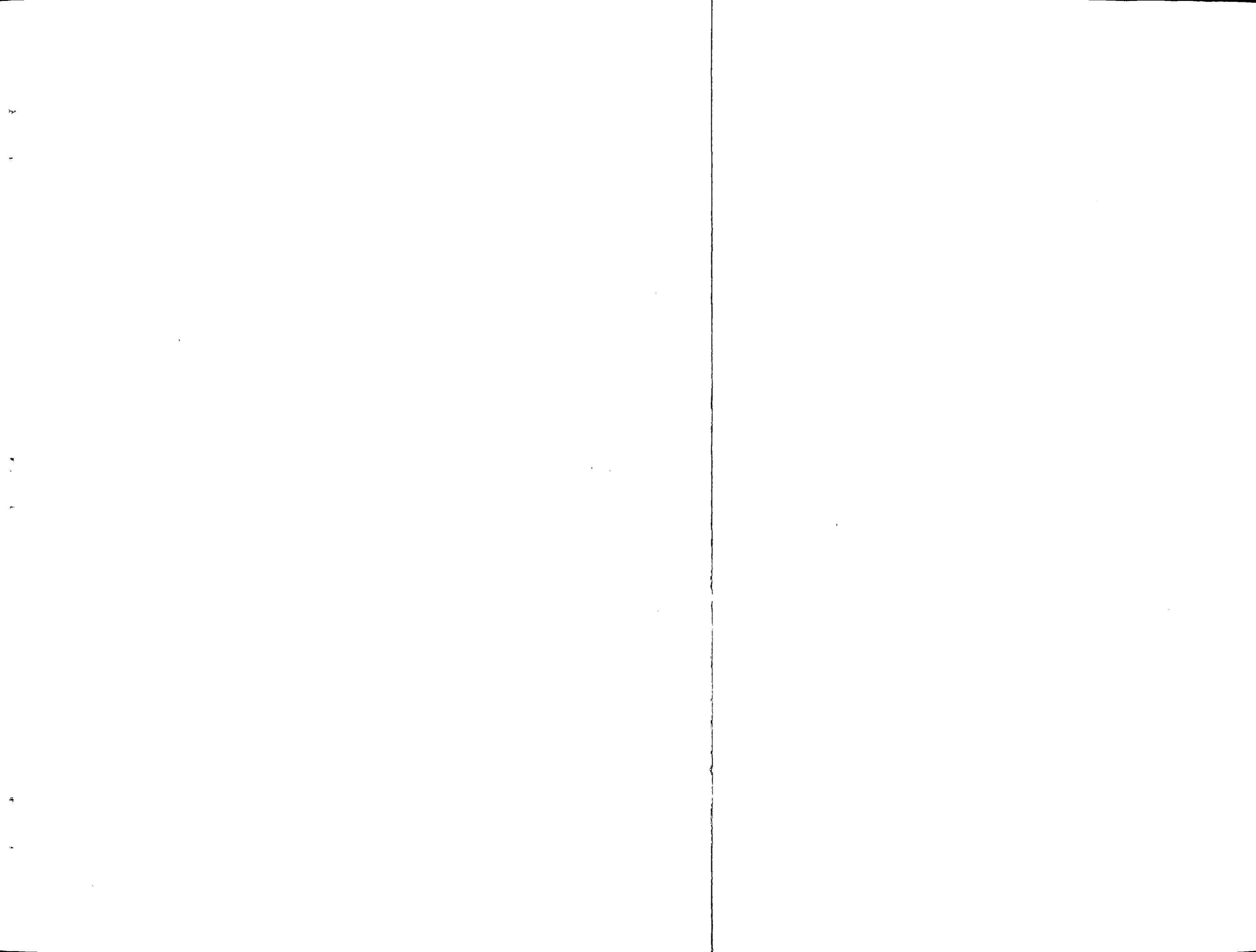


FIGURE 2-5a  
 GUNNISON RIVER BASIN,  
 COLORADO

- EXISTING WATER RESOURCE DEVELOPMENTS
- BASIN BOUNDARY
  - - - COUNTY BOUNDARY
  - STREAM
  - LAKE OR RESERVOIR
  - CONTINENTAL DIVIDE
  - | DAM

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Valley. Completed in 1910, it was the first Bureau of Reclamation project in Colorado.

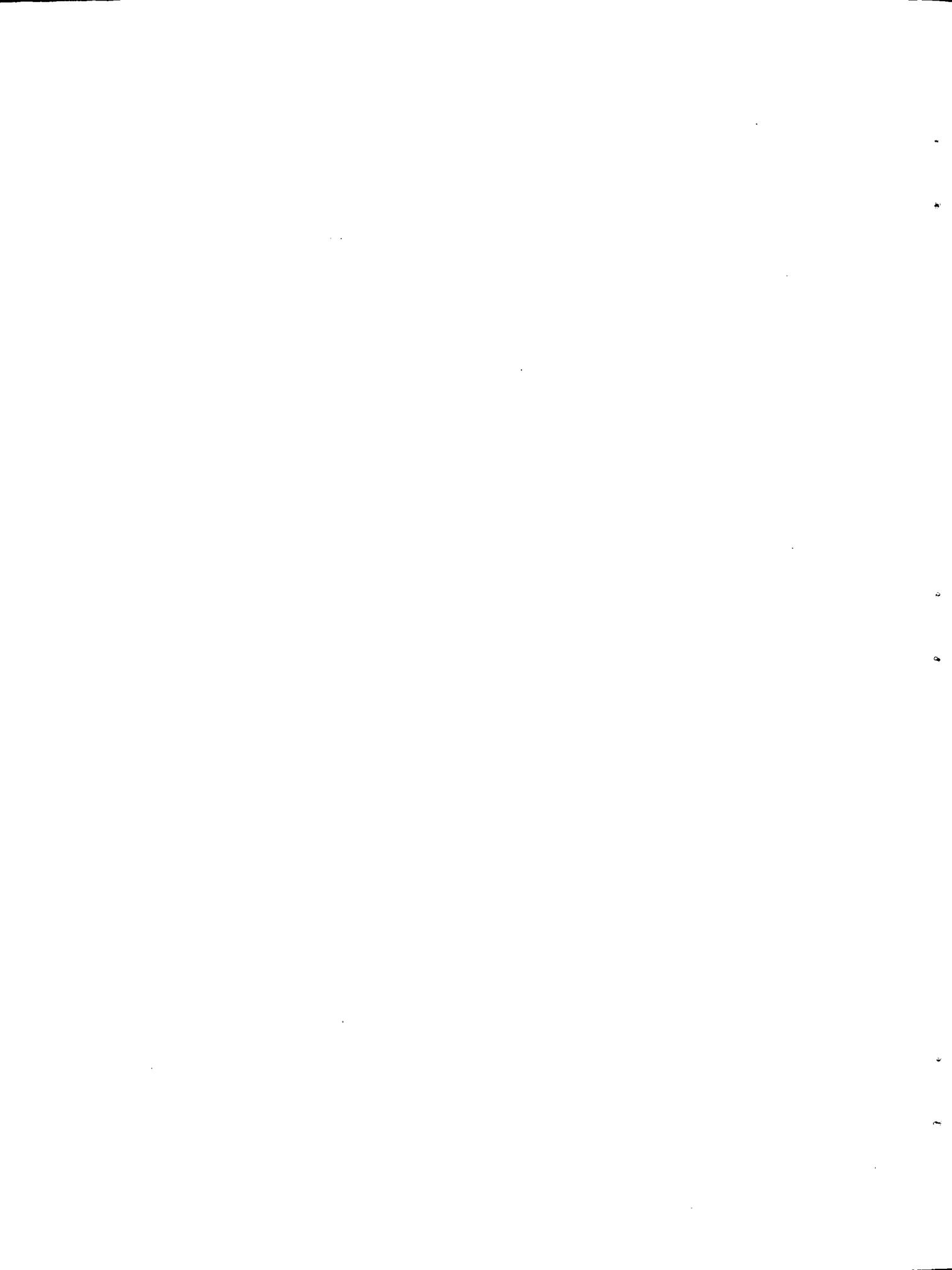
The only significant change altering average upper basin depletions since 1960 was the development of the Curecanti Unit. This unit, authorized by the Colorado River Storage Project Act (P.L. 84-485) in 1956 and constructed by the Bureau of Reclamation, supplies longterm hydroelectric power and carryover water storage for the Upper Colorado River basin. The project includes 3 dams and reservoirs--Blue Mesa, Morrow Point, and Crystal--and inundates nearly 35 miles (56 km) of the Gunnison River above the study segment. Figure 2-5a shows existing regional water resource developments.

North of Blue Mesa Reservoir in western Gunnison County, the Bureau of Reclamation's authorized Fruitland Mesa Project would take water from three Gunnison River tributaries--Soap, Curecanti, and Crystal Creeks; Soap Creek flows would be regulated by Soap Park Reservoir. The project would irrigate lands in Montrose and Delta counties, east of the study area.

Ground water in the region is uncommon and high in dissolved solids. Consequently, there has been relatively little use of this water source, and relatively little data have been developed on its use. It is estimated that ground water provides less than 1 percent of the region's total water consumption.

### Fish and Wildlife

The diversity of vegetative cover and water temperature conditions provides a wide variety of fish and wildlife habitat types. (Figure 2-6 illustrates some popular game species' distribution in the Gunnison basin.) Virtually all lakes and streams are managed by



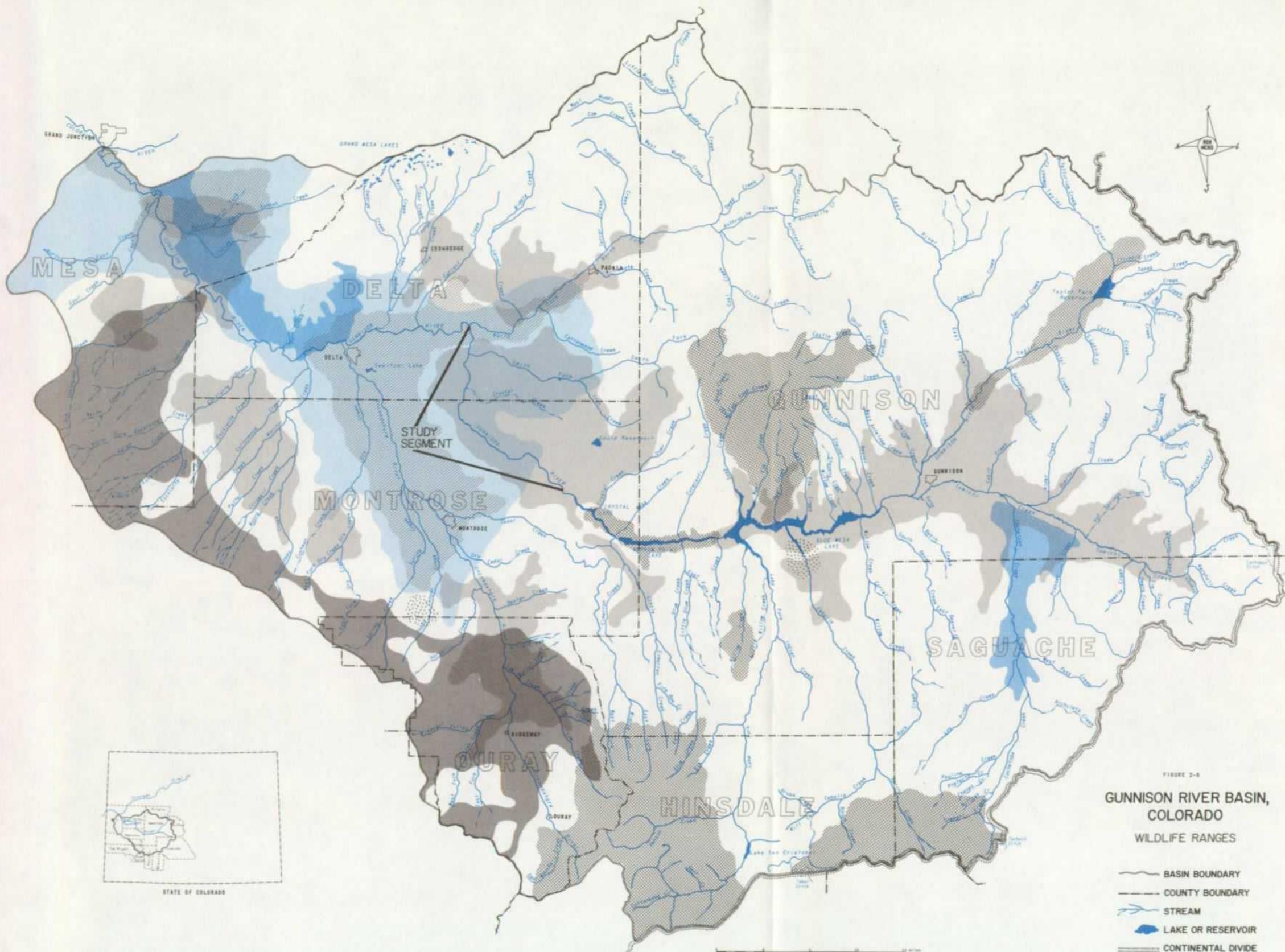


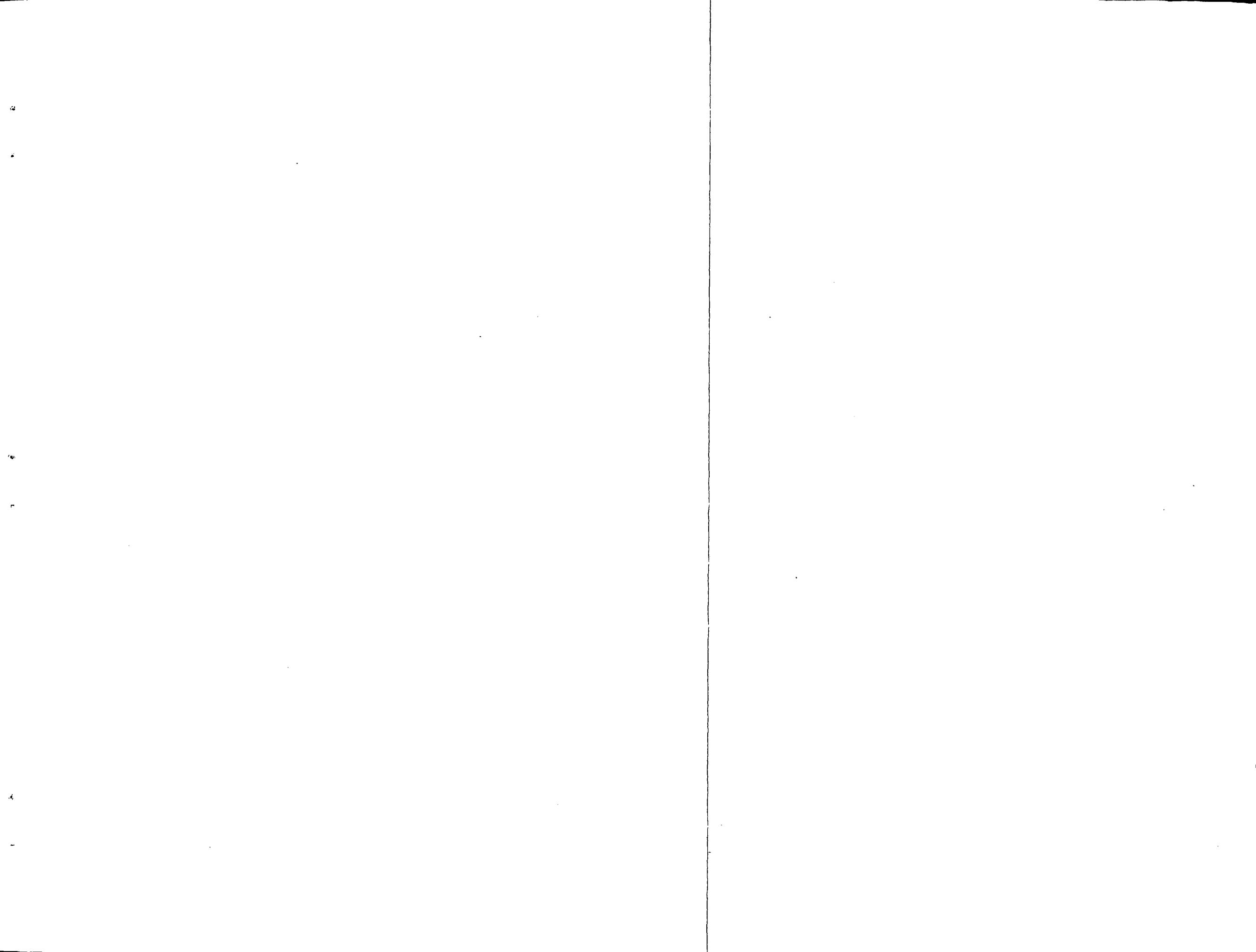
FIGURE 2-6  
**GUNNISON RIVER BASIN,  
 COLORADO**  
 WILDLIFE RANGES

- BASIN BOUNDARY
- COUNTY BOUNDARY
- ~ STREAM
- LAKE OR RESERVOIR
- ==== CONTINENTAL DIVIDE
- DEER AND ELK CRITICAL WINTER RANGE
- BIGHORN SHEEP RANGE
- SAGE GROUSE STRUTTING GROUNDS
- WILD TURKEY RANGE AND CONCENTRATIONS
- ANTELOPE RANGE
- PHEASANT RANGE
- CHUKAR RANGE

Source: U. S. Department of the Interior, Fish and Wildlife Service

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the Colorado Division of Wildlife, with primary emphasis on such trout species as the rainbow, German brown, and cutthroat. With some exceptions, such as mule deer which are increasing from a suboptimal level, most fish and wildlife populations within the region are currently at or near optimum levels with respect to their habitats.

The valley floors below 6,000 feet (1,829 m) in elevation are predominantly agricultural and are of limited value to wildlife relative to natural vegetation. Lands up to 1,000 feet (300 m) above the irrigated fields contain primarily sagebrush and associated plant species, many of which are utilized by wildlife. These areas constitute the lower limits of big game winter range and are valuable to a host of other wildlife species, including many small mammals, raptors, and songbirds.

Areas between 7,000 and 8,000 feet (2,134 and 2,438 m) elevation are the heart of big game winter range for mule deer and elk, and they also support a small number of Rocky Mountain bighorn sheep in the winter. Above 8,000 feet (2,438 m), subalpine and alpine vegetation provide summer range for big game. Sparsely vegetated high mountain peaks and isolated rocky crags provide summer range for the bighorn sheep.

Endangered fish and wildlife species of the region that are on the federal list include the American peregrine falcon, bald eagle, and Colorado squawfish.<sup>1</sup> The razorback sucker, also found within the region, has been proposed for inclusion on the federal list as a threatened species; it is found in the Gunnison River below the study area. The river otter, peregrine falcon, greater sandhill

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1. Endangered and Threatened Wildlife Plants, USDI, Fish and Wildlife Service. Federal Register, Thursday, July 14, 1977, Part V.

crane, humpback sucker, Colorado squawfish, and white pelican appear on the Colorado threatened and endangered species list and are found, at least occasionally, within the regional area.<sup>1</sup>

## CULTURAL RESOURCES

Archeological evidence indicates that the Gunnison River area has been sporadically utilized on a temporary, seasonal basis over the past 10,000 years by a variety of cultural groups. Fragmentary Folsom points, dating from approximately 10,000 years ago, have been found on the Uncompahgre Plateau and near the town of Cimarron just south of Morrow Point Dam. Excavated sites in the general region suggest intermittent occupation and possible influence by Desert Archaic, Basketmaker, Fremont, and Anasazi cultural groups.

It has been suggested that Shoshonean speakers, historically known as the Utes, gradually moved into the area after A.D. 1150. The Tabeguache of the Uncompahgre Ute band wintered along the Uncompahgre and Gunnison Rivers between present-day Montrose and Grand Junction. During the summer they hunted at higher elevations in the San Juan Mountains to the south and in the headwaters of the Gunnison River along Tomichi Creek to the east. Many of the small, temporary campsites located in the vicinity of Blue Mesa Lake and along the rims of the Black Canyon of the Gunnison National Monument are apparently related to this late prehistoric and early historic occupation.

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1. Colorado Threatened and Endangered Wildlife List. An Action of the Colorado Wildlife Commission. February 1, 1976.

The Black Canyon region has been known to Europeans since the late 1700's. In 1765 the Don Juan Maria de Rivera Expedition found the Black Canyon area of the Gunnison River while searching for silver. In 1776 the Dominguez-Escalante Expedition crossed the North Fork of the Gunnison, which they called the San Xavier. Exploration of the region resumed in the 1830's with the arrival of fur trappers. The area became so well traveled that Antoine Robidoux built a fur trading fort by the Uncompahgre River in 1835 which lasted until the 1840's. In addition to fur trappers, some of the more prominent visitors to the Gunnison country included Marcus Whitman, of Oregon mission fame, and Captain John W. Gunnison, for whom the Gunnison River was named.

The 1860's saw major developments in the region, including the discovery of silver and gold in the San Juan Mountains in 1861. The Ute Indians blocked exploration; however, it was not until they were moved as a result of the Brunot Treaty of 1873 that the San Juans boomed.

In 1875 a road over Marshall Pass was completed, and the town of Gunnison had effective transportation. That same year, Ferdinand V. Hayden, one of Colorado's best-known surveyors, provided the first accurate surveys for the Gunnison and Tomichi areas. In 1881 tracks of the Denver and Rio Grande Railroad reached Gunnison. This narrow gauge line provided the San Juans with cheap transportation, and mining boomed. Though most of the route of the narrow gauge railroad is now inundated by the Curecanti Project, a small section is exposed above Morrow Point Dam.

In 1910 the Gunnison Diversion Tunnel was completed, sending the Gunnison River's waters from East Portal to the Uncompahgre Valley

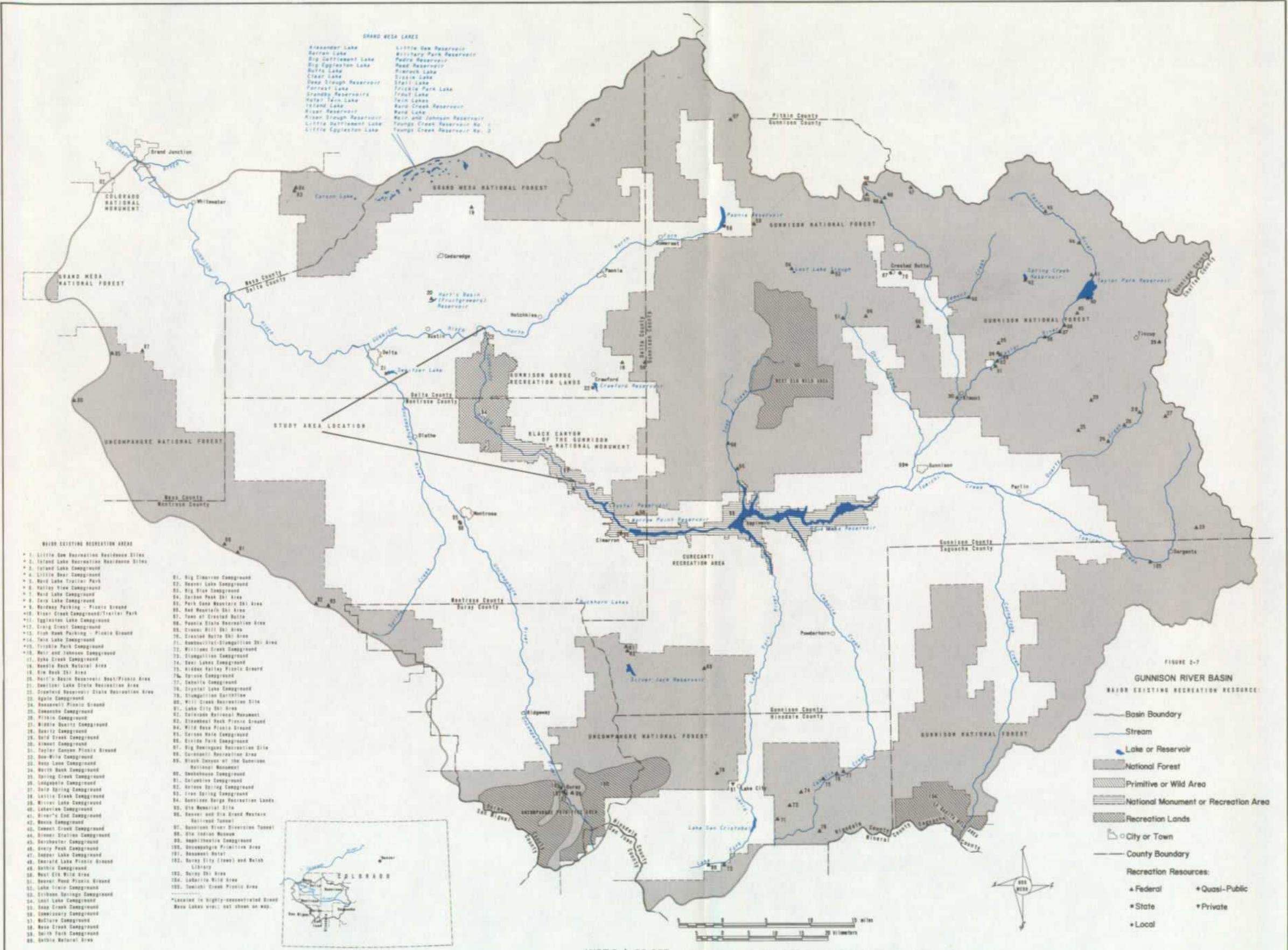
to irrigate 80,000 acres of land. This was one of Colorado's first diversion tunnels. Because of its historic significance, the tunnel has been named a National Engineering Landmark by the American Society of Civil Engineers.

## RECREATIONAL RESOURCES

Today the region is renowned for its abundance and diversity of recreation resources. More than 95 percent of the Gunnison River within the study corridor, about 28 miles (45 km), is contained in either Black Canyon of the Gunnison National Monument (12.7 miles, 20.4 km) or Gunnison Gorge Recreation Lands (13.5 miles, 21.7 km).

Major recreation areas, or areas where recreation is a primary use, attract visitors from a large geographic region. These areas are depicted in figure 2-7. Nearly 90 percent of the approximately 256,000 acres (103,600 ha) associated with these areas, as summarized in table 2-2, is in federal ownership. Recreation acreage represents about 5 percent of the total land and water surface in the region. Besides federal areas, the total includes state, local, private and quasi-public facilities, as well as sites listed on the National Register of Historic Places and the National Registry of Natural Landmarks.

Although most of the reservoirs in the region have been constructed to service irrigation water needs, many support limited recreation use, including boating and fishing. Numerous fishing lakes are concentrated northwest of the study segment on Grand Mesa, one of America's largest flat-top mountains, at elevations of about 10,000 feet (3,048 m).



- GRAND MESA LAKES**
- Alexander Lake
  - Barren Lake
  - Big Settlement Lake
  - Big Eggleston Lake
  - Butts Lake
  - Clear Lake
  - Deep Slough Reservoir
  - Ferris Lake
  - Franklin Reservoir
  - Helen Lake
  - Island Lake
  - Island Reservoir
  - Little Settlement Lake
  - Little Eggleston Lake
  - Little Owl Reservoir
  - Military Park Reservoir
  - Pedro Reservoir
  - Road Reservoir
  - Riviera Lake
  - Star Lake
  - Trickle Park Lake
  - Trout Lake
  - Yain Lakes
  - Yard Creek Reservoir
  - Young Creek Reservoir No. 1
  - Young Creek Reservoir No. 2

- MAJOR EXISTING RECREATION AREA**
- 1. Little Owl Recreation Residence Sites
  - 2. Island Lake Recreation Residence Sites
  - 3. Island Lake Campground
  - 4. Little Bear Campground
  - 5. Nord Lake Trail Park
  - 6. Valley View Campground
  - 7. Nord Lake Campground
  - 8. Nord Lake Campground
  - 9. Nord Lake Campground
  - 10. Nord Lake Campground
  - 11. Eggleston Lake Campground
  - 12. Long Creek Campground
  - 13. Fish Creek Campground
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  - 100. Fish Creek Campground

FIGURE 2-7  
**GUNNISON RIVER BASIN**  
 MAJOR EXISTING RECREATION RESOURCE

- Basin Boundary
- Stream
- Lake or Reservoir
- National Forest
- Primitive or Wild Area
- National Monument or Recreation Area
- Recreation Lands
- City or Town
- County Boundary

**Recreation Resources:**

- ▲ Federal
- ◆ Quasi-Public
- ★ State
- † Private
- Local

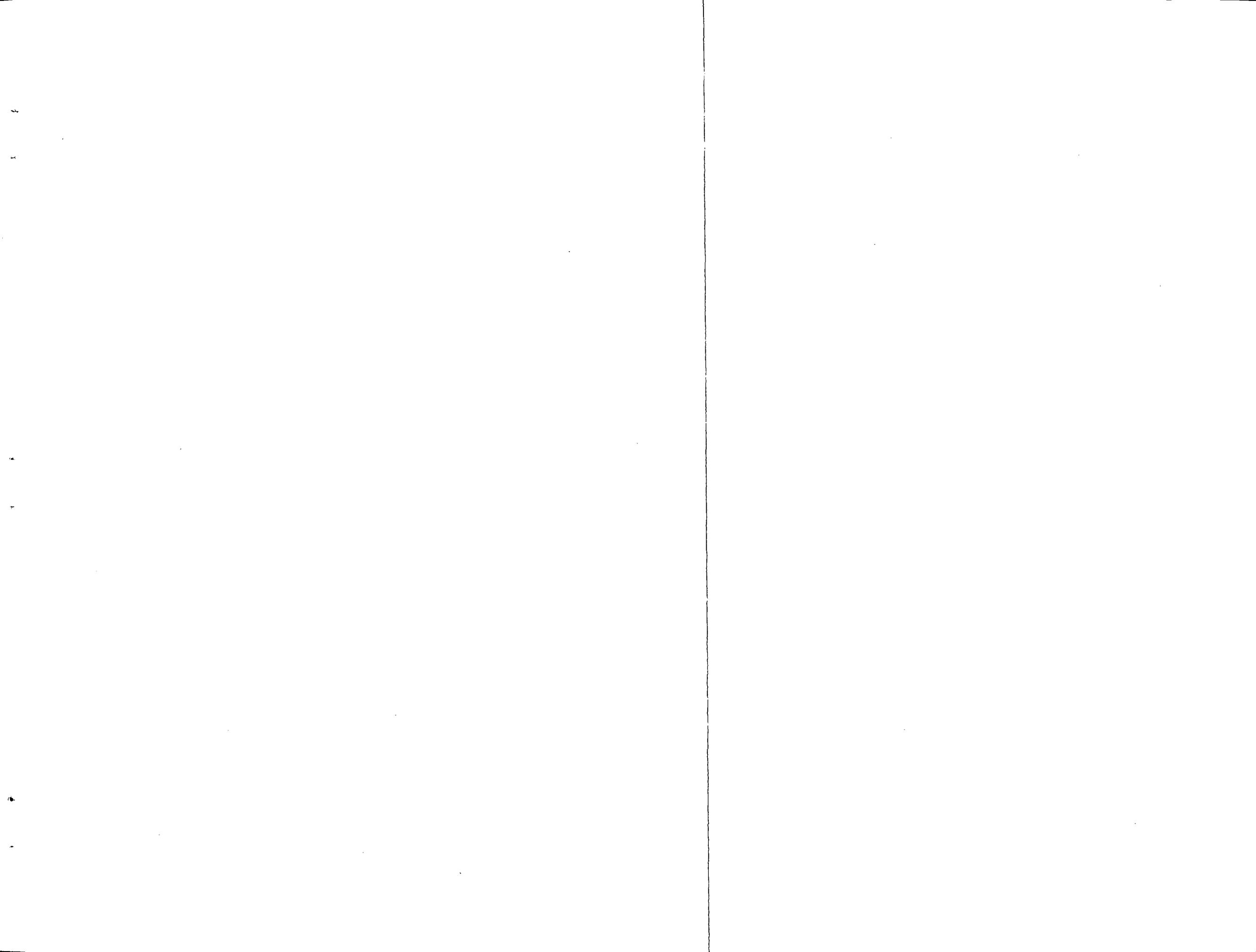


Table 2-2

GUNNISON RIVER REGION  
Existing Recreation Acreage

<u>Ownership</u>	<u>Acres (Hectares)</u>	<u>Percent</u>
Federal:		
U.S. Forest Service	141,800 (57,400)	55
National Park Service	57,200 (23,100)	22
Bureau of Land Management	30,300 (12,300)	12
State	2,900 ( 1,200)	1
Local:		
City	800 ( 330)	less than 1
County	100 ( 50)	less than 1
Private	22,800 ( 9,200)	9
Quasi-public*	100 ( 50)	less than 1
TOTALS	256,000 (103,600)	100

\*Under private ownership or control, but open to the public.

Several rivers and streams that possess noteworthy value for fishing and river floating, located within 150 miles (240 km) of the study corridor, are shown in figure 2-7a. Among these, the Taylor River is well known for its fishery and the Dolores, Colorado, and Arkansas for floating and related activities.

Estimates of recreation use occurring in the region during 1973 are given in table 2-3, ranked in their order of popularity. For the activities shown, the length of recreation season varies between about 250 days for hiking and 150 days for snow skiing.

According to the 1976 Colorado State Comprehensive Outdoor Recreation Plan (SCORP), recreation needs exist in Region 10 for

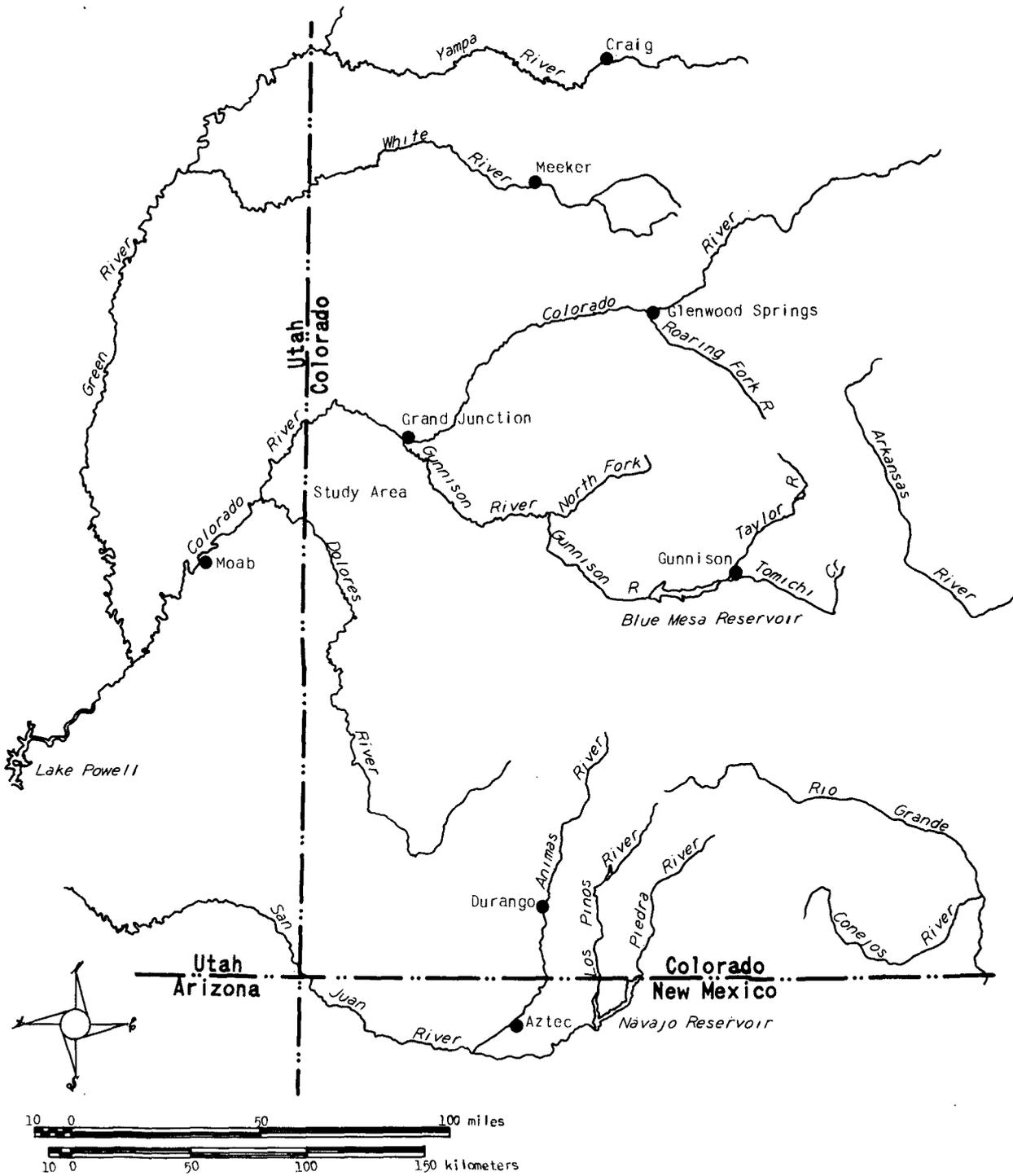


FIGURE 2-7a  
**COMPARATIVE RIVERS**  
 WITHIN 150 MILES OF STUDY AREA  
 GUNNISON WILD AND SCENIC RIVER

UNITED STATES DEPARTMENT OF THE INTERIOR  
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Much of the canyon use  
in the monument occurs at overlooks  
along the north and south rims.

all activities listed in table 2-3. Although the exact magnitude of these needs is not known in many instances, the SCORP does recognize that Colorado's rivers should be protected for their scenic and environmental values, in addition to making them available for recreation use.

Table 2-3

GUNNISON RIVER REGION  
Participation in Selected Activities in 1973

<u>Activity</u>	<u>Participation (Activity Days)<sup>1</sup></u>		
	<u>Colorado Residents</u>	<u>Non-Residents</u>	<u>Total</u>
Fishing	2,312,700 <sup>2</sup>	991,100 <sup>2</sup>	3,303,800 <sup>2</sup>
Hiking (x-country/trails)	852,700	2,181,600	3,034,300
Camping	949,900	1,512,900	2,462,800
Picnicking	453,400	1,753,200	2,206,600
Four-wheeling (roads/ trails/x-country)	345,400	1,046,500	1,391,900
Pleasure driving (parks/ recreation areas)	64,800	1,230,300	1,295,100
Horseback riding (trails/ x-country)	528,900	335,000	863,900
Hunting	312,600 <sup>2</sup>	78,100 <sup>2</sup>	390,700 <sup>2</sup>
Game playing (open space)	356,200	25,800	382,000
Snowskiing (x-country)	183,500	51,800	235,300
Power boating	21,600	125,400	147,000
Snowmobiling (open space)	129,500	12,900	142,400
Boating-waterskiing	10,800	91,100	101,900
Technical mountain climbing	10,800	68,700	79,500
TOTALS	<u>6,532,800</u>	<u>9,504,400</u>	<u>16,037,200</u>

1 Except as noted, all data are estimated from the 1974 Interim Colorado Statewide Outdoor Recreation Plan (Region 10) and are rounded to the nearest hundred activity days.

2 Estimate, based on Colorado Division of Wildlife information.

## POPULATION AND ECONOMY

Between 1960 and 1970 population grew within the region at the rather slow rate of 1.8 percent. More recently (1970-75), population has increased 8 percent as the recreation industry, migration from urban centers, the ingress of retired and semi-retired people, and manufacturing and energy-minerals sectors have expanded. Western State College in Gunnison, the new Delta-Montrose Area Vocational School, Crested Butte ski area, Curecanti National Recreation Area, and Black Canyon of the Gunnison National Monument enhance the attractiveness of the region as a place to live and work.

In 1970 Delta and Montrose Counties accounted for 75 percent of the region's population of 45,000. Population density in some areas of the region was as low as 0.2 persons/sq mi (0.08 persons/sq km) in 1970. Compared with statewide figures, the region had a higher proportion of persons over 65 years of age; a slightly lower level of formal education attainment; and a slightly lower level of housing quality based upon the number of persons per unit.

In fiscal year 1972-73, 12.5 percent of the total population was on welfare, and 6.7 percent received food stamps. Both of these figures exceed comparable data computed on a statewide basis. This suggests that a significant percentage of the residents are not sharing in the region's general economic well-being.

Agriculture is the major employer, accounting for 17.8 percent of the total civilian work force in 1973. Although total farm income is generally smaller than total non-farm income, it is larger than any other industry sector.

Mining continues to run second as an employer, but it has the potential to expand substantially as coal deposits in the region are

developed. Most of the present coal exploration and mining development is located between Delta and Paonia Reservoir; however, some coal mines are also near Cedaredge and south of Montrose.

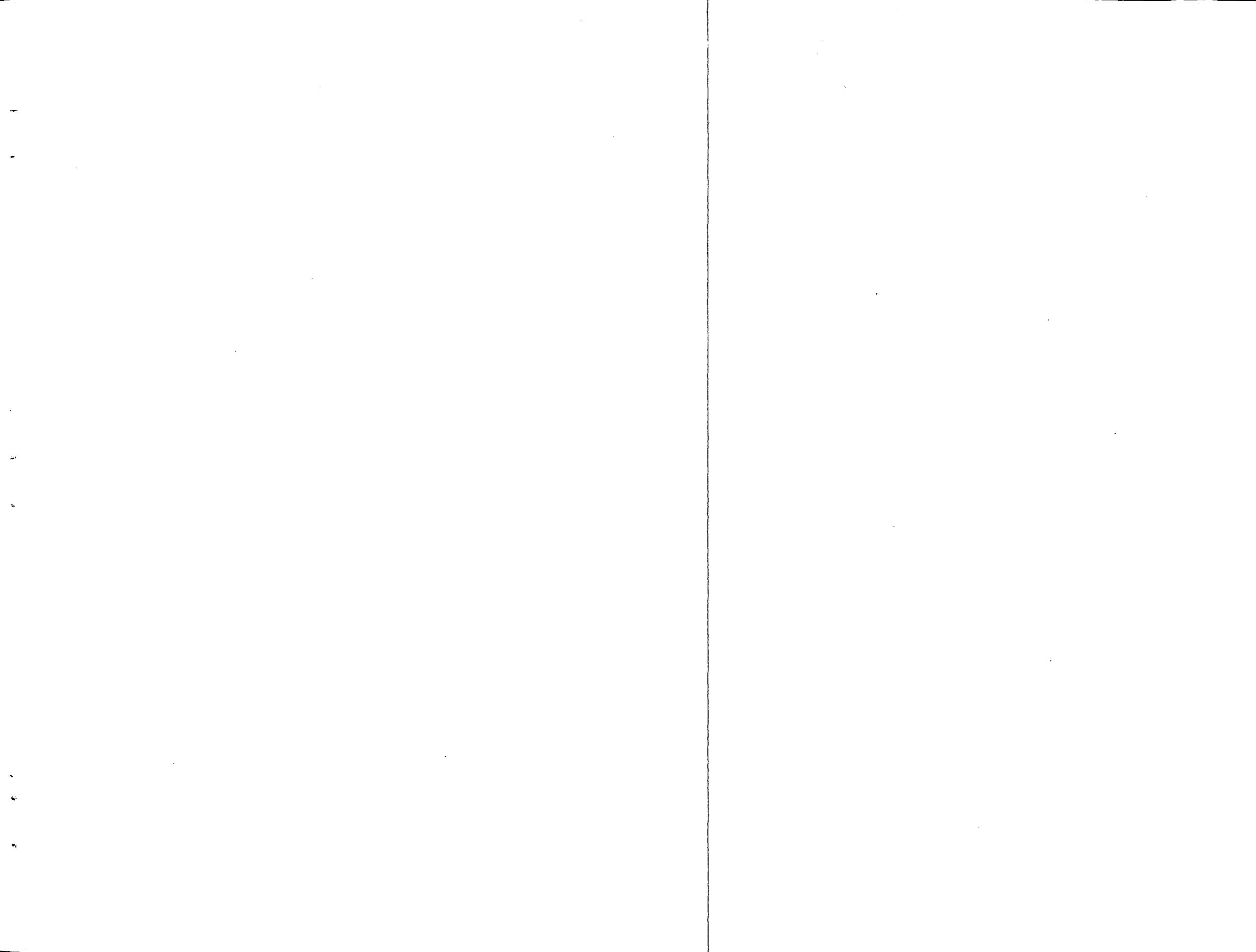
Income in the trade and services sector reflects the significance of recreation and tourist activities. For Delta and Montrose Counties, it is estimated that tourists contribute nearly 50 percent of revenues from lodging and 25 percent from restaurants, with lesser amounts from gasoline, retail food sales, retail trade, and other services. In fiscal year 1975, Delta County received about \$1.5 million in tourist dollars, and Montrose County received about \$2.5 million, representing a combined increase of approximately 30 percent since 1965.

Total employment in the region increased from 15,000 to 17,000 between 1970 and 1973, and unemployment decreased from 6.2 to 4.2 percent between 1970 and 1974. Labor force participation rates for the region were significantly lower than the state average in 1970, a fact only partially explained by the large retirement population. Regional per capita personal income, although below the \$5,514 average for Colorado, has shown consistent growth since 1970. The percent of families (15.9) below the poverty level further indicates a financial disparity or deficit for some segments of the population.

## TRANSPORTATION

While scheduled public transportation is available to Montrose, Delta, Gunnison, and Grand Junction, special arrangements must be made to get from these cities to the river study area. Major airports, railroads, and highways that serve these cities and towns are shown in figure 2-8.





Federal, state, and county highways account for about 4,700 miles (7,564 km) of roadway in the region, ranging from the all-weather U.S. highways to primitive roads on which no maintenance is done. East-west Interstate 70 passes through Grand Junction immediately outside the region and is the closest interstate highway to the study area.

Transcontinental U.S. Highway 50 provides the principal access to the Black Canyon of the Gunnison National Monument. Eight miles (13 km) east of Montrose this highway connects with State Route 347, the 5-mile (8-km) entrance road to the south rim of the monument. It is about 80 miles (129 km) by road from the south rim, through Montrose, Delta, and Crawford, to the north rim of the monument.

Four commercial airports serve the region--Walker Field, north of Grand Junction off Interstate 70; Blake Field, north of the U.S. 50 and State Highway 92 intersection at Delta; Montrose County Airport, located north of Montrose off U.S. Highway 50; and Gunnison County Airport, also off U.S. Highway 50, south of Gunnison.

Although passenger and freight rail service have declined, expanding development of resources in this area may reverse this trend. Since the Denver and Rio Grande Western Railroad line from Montrose to Ridgway was abandoned, freight rail service in the region is quite limited. The only passenger rail service available is immediately outside the region at Grand Junction.

#### LANDOWNERSHIP AND USE

About 3.7 million acres (1.5 million ha), or 70 percent of the regional land area, are publicly owned. The majority of these

public lands are in federal ownership, with the national forests accounting for some 2.3 million acres (930,800 ha). Most of the region's remaining 1.4 million acres (583,000 ha), about 28 percent of the total acreage, are in private ownership. Less than 1 percent of the total acreage consists of state and local areas.

Lands are used primarily for the production of minerals, timber, range-forage, mountain meadow hay, and irrigated crops. There are approximately 264,000 acres (106,841 ha) of irrigated land within the region. Fruit and truck crop farming, together with general and cash-crop farming and the production of forage and grain crops for livestock feed, are the principal types of agricultural cropping. Private and publicly owned, nonirrigated land furnishes summer grazing for livestock enterprises.

## CHAPTER III GUNNISON RIVER CORRIDOR

The most prominent feature of the Gunnison River is the 50-mile (80-km) Black Canyon which begins near the community of Sapinero and extends downstream to the vicinity of Austin, below the confluence of the main stem with the North Fork. The upper Black Canyon, which extends from near Sapinero to the Crystal Dam site, was set aside for hydropower development in the 1950's; the lower Black Canyon remains essentially undeveloped, especially through the study area. The study area described in this chapter is a narrow visual corridor, averaging about 3/4-mile (1.2-km) wide, immediately adjacent to the river in the lower Black Canyon from the upstream boundary of Black Canyon of the Gunnison National Monument to the confluence with the North Fork (see figure 3-1).

The Gunnison River was considered in two segments because of their differing quality of resource values within the study corridor. The 26.2-mile (41.8-km) upper segment, from the upstream boundary of the monument to about 1 mile (1.6 km) below the Smith Fork confluence, was considered as a unit because of its consistently outstanding geologic, scenic, wildlife, and recreation values. On the other hand, the 2.7-mile (4.3-km) lower segment, from below the Smith Fork to the North Fork confluence, exhibited virtually none of these to an outstanding degree.

### RIVERSCAPE - SCENIC RESOURCES

The overall dominant character of the study corridor is the awe-inspiring and overwhelming magnitude of the river-carved canyon, as depicted in figure 3-1a. The canyon ranges from extremely steep and narrow upstream in the monument to very wide, with a small inner canyon, in the gorge downstream. Scenic

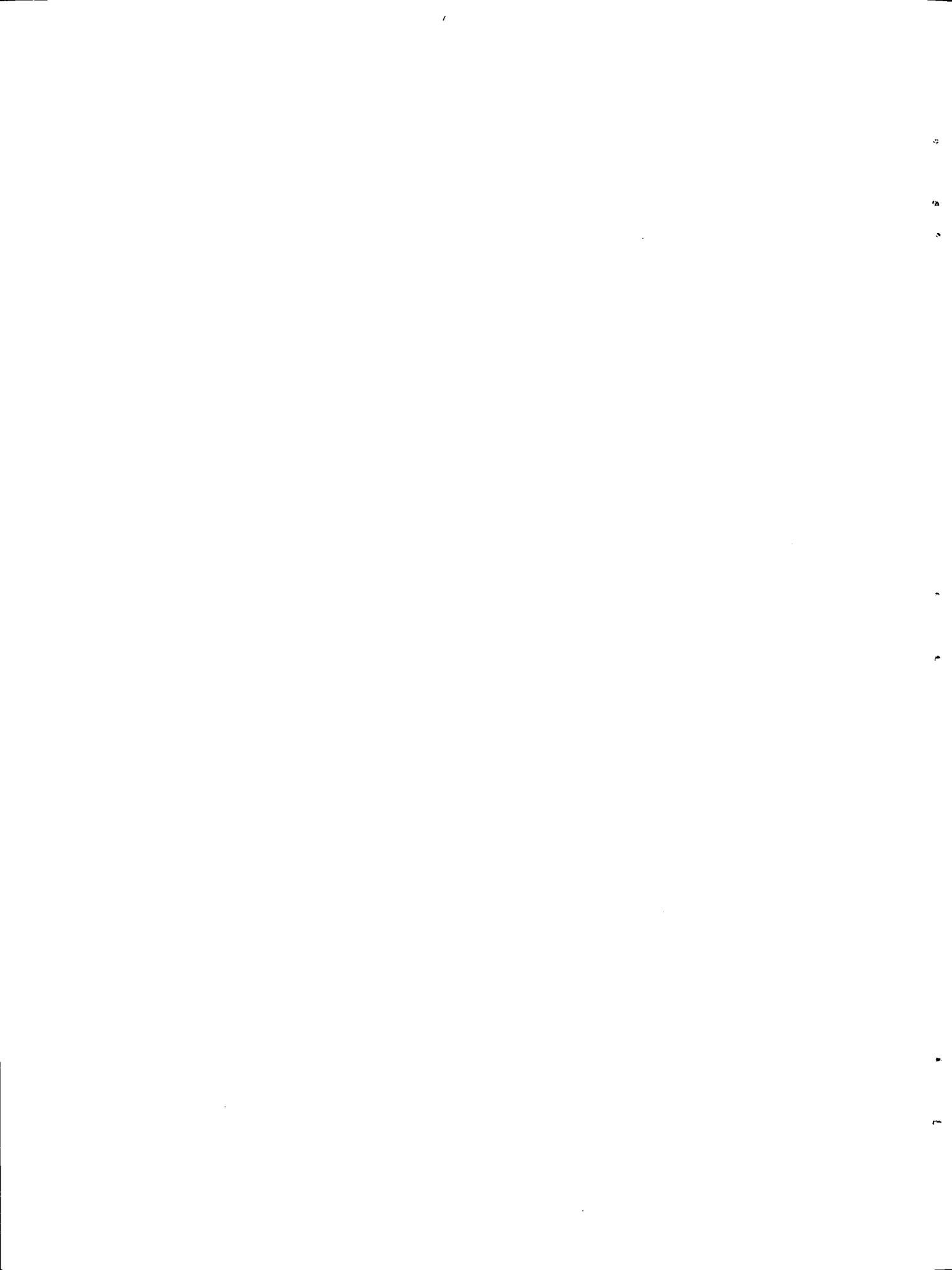
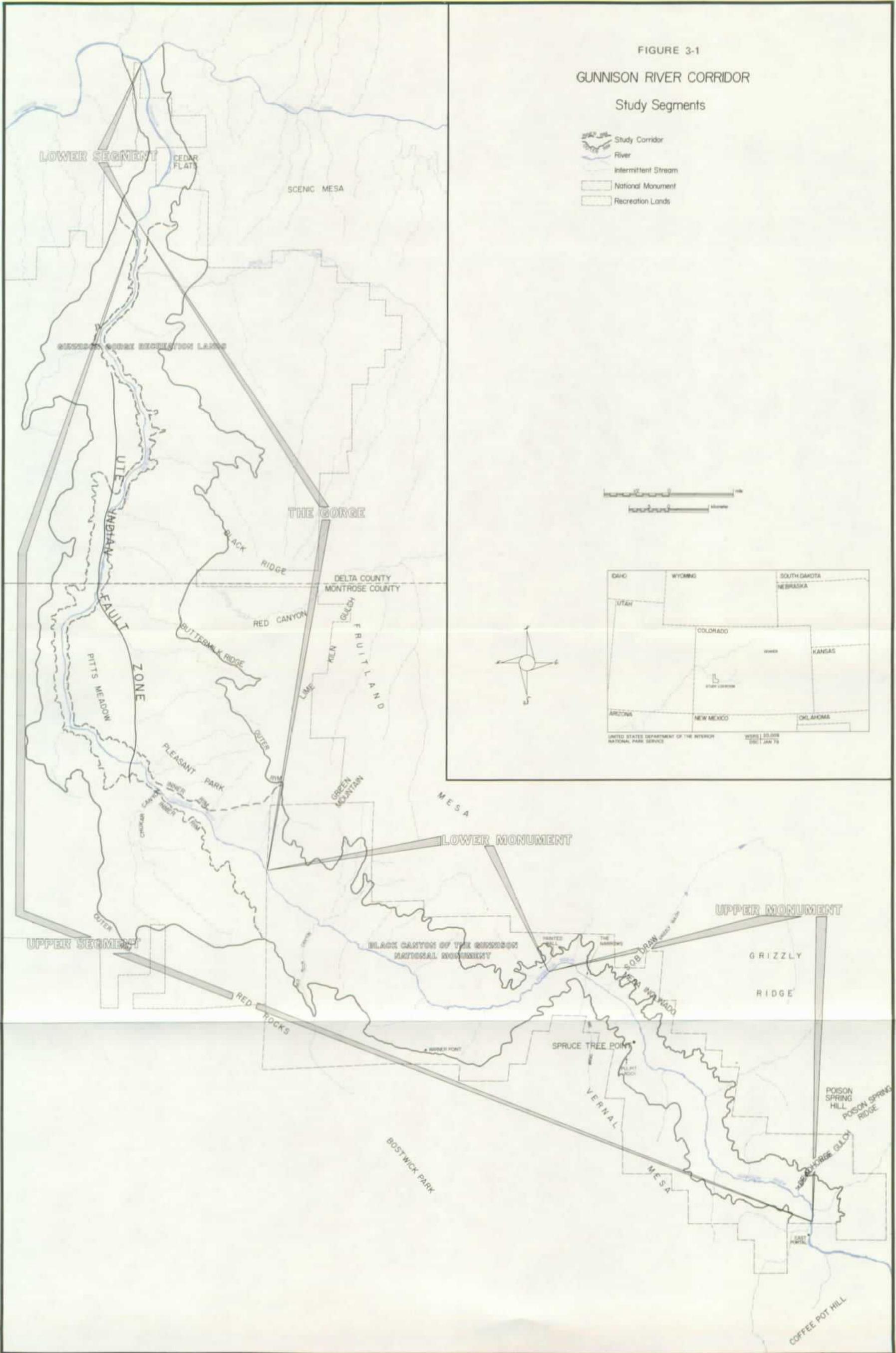


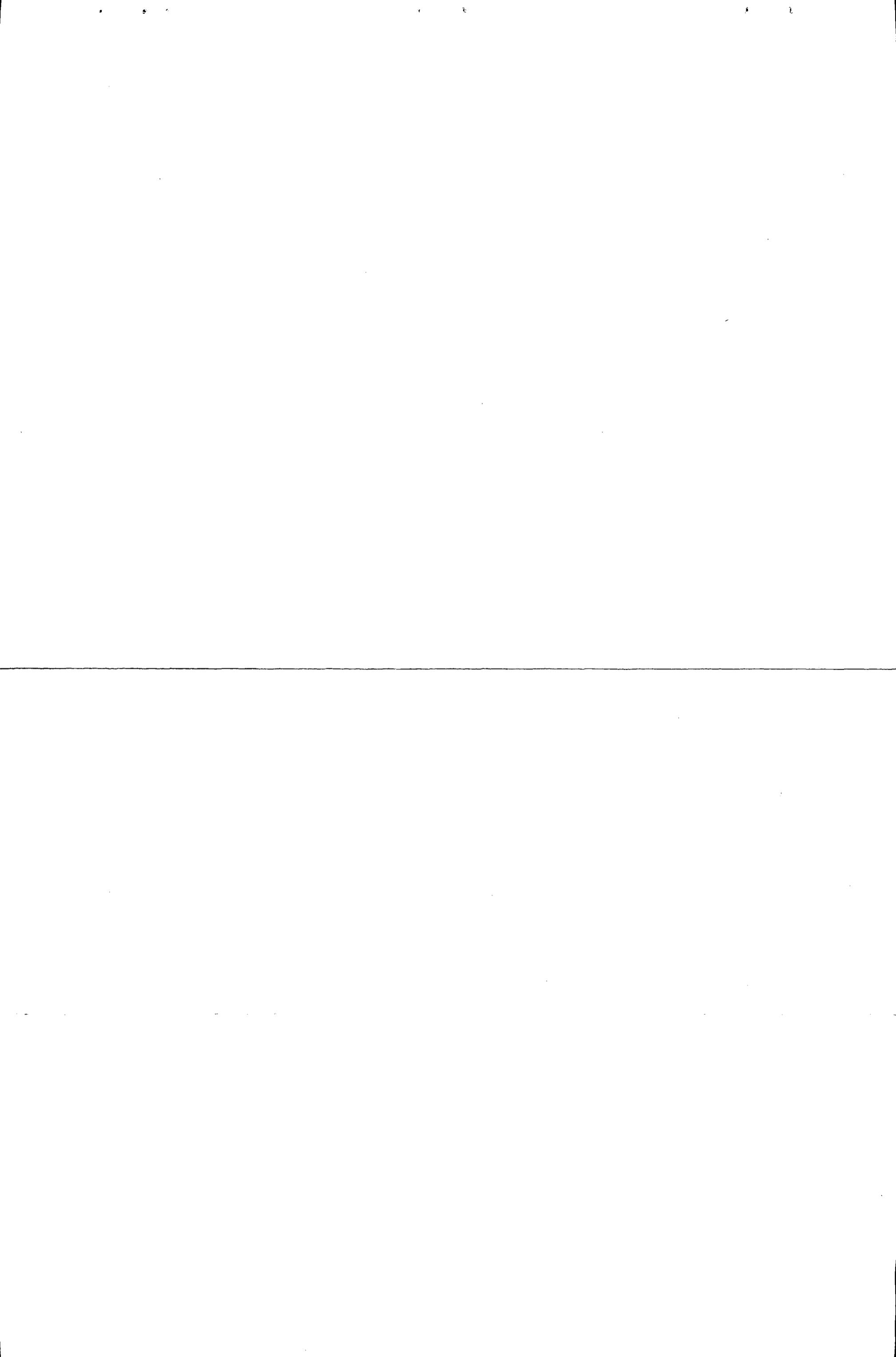
FIGURE 3-1

GUNNISON RIVER CORRIDOR

Study Segments

-  Study Corridor
-  River
-  Intermittent Stream
-  National Monument
-  Recreation Lands





values found here are inextricably interwoven with the geologic and physiographic features of the area.

From certain vantage points along the rim of the canyon, the best being in the monument, outstanding panoramas are possible of the canyon and the surrounding hills and valleys. The river, nearly 1/2 mile (0.8 km) below, can be seen and heard, but distance obscures the turbulent flow of the river and a casual glance gives no indication of movement--the river and its canyon apparently frozen in time. Even when one realizes and respects the tremendous power of water and the resistance to erosion of the rock through which it has cut, it is difficult to comprehend a feature of such proportions.

It is impossible to pass along the river for the length of the study area without getting in the water. The shoreline is generally narrow, leaving only the river and sheer, high walls in many locations. The upstream part of the river in the monument has a very steep gradient, resulting in a series of rapids and deep, dark pools. In the lower part within the gorge, the gradient is gradual and the river more placid.

Riparian vegetation is typical of other rivers in the southwest, but it contrasts with the adjacent pinyon-juniper and exposed rock, creating an oasis-like appearance. Each twist and turn of the river offers a new view of the canyon walls, streambank vegetation, rocks, rapids, and pools. As a result, the quality of the scenery is outstanding.

With its narrow, sheer, dark walls, the monument is breathtaking and unique. It has no significant permanent intrusions, as indicated in figure 3-2. The gorge is not as overwhelming, but its inner-outer canyon relationship is geologically more diverse. It is relatively free of intrusions down to the Smith Fork. Downstream

from the Smith Fork the scenic quality is not outstanding and a few minor, permanent visual intrusions exist. However, the peaceful waters provide an opportunity for whitewater boaters to relax after the hectic rapids. These and other scenic values are summarized in table 3-1 and discussed by segment below.

### Upper Segment

This 26-mile (42-km) reach of the study corridor extends from the upstream monument boundary to about 1 mile (2 km) below the Smith Fork, as shown in figure 3-1. From a scenic standpoint, this segment is further divisible into three distinct elements--the upper monument, lower monument, and gorge.

Upper Monument (7.5 miles; 12.1 km). The upper reach of the Gunnison River in the monument, from its southern boundary to the vicinity of Painted Wall, flows through a deep, sombre, precipitous gorge of dark Precambrian rock where the plummeting vertical aspect of the canyon walls is extreme. At its most constricted point--a site known as the Narrows (see figure 3-1a, profile F)--the canyon is only 40 feet (12 m) across at its base, 1,750 feet (530m) from river to rim, and 1,100 feet (335 m) across those rims.

Average stream gradient is 120 feet per mile (22 m/km), in comparison to 80 feet per mile (15m/km) for the Yellowstone River in its Grand Canyon. In one 2-mile (3-km) stretch, the Gunnison drops 480 feet (146 m). An even steeper gradient occurs within a 1-mile (2-km) segment of this reach where the river drops 275 feet (84 m), and there is a 43-foot (13-m) cataract terminating in a 17-foot (5-m) waterfall.

The Painted Wall in this segment is the highest cliff in Colorado, averaging 2,250 feet (685 m). The shoreline varies between narrow

and nonexistent. It is clogged with rocks and boulders, though there are also some small beaches and thickly vegetated streambanks where box elder grows.

Rainbow and brown trout are common here. Wildlife tends to be sparse down in the canyon, though in warm months birdlife usually is abundant. Violet-green swallows are among the most common birds, often skimming in flocks just above the river, hunting insects. Higher up, wildlife is generally typical of the regional ecosystems.

Lower Monument (5.2 miles; 8.4 km). The lower reach of the Black Canyon through the monument from the vicinity of Painted Wall to the monument-gorge boundary is deeper than the upper stretch--maximum is 2,700 feet (82 m) near Warner Point--but is not quite as spectacular. The walls start to flare outward as shown in figure 3-1a (profile E), and the river's gradient itself is less, averaging 45 feet/mile (9 m/km). The shoreline remains narrow and rocky, the canyon walls dark and rugged, and the vertical aspect extreme and often dizzying. Vegetative and wildlife communities are similar to those of the upper monument, though box elders appear more often on the stream bank.

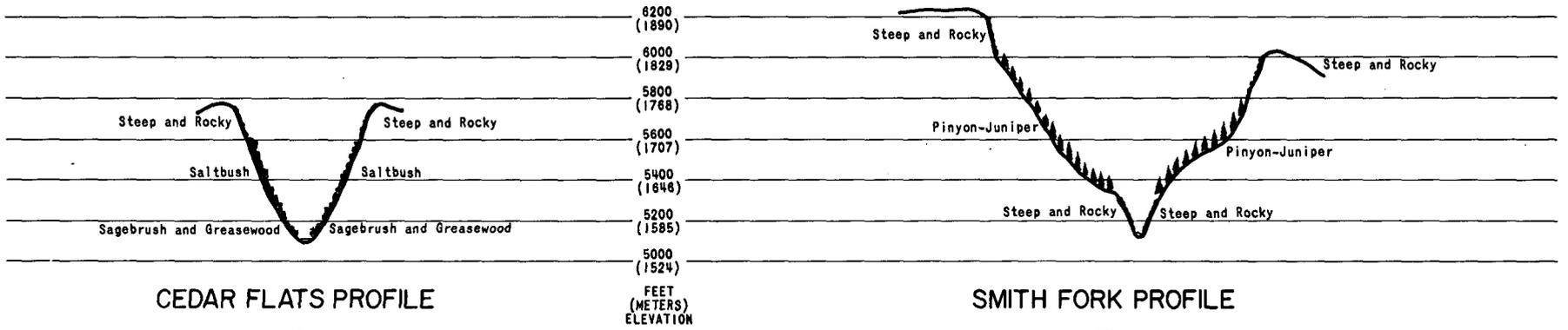
The Gorge (13.5 miles; 21.7 km). About 1 mile (1.6 km) below the monument boundary in the Gunnison Gorge Recreation Lands, the landscape changes abruptly. In this reach which continues downstream to about 1 mile (1.6 km) below the Smith Fork, and which is represented in figure 3-1a (profiles D, C, and B), the younger sedimentary rocks have been stripped partly away over eons of geologic time but are well preserved in an outer wall and rim. The result is a double canyon, composed of an inner and outer gorge.



FIGURE 3-1a

# GUNNISON RIVER STUDY, COLORADO CANYON PROFILES

(see Visual Intrusions Map for locations)

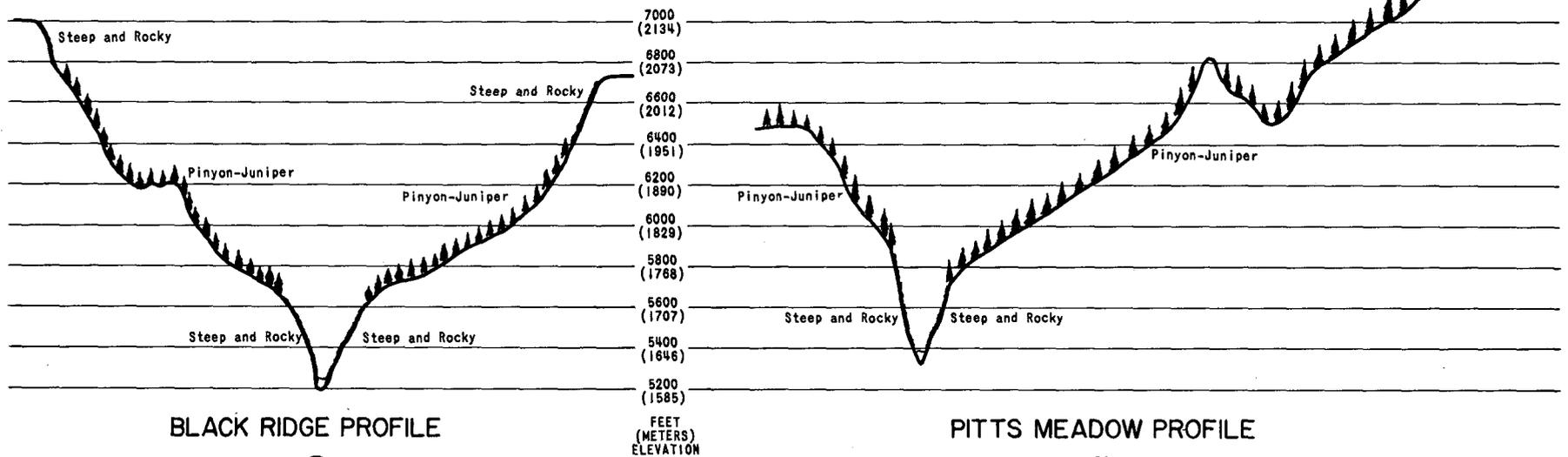


CEDAR FLATS PROFILE

A

SMITH FORK PROFILE

B

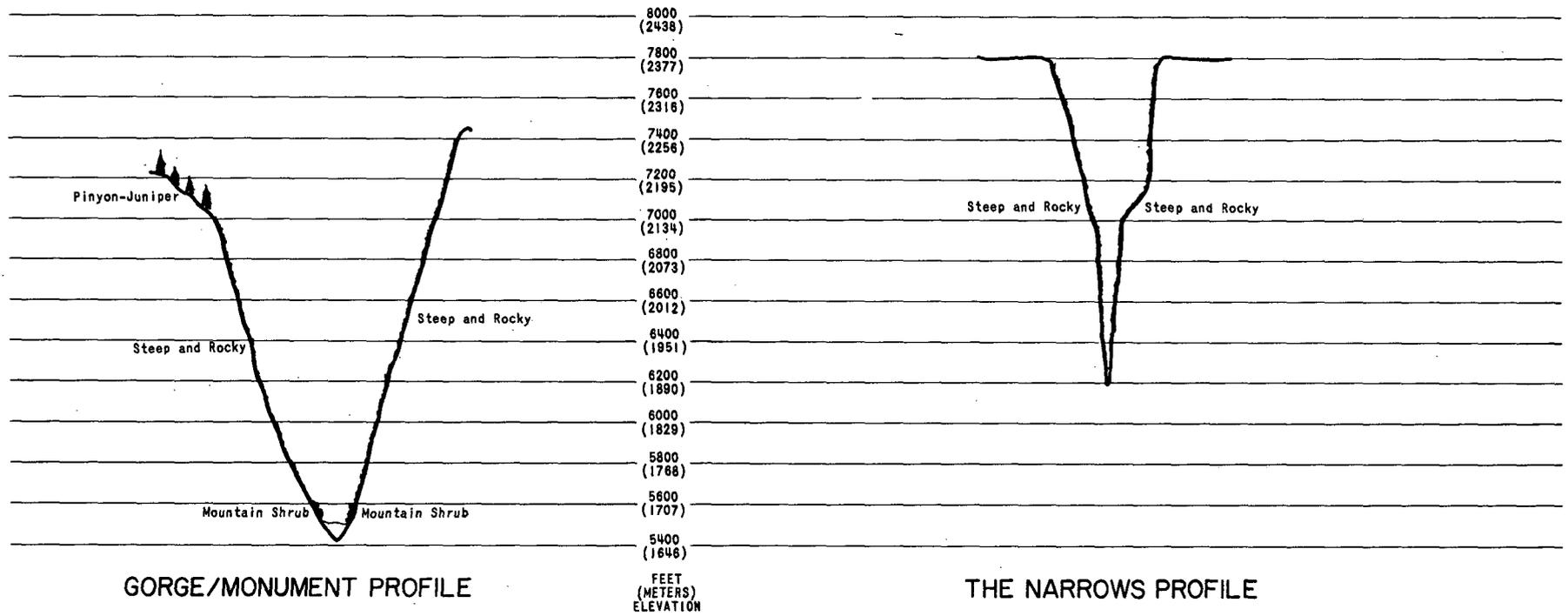


BLACK RIDGE PROFILE

C

PITTS MEADOW PROFILE

D



GORGE/MONUMENT PROFILE

E

THE NARROWS PROFILE

F

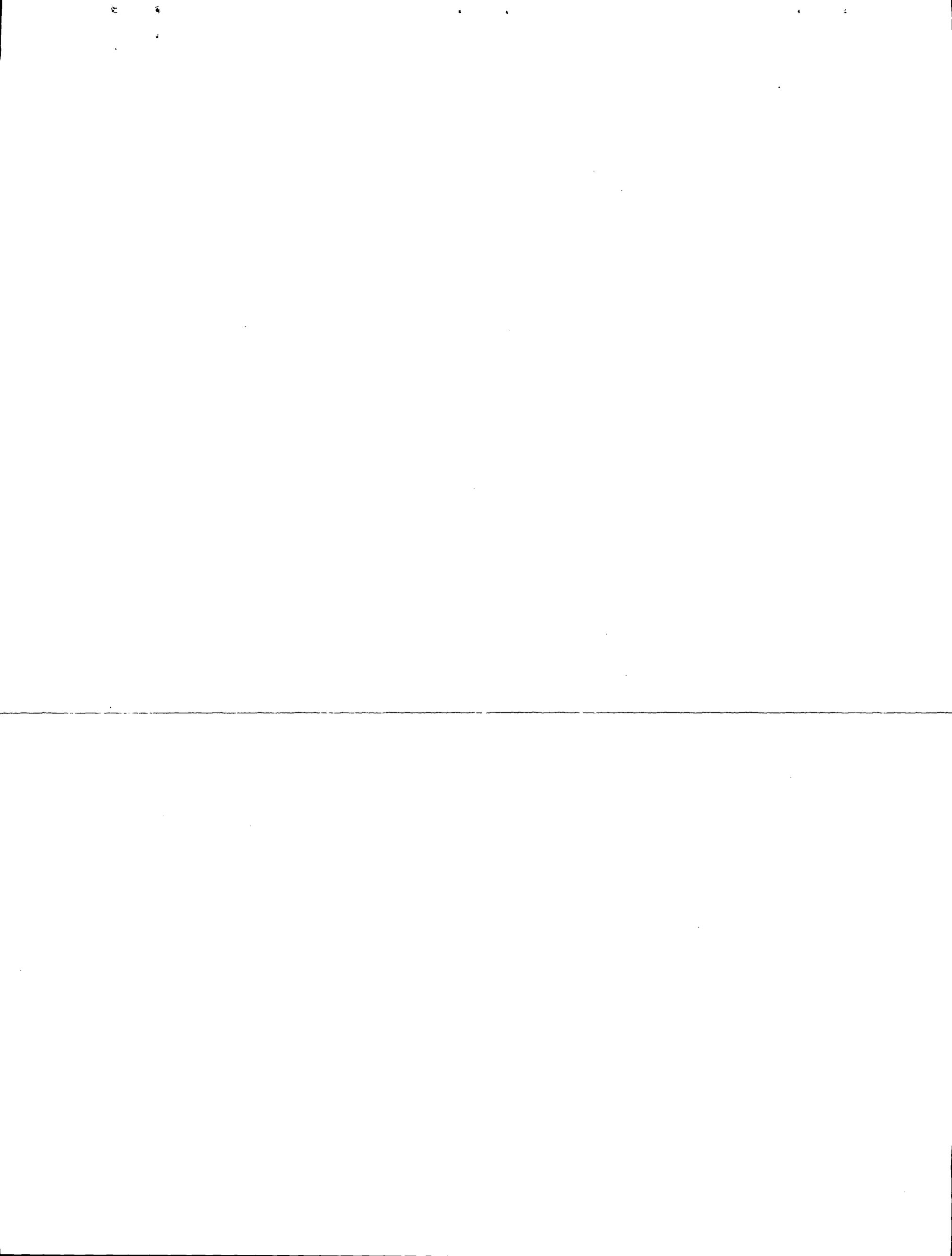
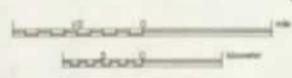


FIGURE 3-2

### GUNNISON RIVER CORRIDOR

#### Visual Intrusions

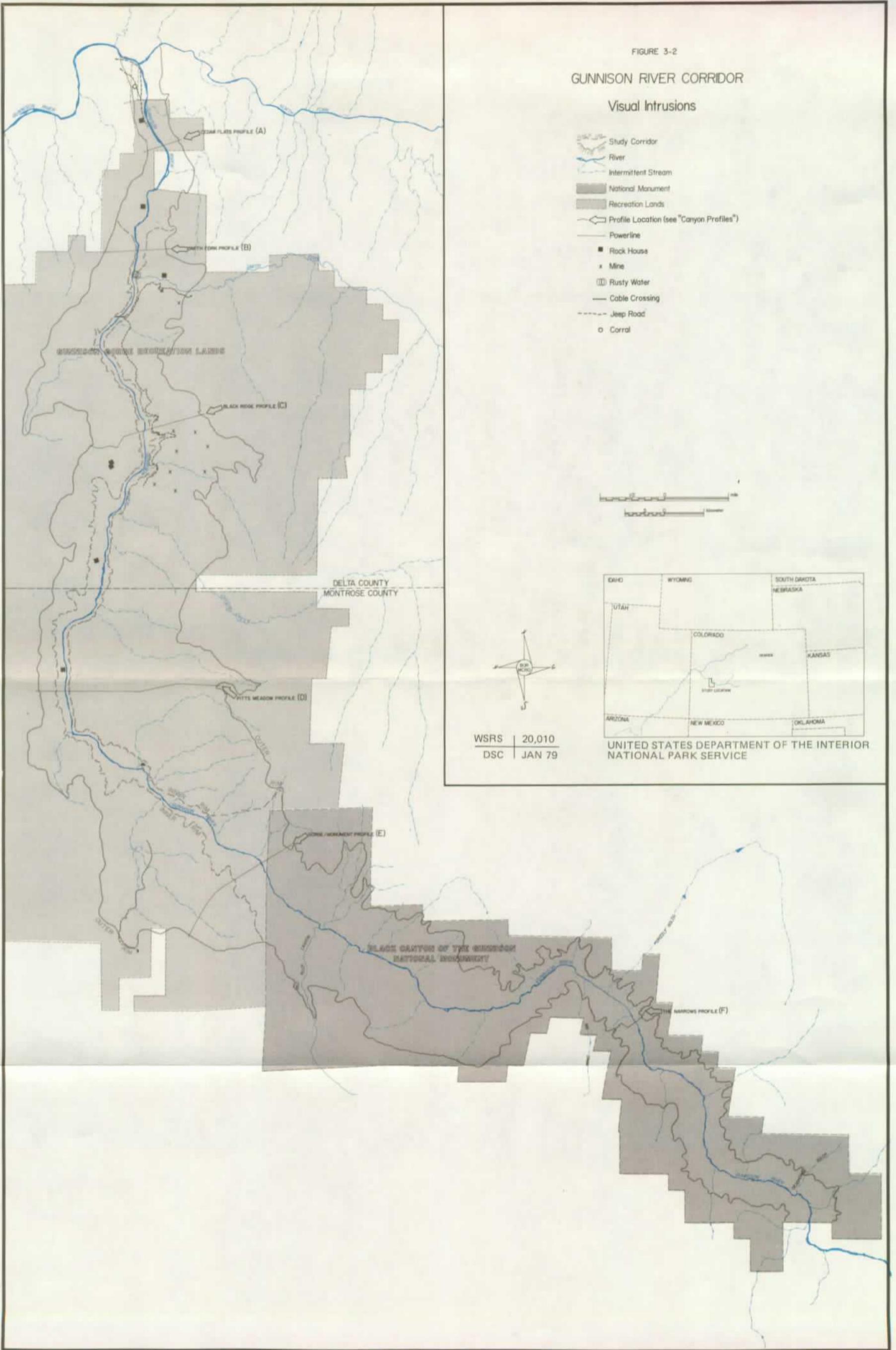
-  Study Corridor
-  River
-  Intermittent Stream
-  National Monument
-  Recreation Lands
-  Profile Location (see "Canyon Profiles")
-  Powerline
-  Rock House
-  Mine
-  Rusty Water
-  Cable Crossing
-  Jeep Road
-  Corral



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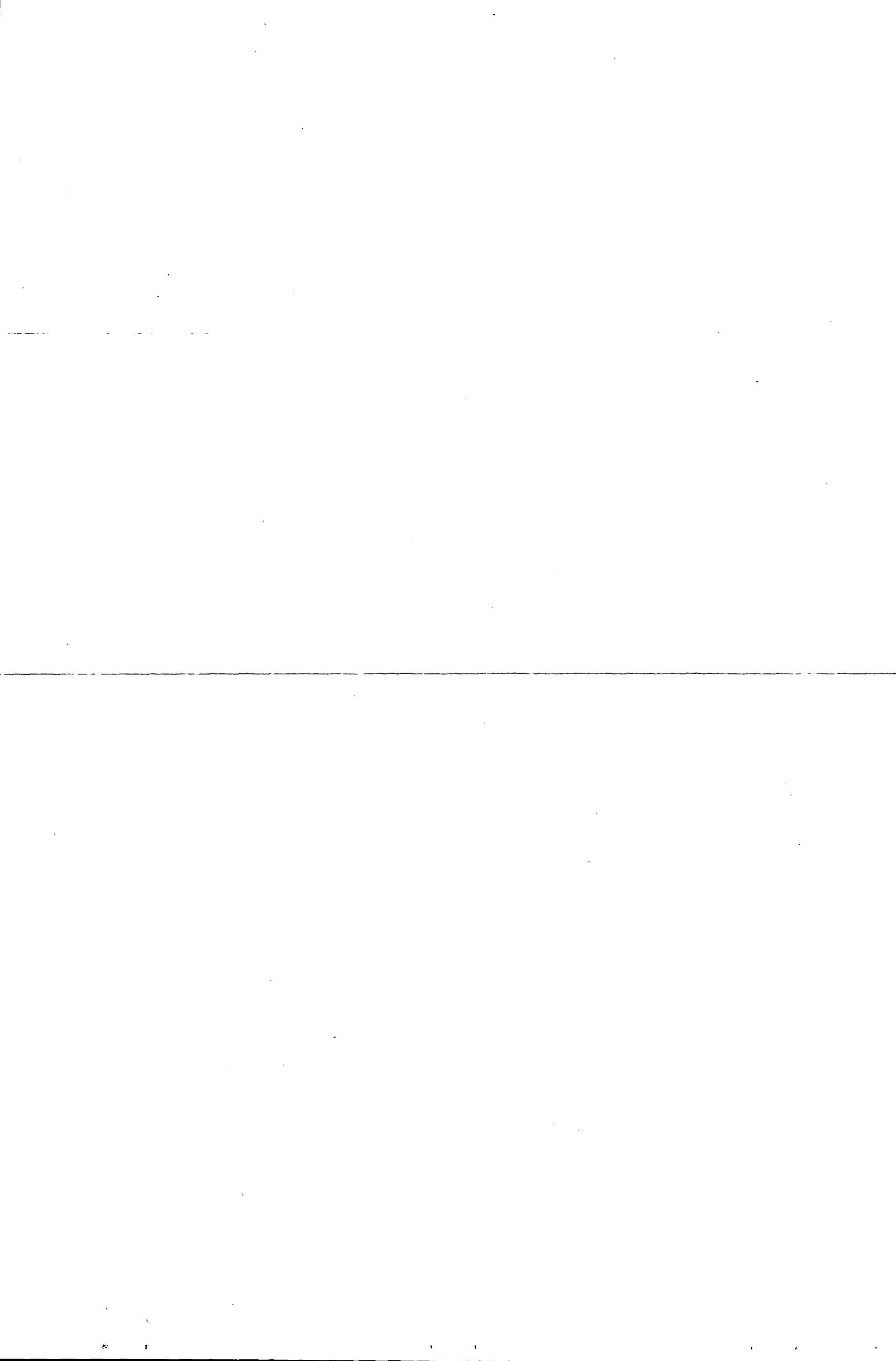
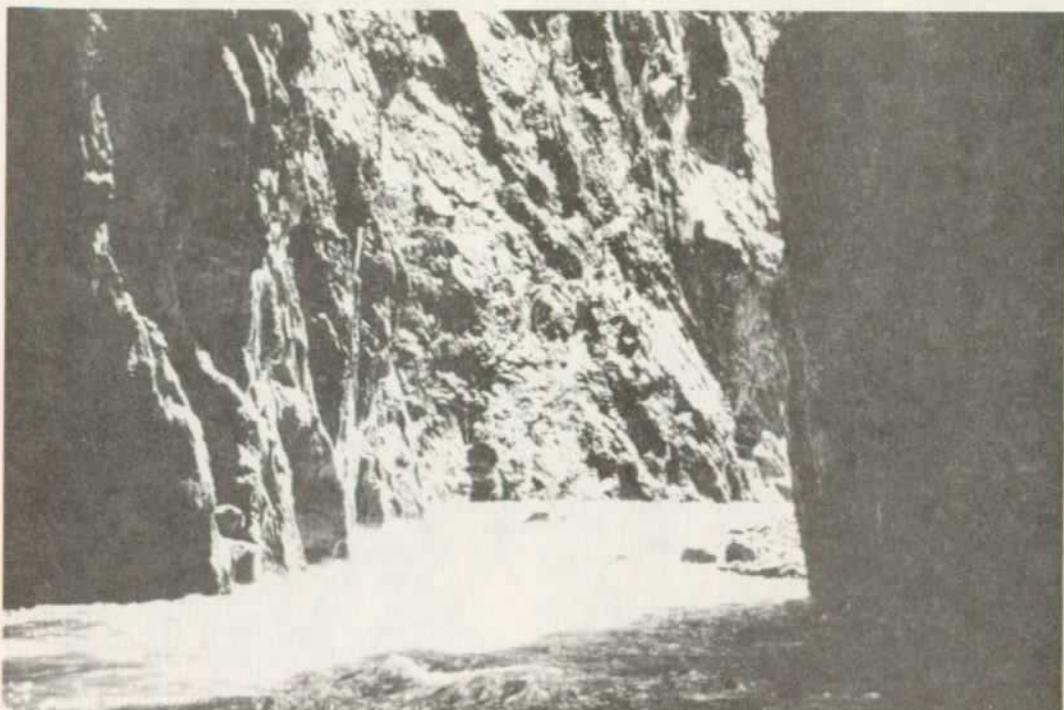


TABLE 3-1  
GUNNISON RIVER CORRIDOR  
Scenic Resources

Comparison Criteria	UPPER SEGMENT			LOWER SEGMENT 2.7 miles (4.3 km)
	Upper Monument 7.5 miles (12.1 km)	Lower Monument 5.2 miles (8.4 km)	Gorge 13.5 miles ( 21.7 km)	
Land Form*	Canyon of dark rock and extremely narrow; e.g., in narrows (40 ft. [12 m]) across at river, 1/4 mile (0.4 km) at top, 1,750 ft. (533 m) high. Some walls sheer and unbroken with network of pegmatite dikes and sills. Rock layers often severely deformed. Shoreline very narrow, rocky.	Canyon of dark rock, narrow but more flaring. Walls broken and eroded, 2000-2500 feet (610-762 m) high. Less spectacular network of dikes and sills. Rock layers often severely deformed. Shoreline narrow, rocky.	Steep, narrow inner canyon of dark rock severely deformed; 400-800 ft. (122-244 m) high, 1/8-1/4 mile (0.2-0.4 km) wide. Exposed faults. Outer canyon of horizontally-oriented red and tan sedimentary strata, 1000 to 2000 ft. (305-610 m) high, 2 miles (3 km) wide. Larger shoreline flats of soil and sand narrowing again below Ute Trail. Two large tributary streams in Smith Fork and Red Canyons.	Gradually diminishing (vertically) canyon. Precambrian disappears at upper boundary of this segment. Sedimentary strata are highly eroded and not well defined. Shallow canyon.
Vegetation	Minor to non-existent on walls; scattered Douglas fir and pinyon-juniper. Riparian: Douglas fir and ponderosa pine in upper half, lush pinyon-juniper in lower half, grassy shrubs, occasional cottonwoods, and box elder.	Minor on walls but more Douglas fir and pinyon-juniper than in Upper Monument segment. Riparian: Pinyon-juniper occasional cottonwoods and box elders; grasses and shrubs.	Outer canyon covered with pinyon-juniper. Riparian at bottom of inner canyon; pinyon-juniper, grasses, shrubs, occasional cottonwood, and box elder.	Scattered pinyon-juniper on north side, no perception of vegetation on south side. Riparian - reeds; grasses.
Water	Steepest gradient, swift, clear, average rate of fall 120 ft./mi. (23m/km) 480 feet (146 m) in one 2-mile (3-km) stretch. Large boulders create many rapids and falls. Huge boulders at Narrows hide river. One water-fall 17 ft. (5 m) high w/43-foot (13-m) cataract.	Steep gradient, swift, clear, average rate of fall 45 ft./mile (8 m/km). Large boulders create many rapids. Muddy water enters through Red Rock Canyon from irrigated fields.	Gradual gradient, slower, not very clear, average rate of fall 27 ft./mile (5 m/km). Few rapids, except for several good rapids in a 2-mile (3-km) stretch upstream from Smith Fork.	Shallow gradient, placid, meandering. Water not clear, but not as muddy as North Fork downstream.
Landmarks	Named rock formations; e.g., Painted Wall, The Narrows, Pulpit Rock. 43-foot (13-m)-long cataract terminating in a 17-foot (5-m) waterfall.	Warner Point.	Named features; Pitts Meadow, Pleasant Park, Buttermilk Ridge, Black Ridge, Red Canyon, Smith Fork; geologic faults in Ute Trail and Chukar Canyon areas.	None.
Spatial Enclosure	Extreme.	Extreme but less so than in the Upper Monument segment.	Strong in bottom of inner canyon but not extreme because of low walls. Moderate in Ute Trail area and in outer canyon.	Weak.
Panoramas	Breathtaking views from canyon rim and river bottom.	Outstanding views but less impressive than in the Upper Monument segment.	Outstanding views of inner and outer canyons and fault zones from Ute Trail and other high points along rim.	None outstanding.
Cultural Features	None.	None.	Six historic cabins; three along the river and three others within the outer rim.	Two historic cabins.
Visual Intrusions	Very few: toilet and fire rings at base of Gunnison Point; trash of fishermen and hikers along river.	Very few: toilet and fire rings at base of Warner Point; trash from fishermen and hikers; irrigation water discharge down Red Rocks Canyon.	Several: trash of fishermen and boaters; two low-standard dirt roads, neither visible from the river; cable across top of inner canyon; 3/4 mile (1.2 km) upstream from Smith Fork; rusty water from Smith Fork; area of recent mining activity (not visible from river on trails).	Several: powerline, steel towers; two low-standard dirt roads; irrigation ditch.
Scenic Quality	Outstanding.	Outstanding.	Outstanding.	Not outstanding.
Relative Wilderness Quality	Pristine.	Pristine.	Mostly pristine.	Not pristine.

\* Refer to river canyon profiles in figure 3-1.



River flow is severely constricted at the Narrows.



Colorful pegmatite dikes interlace across Painted Wall.

The river itself is entrenched in a steep, narrow inner canyon of dark Precambrian rocks, many of which are severely deformed. The distance from river to inner rim varies between 400 and 800 feet (120 and 240 m); inner rim to inner rim distance varies from 600 feet (180 m) to a quarter-mile (400 m). Above this lower inner gorge flares a broad, spacious canyon carved through a succession of lavender, red, green, gray, and tan Jurassic and Cretaceous strata. Depth of this outer gorge ranges between 1,000 and 2,000 feet (300 and 600 m); its width is approximately 2 miles (3 km). Three major tributary canyons drop down to the Gunnison along this segment. The largest of these, the Smith Fork, rises in the West Elk Mountains and contains a fairly large stream, but nearly all of its water is used for irrigation on land northeast of the study area. Red Rock Canyon Creek drains the Bostwick Park area to the south of the monument. Chukar Canyon provides the primary access to the river just below the monument.

The sequence of rocks, which extends from Precambrian to Cretaceous, covers a span of 1.75 billion years. The wide variety of strata tend to color this segment more brilliantly than in the monument; here, in addition to the somber grays, are buffs, greens, lavenders, tans, and reds. This color variety is closely related to the geology which shows many unique structural features, the most prominent being the dramatically exposed Ute Indian Fault and the equally evident Uncompahgre Unconformity.

The shoreline of the inner gorge is variable. In places there are broad flats and benches; almost as often there is little but a rubble of boulders and steep walls dropping directly into the river. Some box elders grow on the riverbanks, along with grasses and shrubs. The outer canyon is sparsely covered with juniper and pinyon, and in many places it is virtually without soil.

The river in this segment drops an average of 27 feet/mile (5 m/km) creating a swift flow in its own right, but it is hardly comparable to the roar and crash of the river in the monument. There are many rapids, the most notable being in a 2-mile (3-km) stretch just below Red Canyon of Crystal Creek where the gradient is 43 feet/mile (8 m/km). Water quality remains high, though there is slightly more suspended matter in the Gunnison here.

There are a number of cultural sites along this segment, including six historic cabins, the Ute Trail, and an abandoned lime kiln. Several comparatively recent manmade intrusions are also present: two rough dirt roads, a cable across the top of the inner gorge about 1 mile (1.6 km) upstream from the figure 3-1a (profile B) representation, and an area of recent nonproductive mining near the point represented by profile C. None of these, except the cable, is apparent from the river. Mule deer are occasionally seen and elk less commonly, except in the winter. Resident raptors include the golden eagle, redtailed hawk, kestrel, and turkey vulture; the prairie falcon may also nest on the upper rims of the gorge and bald eagles winter here. Thousands of waterfowl also use the gorge as a resting area in the winter months.

### Lower Segment

In the last 2.7-mile (4.3-km) portion of the study corridor, extending from 1 mile (1.6 km) below the Smith Fork to the confluence with the North Fork, the Gunnison riverscape changes. The dark Precambrian rocks of the Black Canyon pass below the surface of the river and the sandstone slopes diminish, leaving the area surrounded by Mancos shale. The river flow is placid and the stream course meandering. As opposed to the upper segment, which contains only very minor manmade intrusions, this lower



Canyon walls of the lower monument begin to flare outward.



A broad outer canyon dwarfs the narrow inner canyon through the gorge.

segment has two rough dirt roads, a high-voltage transmission line, and a diversion that are readily visible from the river. Vegetation is sparse, and the landscape lacks features of outstanding quality.

## NATURAL ENVIRONMENT

The study corridor lies in a transition zone between two physiographic provinces, the Southern Rocky Mountains to the east and the Colorado Plateaus to the west. Inasmuch as the boundary is ill defined, the area shares characteristics of both provinces. The wide variety of landforms, as shown in figure 3-3, is the result of the Gunnison River which, down through time, has carved the Black Canyon into the deeply exposed Gunnison uplift.

### Physiography

The Gunnison uplift, as shown in figure 3-4, is the dominant structural feature of the study area. This major crustal block extends about 55 miles (90 km) southeastward from Austin and has a mean width of about 15 miles (25 km). The sloping tops of Fruitland Mesa, Grizzly Ridge, Vernal Mesa, Poison Spring Ridge, Dead Horse Mesa, Poverty Mesa, Mesa Inclinado, and several mesas near the head of the canyon all are manifestations of this great tilted block.

Just below the monument the difference in altitude from the tip of Green Mountain east of Pleasant Park to the river below Red Rock Canyon is more than 3,000 feet (915 m). Although this major difference in elevation is not readily evident from the river, 1.5 miles away, this is the greatest local relief in the entire Black Canyon region.



Chukar Canyon in center foreground provides access to the river upstream in the Gunnison Gorge Recreation Lands. (view northwest)



The Uncompahgre Unconformity is evident at the canyon rim above the Narrows.



Numerous rapids line the river just upstream from the Smith Fork confluence.

The gorge is prime habitat for the endangered river otter.

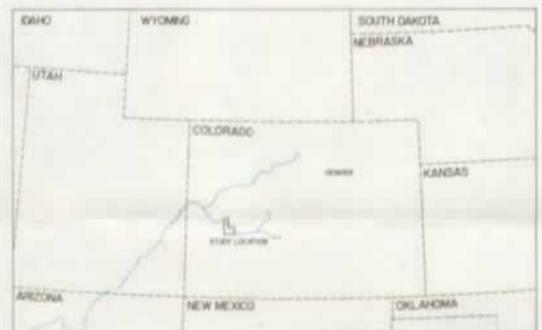
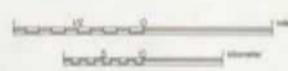


FIGURE 3-3

### GUNNISON RIVER CORRIDOR

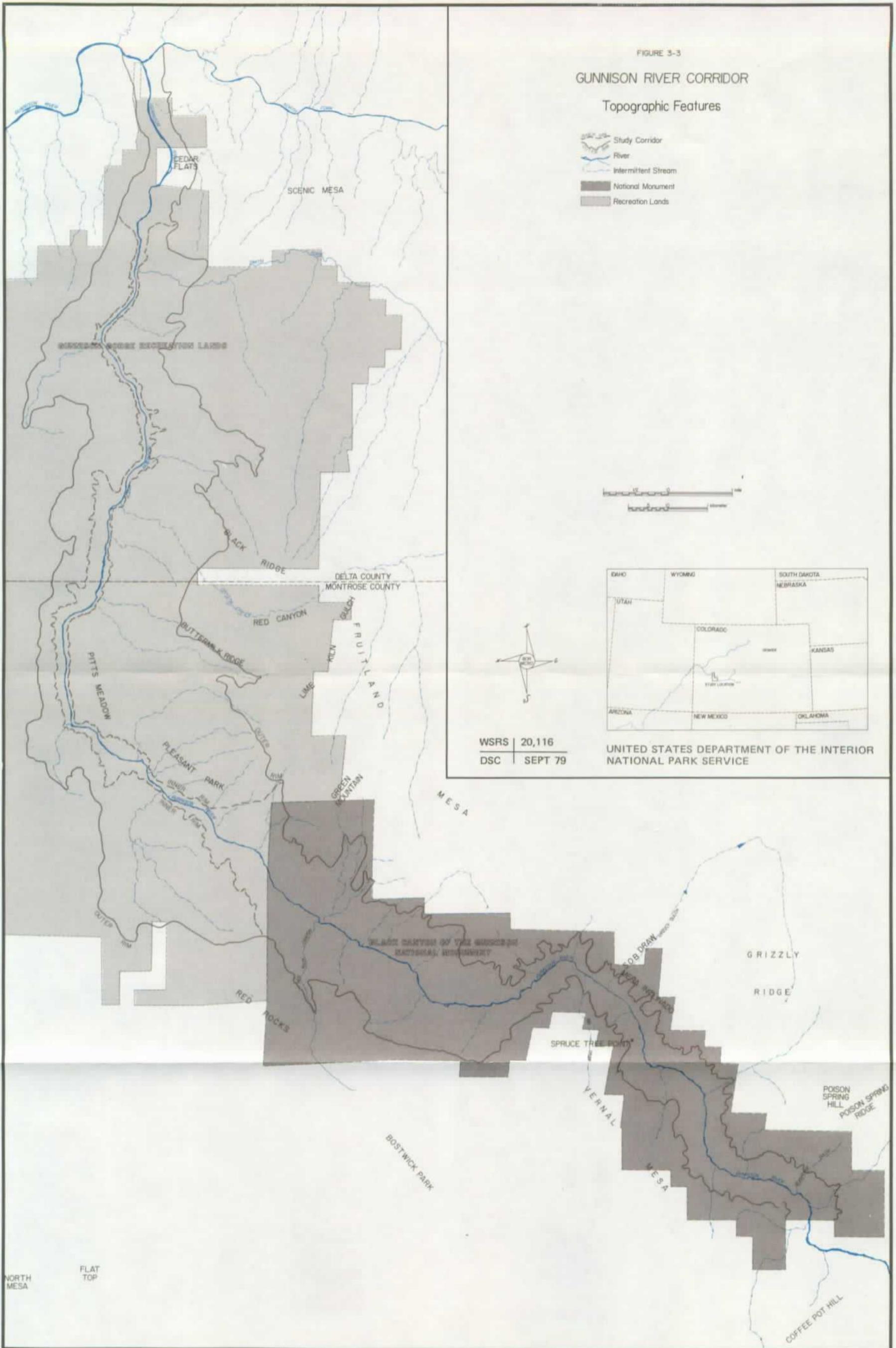
#### Topographic Features

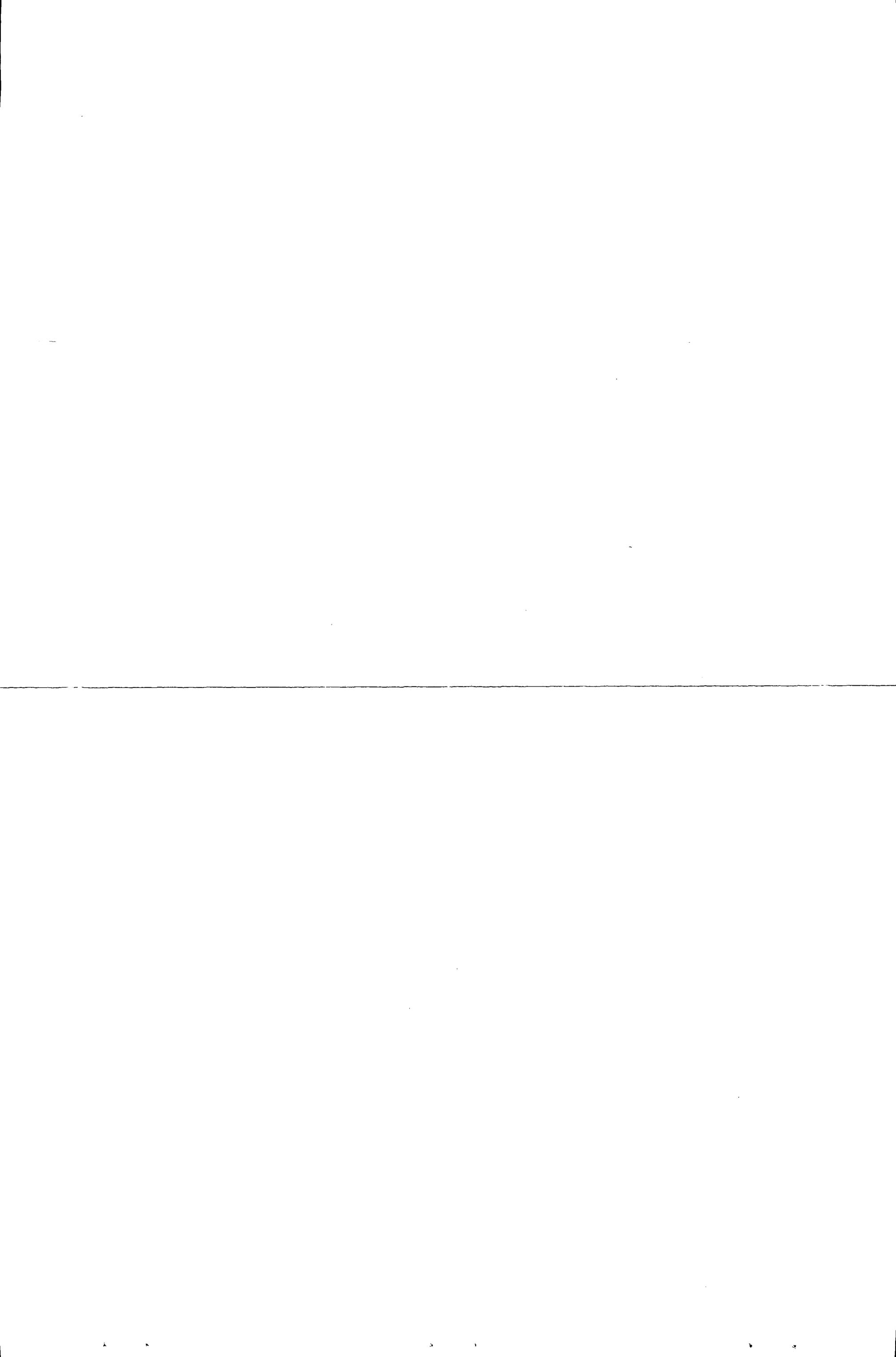
-  Study Corridor
-  River
-  Intermittent Stream
-  National Monument
-  Recreation Lands



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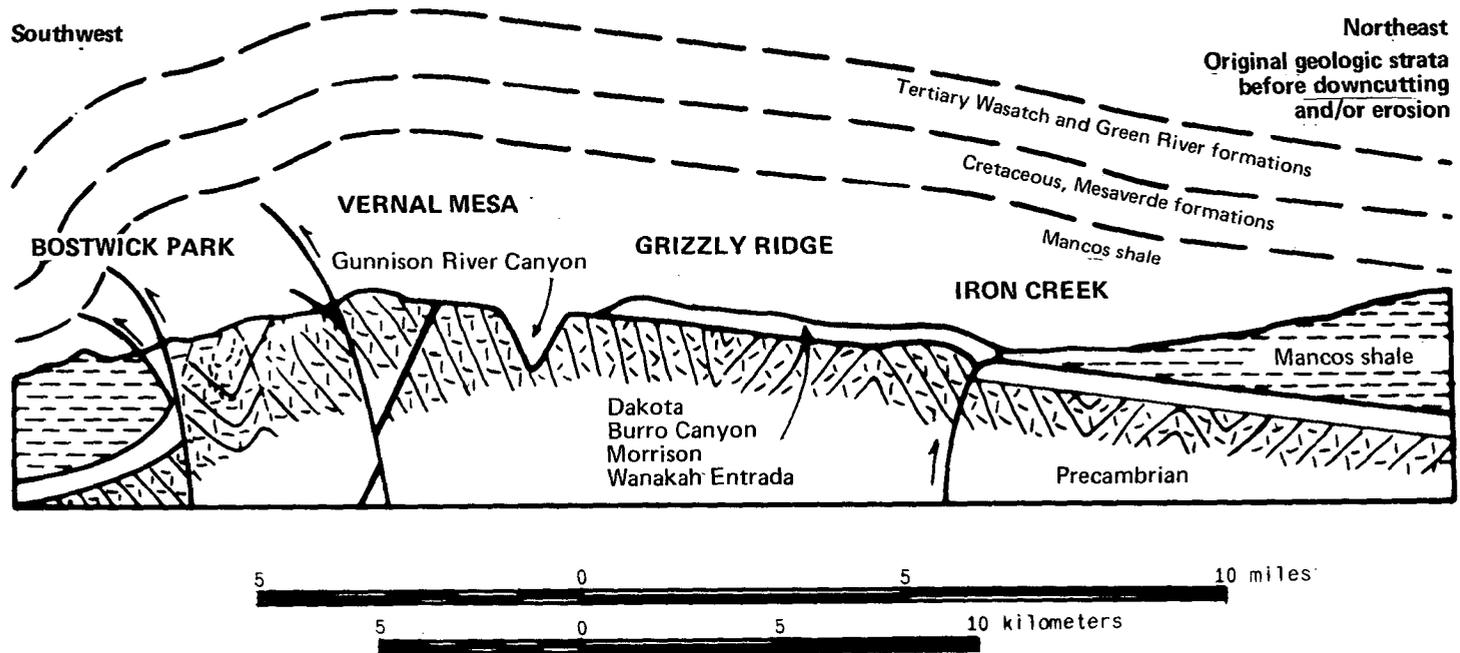
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Roads border the river above the North Fork confluence.



Vertical exaggeration about 2½ times.

FIGURE 3-4  
 GUNNISON RIVER BASIN, COLORADO  
 GUNNISON UPLIFT

## Geology

At one time the entire region was capped by flat-lying, Tertiary volcanic rocks. This capping has been differentially eroded so that none of it remains in the study area, although much of it remains on the rims in the headward part of the canyon and on the mesas bordering the Curecanti Recreation Area. Table 3-2 lists chief rock formations located in the vicinity of the study corridor. This corridor is divisible into three contrasting geologic areas within the upper and lower segments: (a) monument section, (b) gorge section, and (c) lower segment.

Upper Segment. Geologically, the upper segment is divided into the monument section and the gorge section. The monument section extends from the upstream boundary of the monument to the vicinity of Chukar Canyon. The gorge section extends from Chukar Canyon to about 1 mile (1.6 km) below the confluence of the Smith Fork.

Monument Section. Precambrian crystalline rocks are exposed along the full length of this section. They include a profusion of metamorphic varieties, such as feldspathic gneiss, mica schist, quartzite, metagraywacke, amphibolite, and abundant igneous rocks of varied textures and ages. The otherwise dark gray basement rock of Precambrian granite and schist is interlaced with abundant light orange pegmatite dikes and sills. These colorful outcrops are most prominent in the monument on Painted Wall. Other good pegmatite exposures occur near the mouth of Chukar Canyon, Rock Point, and in the northeast wall of the canyon opposite Gunnison Point.

Two main sets or families of steeply dipping joints extend throughout the canyon area; one set trends northwestward, the other northeastward. Joints are fractures in rocks, along

Table 3-2

BLACK CANYON REGION  
Major Rock Formations

Era	System	Formation	General Character and Thickness	Approximate Age in Millions of Years	Where Well Exposed
Cenozoic	Quaternary	Surficial deposits (Alluvium, talus, and landslides)	Highly variable unconsolidated deposits of many types.	Mostly less than one million years	Various cut banks of streams, hill-sides, and canyon floors
	Tertiary	Blue Mesa Tuff	Cliff-forming, light-bluish gray to pale-reddish brown welded volcanic tuff, <250 feet thick	25	Rim rock of Blue, Black, Dillon, Fitzpatrick, and Soap Mesas
		West Elk Breccia	Light- to dark-gray, very coarse, very heterogeneous volcanic tuff-breccia <1,000 feet thick near Blue Mesa Reservoir	27	Soap Creek, Black Mesa
Mesozoic	Cretaceous	Mancos Shale	Dark-gray silty marine clay shale. Forms badlands northeast of Montrose. As much as 2,200 feet thick	89-90	West and north of Gunnison River Study Corridor
		Dakota Sandstone	Light-gray fluvial and littoral quartzitic sandstone. Forms dipslopes; <100 feet thick	100	Lower Gunnison River Study Corridor
		Burro Canyon Formation	Cliff-forming, fluvial conglomeratic sandstone <120 feet thick	120	Lower Gunnison
Mesozoic	Jurassic	Morrison Formation	Brushy Basin Member: Vari-colored red, lavender, green and gray fluvial mudstone, shale, and sandstone, <350 feet thick  Salt Wash Member: Interbedded gray cliff-forming fluvial sandstone and red silty shale, 110-175 feet thick	130	Lower Gunnison River Study Corridor
		Wanakah Formation	Mostly gray silty lacustrine mudstone interbedded with gypsum, <255 feet thick  Junction Creek Member: Gray crossbedded eolian sandstone as much as 90 feet thick  Pony Express Limestone Member: Silty gray lacustrine limestone 1-7 feet thick. Nonexistent east of Dead Horse Mesa	135	Lower Gunnison River Study Corridor
		Entrada Sandstone	Yellow to pink fine-grained eolian sandstone having a basal conglomerate 1-5 feet thick. Formation is 100 feet thick west of Pitts Meadow but thins to zero east of Poison Spring Hill	140	Lower Gunnison River Study Red Rock Canyon
Paleozoic	Ordovician or Cambrian	Diabase	Dark gray to black, fine- to medium-grained dikes a few inches to 300 feet wide and several miles long	510 ± 60	Morrow Point Reservoir
Precambrian		Pegmatite	Abundant light-gray to pink very coarse-grained dikes and irregular intrusive bodies. Range in thickness from less than an inch to many hundreds of feet	Wide range in age 1,360+	Widespread throughout Gunnison River Study Corridor
		Curecanti Quartz Monzonite	Light-gray to pink, medium-grained quartz monzonite or granite typically exposed at Curecanti Needle. Thousands of feet thick	1,420 ± 15	Morrow Point Reservoir Curecanti Needle
		Vernal Mesa Quartz Monzonite	Mottled gray very coarse-grained prophyritic quartz monzonite, typically exposed at Chasm View. Thousands of feet thick	1,480 ± 40	Chasm View, Pair Wall overlook, Sunset View
		Pitts Meadow Granodiorite	Mostly medium- to dark-gray medium-grained foliated granodiorite or quartz diorite (trondhjemite). Batholithic in size.	1,730 ± 190	Lower Gunnison River Study Corridor
		Metamorphic rocks	The predominant rocks of the Gunnison River Canyon. Various feldspathic gneisses, schists, and metaquartzites of varied color and texture. Thousands of feet thick	1,700 ± 70	Widespread throughout Gunnison River Study Corridor



Cliffs of mica schist line the inner gorge near the mouth of Chuckar Canyon.

which there has been little or no displacement of one side past the other. They contrast with faults, along which there has been appreciable or even great displacement. The northwesterly set of joints is the more prominent in the monument where some individual fractures extend more than 2 miles (3 km).

Gorge Section. Below Chukar Canyon there is exposed a unique sequence of dark gray granite and sedimentary rocks with their reds, tans, grays, and greens. These Mesozoic sedimentary rocks form bright-colored flaring walls, 1,000 feet (300 m) thick and nearly free of soil, above a narrow inner gorge of dark Precambrian granite (the Pitts Meadow Granodiorite).

Although the schists and granites are more spectacular in the monument and the sedimentary rock of the gorge is common to other rivers in the southwest, the gorge lands are remarkable in combining them both.

The oldest igneous rocks in the canyon are also among the most ancient rocks exposed in Colorado. They occur at Pitts Meadow between Chukar Canyon and the Smith Fork drainage. Radiometric dating indicates these rocks are 1.75 billion years old, as opposed to the 1.42 - 1.45 billion-year-old igneous rocks found in the monument. Metamorphic rocks throughout the Black Canyon have radiometric ages of about 1.75 billion years. The entire mass of rocks has been metamorphosed by compression, shearing, and folding. Similar rocks are found in the heart of the San Juan Mountains 50 miles (80 km) south of the study area, in the Sawatch Range about the same distance to the east, in the Front Range of the Rockies west of Denver, and in the bottom of Grand Canyon of Arizona. These rocks are similar in a general way to those in the Lake Superior and Hudson Bay regions of Canada.

One of the most impressive and best exposed faults in Colorado, the Ute Indian Fault, trends almost due northward along the middle part of the canyon, primarily in the west wall. The 700-foot-high (210-m) escarpment of this fault zone dominates a north-trending line of fractures along which dark Precambrian granite (the Pitts Meadow Granodiorite) was thrust eastward hundreds of feet up and over the younger sedimentary rocks. This remarkable thrust fault is very conspicuous in the Chukar Canyon, Pitts Meadow, and the Ute Trail areas. It extends more than 6 miles (10 km), beginning at the first large ravine 3 miles (5 km) downstream from Red Rock Canyon on the southwest side of the canyon. The fault's clarity of exposure and dramatic topographic expression are outstanding.

Other outstanding geological features in the canyon include the Uncompahgre Unconformity which is well displayed at the contact surface between the Precambrian basement and the overlying Entrada Sandstone. This unconformity is exposed at various other locations through the region and represents a time gap of more than 1.5 billion years. It was formed during the Pennsylvanian to mid-Jurassic periods, when the ancestral Uncompahgre Highland was uplifted and eroded.

Lower Segment. This segment, which exhibits no outstanding geologic features, is devoid of steep canyon walls and is capped by Dakota Sandstone. Lands bordering this section of the corridor are generally rolling. The geologic strata exposed here include the Morrison, Burro Canyon, and Dakota formations. Mancos shale, which is common throughout the surrounding area, is exposed beyond the canyon rims.

## Mineral Resources

When the region was first settled in 1873, mining was the principal economic activity. Areas in both Delta and Montrose Counties near the study corridor have been subjected to insignificant mining operations. The exploratory mines, shown in figure 3-2, have been nonproductive. Principal minerals within the corridor include gypsum, sand, and gravel; gold exists in the river gravels. None occur in commercially significant quantities. Further complicating commercial extraction are access to the mineral resources, which is poor, and transportation to nearby market areas, which is inadequate. As a result, there are no known mineral deposits either in the gorge or monument that exist in concentrations and quantities suitable to permit commercial extraction under existing conditions.<sup>1</sup>

## Energy Resources

Within the corridor there are no known fossil fuels or geothermal resources. The only mineral adjacent to the study area that may have an economic influence on the designation of the Gunnison River is coal. Located several miles north of the study area in the vicinity of the North Fork Valley are the Grand Mesa and Somerset coal fields.

Formations that contain uranium in other parts of the region are found in the northern end of the gorge. An anomaly of several

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1. Brauch, Earl F., Mineral Reconnaissance of the Black Canyon of the Gunnison River and Vicinity, Delta and Montrose Counties, Colorado, U.S. Bureau of Mines, Denver, Colorado (September 1976, unpublished) pp. 1 and 13.

times the background scintillation count has been observed by Al Hornbaker of the Colorado Geological Survey in the Salt Wash member of the Morrison Formation along the Ute Trail, about 1 mile (1.6 km) south of the area represented in figure 3-1a (profile C). However, subsequent examination did not reveal any surface mineralization to indicate the source of the anomaly.<sup>1</sup> There are no other known records to suggest the presence of uranium in the study area.

According to the U.S. Bureau of Mines, "The area in and adjacent to the Gunnison Gorge is an unlikely province for petroleum accumulation because the core of the gorge is composed of igneous and metamorphic rocks."<sup>2</sup> The only other energy resource is the river, which has potential for hydropower production as discussed in the section on "Water Resources."

### Climate

Few climatological data are available for the study area. Based on readings taken at a weather station on the south rim of the monument at an elevation of 8,100 feet (2,470 m), the annual mean temperature at for the period 1969-1975, inclusive, was 42°F (5°C). Annual mean precipitation for the same period was 16 inches (41 cm).

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1. Ibid., p. 8.

2. Brauch, Earl F., Mineral Reconnaissance of the Black Canyon of the Gunnison River and Vicinity, Delta and Montrose Counties, Colorado, U.S. Bureau of Mines, Denver, Colorado (September 1976, unpublished), p. 12.

The deep chasms, sharp ridges, and tributary ravines of the canyon, especially through the monument, cause abrupt microclimatic variations. Some recesses of the canyon that are shielded by cliffs receive little or no sunshine. Other parts, including the stretch between The Narrows and Chasm View, are exposed only for an hour or so at midday. The response of vegetation to such microclimatic variations is obvious in the canyon. The north- and south-facing exposures of High Point, for example, show clearly defined boundaries between pinyon-juniper woodland, oak-serviceberry brushland, and patches of Douglas-fir forest.

### Soils

The major portion of the study corridor consists of rock outcrop and extremely shallow soils. There are no prime or unique agricultural lands located here. Three main groups of soils occur in the study area, namely, (a) Aridic Argiboroll-Aridic Haploboroll, (b) Lithic Ustic Torriorthent, and (c) Ustollic Haplargid general soil map units. Figure 3-5 shows the general location of soil complexes and land types associated with these units.<sup>1</sup>

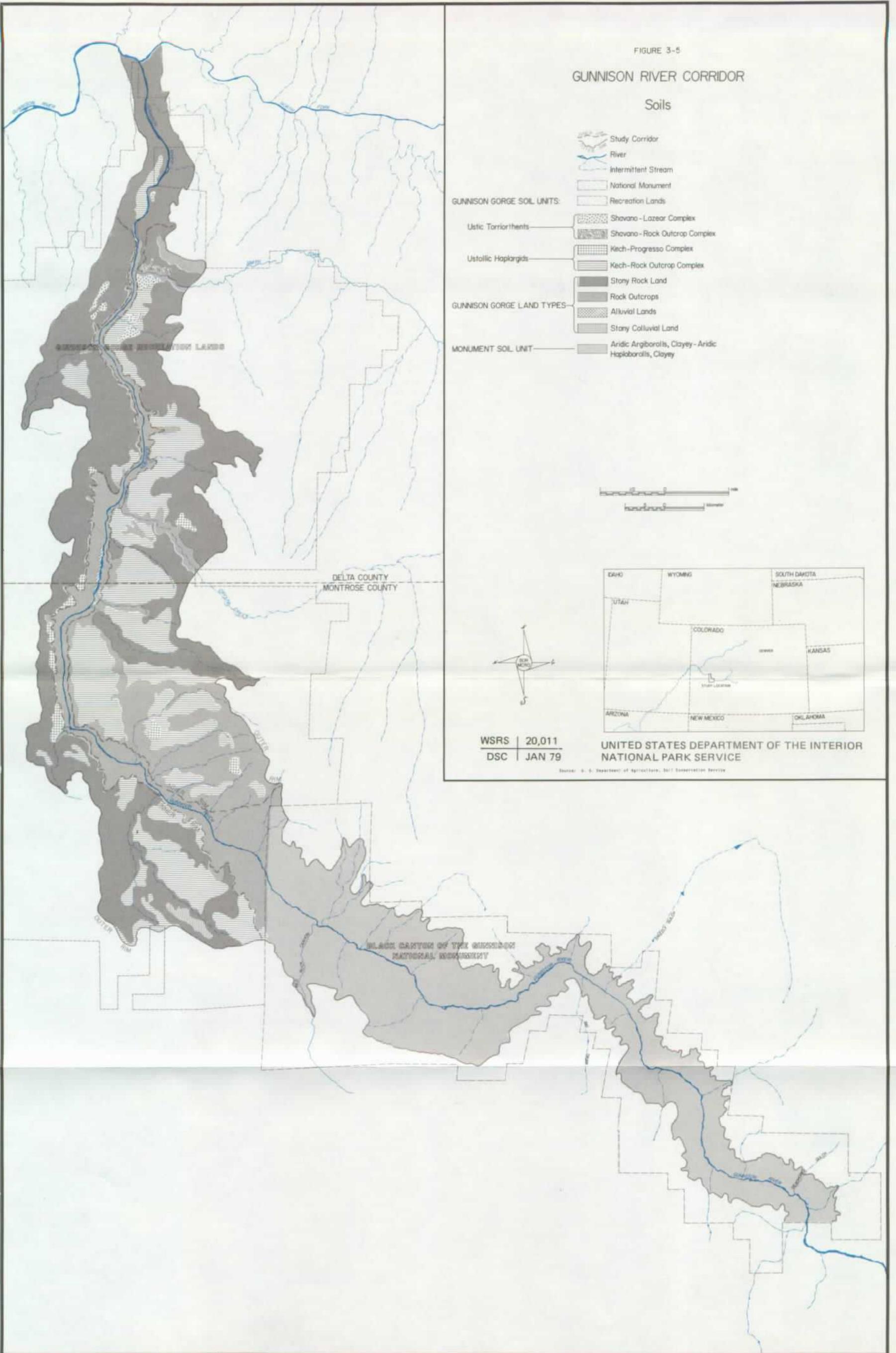
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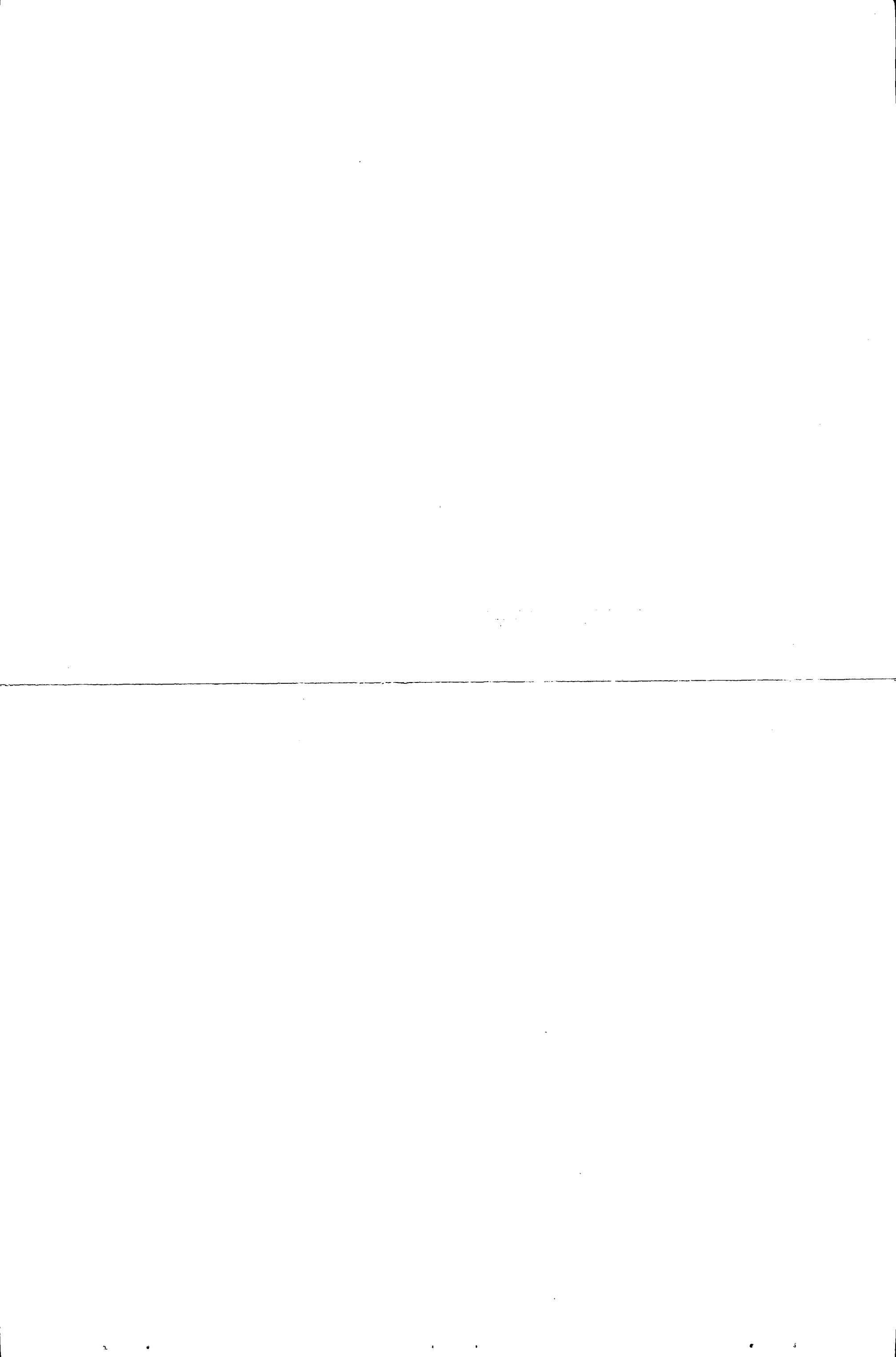
1. A soil complex consists of areas of two or more soils so intermingled that they cannot be shown separately on a soils map. Each area of a complex contains some of each of the dominant soils, with the pattern and relative proportions being about the same in all areas. Land types which are given a descriptive name consist of soil material that is so rocky, shallow, or variable in texture that it cannot be classified by a soil series.

FIGURE 3-5

### GUNNISON RIVER CORRIDOR

#### Soils





## Vegetation

There are seven basic vegetative types along the study corridor which have been combined into three generalized groups (see figure 3-6). These vary with elevation, exposure, slope, and proximity to water. The seven vegetative types and their associated dominant species are (a) mountain shrub--narrowleaf cottonwood and box elder; (b) conifer--ponderosa pine, Douglas-fir, and aspen; (c) steep and rocky--pinyon and Utah juniper; (d) shoreline--box elder and willow; (e) sagebrush and greasewood--big sagebrush, black greasewood, and salt cedar; (f) pinyon-juniper--Utah juniper, pinyon, salt cedar, and narrowleaf cottonwood; and (g) saltbush--shadscale, yucca, and cactus. A summary of the acreage within each vegetative type appears in table 3-3 and includes the area within the outer rim of the gorge.

Table 3-3  
GUNNISON RIVER CORRIDOR  
Area by Vegetative Types

<u>Vegetative Type</u>	<u>Acres</u>	<u>(Hectares)</u>	<u>Percent</u>
Mountain shrub	740	(299)	3.0
Conifer	482.5	(195)	2.0
and rocky	7,072.5	(2,862)	28.7
Shoreline	97.5	(39)	.4
Sagebrush-greasewood	135	(55)	.6
Pinyon-juniper	15,690	(6,350)	63.7
Saltbush	407.5	(165)	1.6
TOTALS	24,625.0	(9,965)	100.0

Because of variations in microclimate and topography within short distances along the study corridor, some of the vegetative types overlap. Grasses are found throughout the corridor. On the extreme lower end below the Smith Fork, desert shrubs predominate. Above this short segment, sagebrush, oakbrush, and

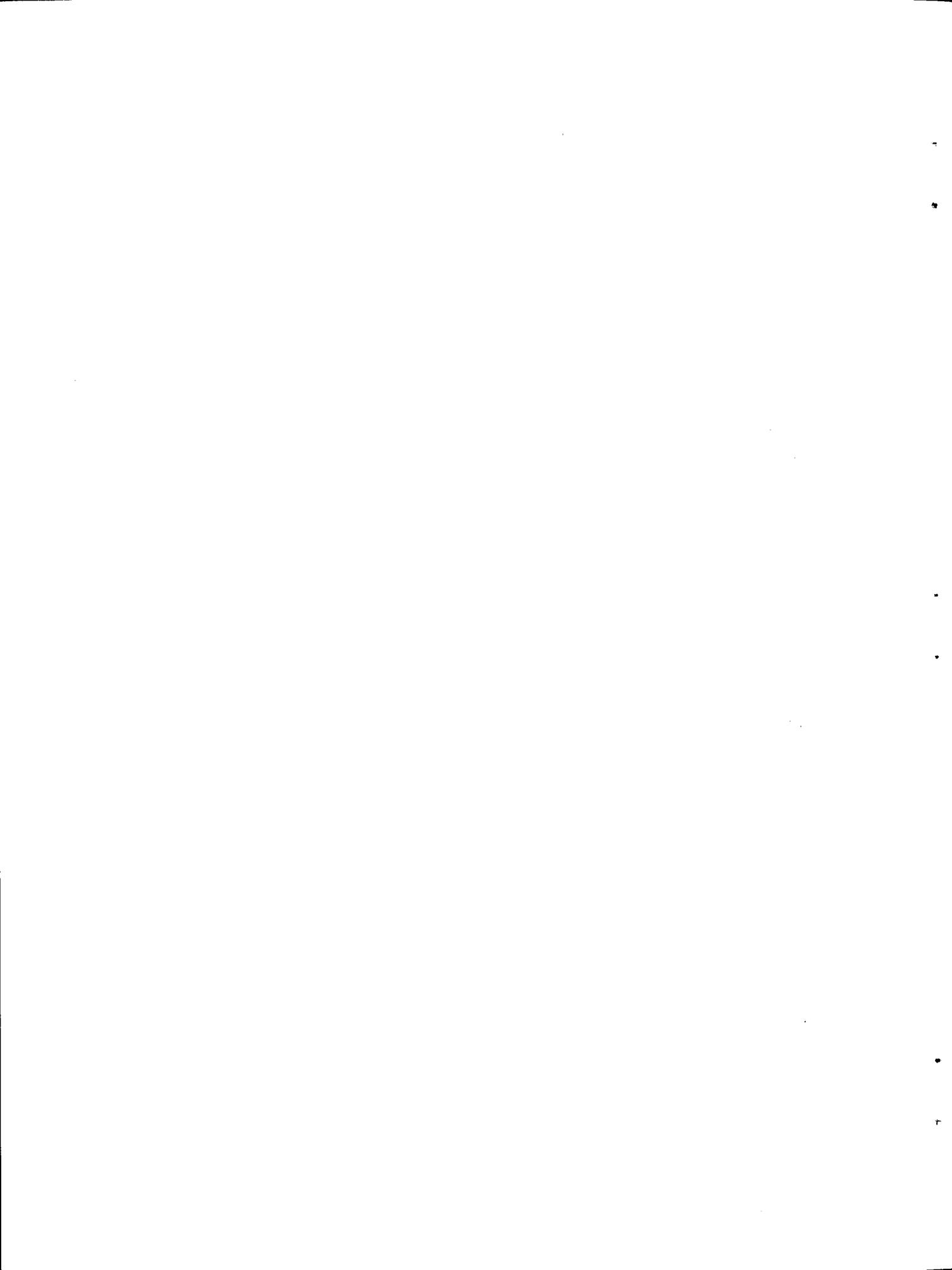


FIGURE 3-6

GUNNISON RIVER CORRIDOR

Generalized Vegetation

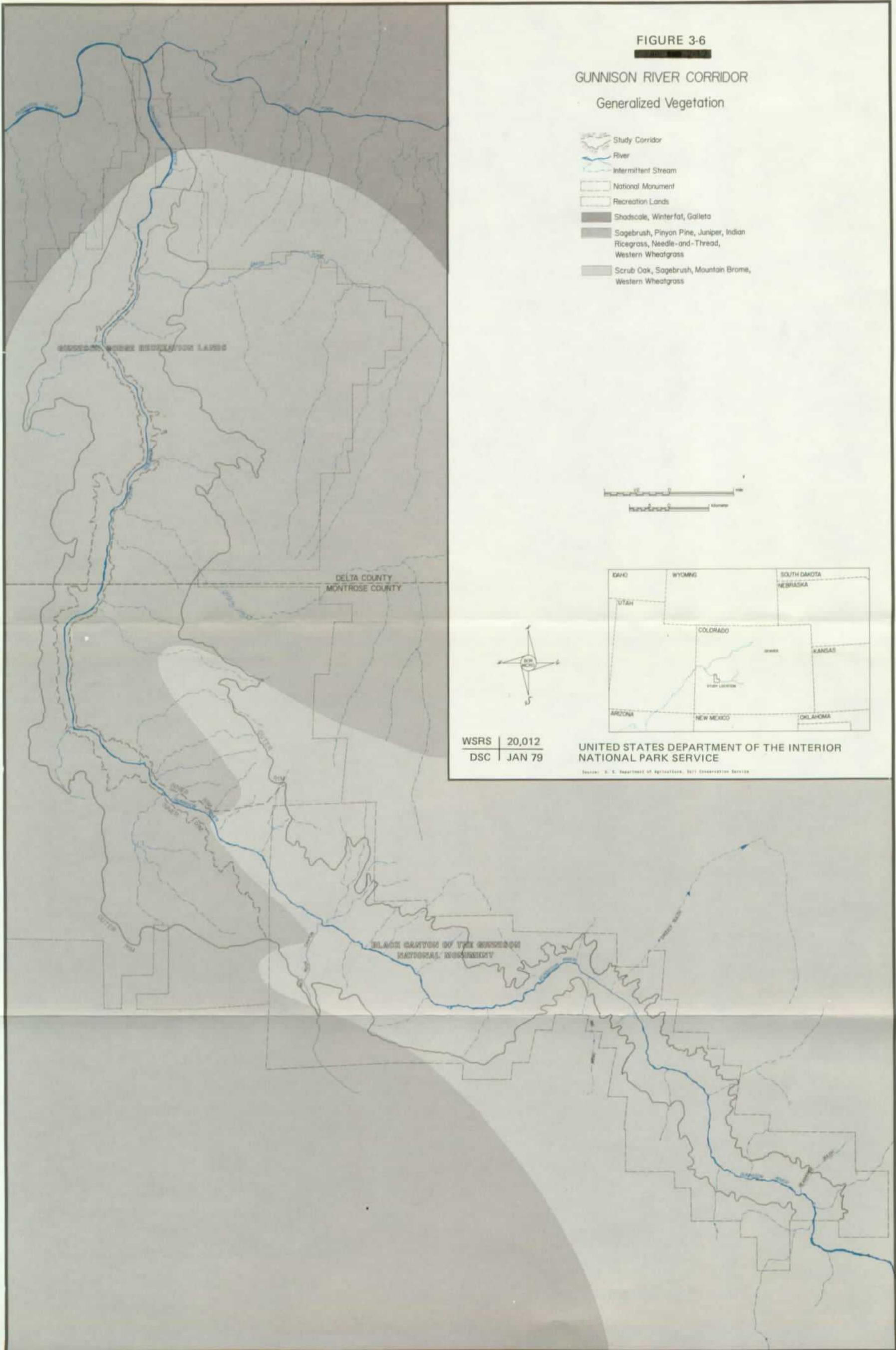
-  Study Corridor
-  River
-  Intermittent Stream
-  National Monument
-  Recreation Lands
-  Shadscale, Winterfat, Galleta
-  Sagebrush, Pinyon Pine, Juniper, Indian Ricegrass, Needle-and-Thread, Western Wheatgrass
-  Scrub Oak, Sagebrush, Mountain Brome, Western Wheatgrass



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Source: U. S. Department of Agriculture, 1977 Conservation Service





pinyon-juniper are found in each of the vegetative types. At the upper end of the study corridor, in the monument, there are scattered occurrences of aspen and conifers.

Endangered, Threatened, and Sensitive Plants. Gunnison rock cress (Arabis Gunnisoniana), which has been proposed for endangered status, is known to occur outside the visual corridor in the monument. Gunnison rock cress may barely extend into the gorge below the monument where there are approximately 1,200 acres (486 ha) suitable for its survival. Several plants found in the monument have been provisionally recommended for listing in the Federal Register as threatened species by the Colorado Native Plant Society. These include: Arabis crandallii (Rock cress sp.); Arabis demissa demissa (Rock cress sp.); and Penstemon teucrioides (Germander penstemon).

A number of plants which are either rare or endemic (limited in range to a certain locality) to Colorado and adjacent states have not yet been included on the Federal Register list of endangered and threatened species. These are present along the lower Gunnison River, both in the gorge and the monument. They include the following four species which have been classified as "sensitive" on the Colorado Native Plant Society list: Astragalus oophorus, Mahonia fremontii, Chamaechaenactis scaposa and Penstemon teucrioides.

Numerous other endangered, threatened, or sensitive species are found in the region. It is probable that some of these also occur in the study corridor, but no survey has been conducted to verify this.



Douglas fir exists within the monument segment of the river corridor.

## Water Resources

The flow of the Gunnison River through the study corridor is derived almost exclusively from upper Gunnison basin runoff. The discharge of the river is regulated by water releases from the Curecanti Project and by diversions through the Gunnison Tunnel.

The watershed boundaries along the river form a relatively narrow corridor that follows the outer rim of the canyon. This results in many small drainage paths toward the river that have extremely steep gradients, short channel lengths, and relatively small watershed areas.

Because the corridor is located in the semi-arid portion of the region, these gullies flow for only brief periods during the spring snowmelt and during intense summer thunderstorms. Although runoff from this source is sporadic, it does have a significant effect on flow by creating rock dams and changing the course of the river.

River flow has been gaged continuously since 1903 by the U.S. Geological Survey about 1/4 mile (0.4 km) below the Gunnison Diversion Tunnel. Discharge for that period has averaged 1,380 cubic feet per second ( $39 \text{ m}^3/\text{s}$ ), or 999,800 acre-feet/year (1.2 billion  $\text{m}^3/\text{yr}$ ).

The Gunnison Tunnel was constructed with a diversion capacity of approximately 1,000 cfs ( $30 \text{ m}^3/\text{s}$ ). These diversions generally occur from April through October and have reduced the daily flow of the river below the tunnel. During the latter part of the irrigation season in 1936, 1949, and 1950, there was no flow in this reach of the river. The Curecanti Project has regulated streamflow so that the discharge is more evenly distributed throughout the year. The effect of regulation is to greatly reduce the spring runoff and to increase the late summer and winter discharges.

Prior to construction of the Curecanti Project, the maximum discharge of the Gunnison River was recorded on June 15, 1921, when 19,000 cfs ( $540 \text{ m}^3/\text{s}$ ) poured through the canyon below the Gunnison Tunnel. But with completion of Crystal Dam (FES 73-21), minimum flows are expected to stabilize near 200 cfs ( $6 \text{ m}^3/\text{s}$ ). Crystal Dam will also trap heavy sediments discharged by the Cimmaron River before reaching the monument.

Since the completion of Morrow Point Reservoir, the river has been subjected to daily flow variations of as much as 400 cfs ( $10 \text{ m}^3/\text{s}$ ) below the Gunnison Tunnel. This is because large quantities of water are released through the electrical generating units at Morrow Point during peak demand periods.

Water releases from Morrow Point are being stored in Crystal Reservoir and are released at a fairly constant rate. The Curecanti Project is obligated to provide a consistent flow of about 1,000 cfs ( $30 \text{ m}^3/\text{s}$ ) to the Gunnison Tunnel during the irrigation season when there is available storage in Taylor Park Reservoir or when there is adequate streamflow. This project must also maintain a minimum flow in the river below the Gunnison Tunnel of 200 cfs ( $6 \text{ m}^3/\text{s}$ ).

Specific operating criteria for Crystal Dam, other than project obligations, have not been formulated. However, the Bureau of Reclamation expects to maintain a flow of at least 400 cfs ( $10 \text{ m}^3/\text{s}$ ) below the tunnel whenever Blue Mesa Reservoir is full. This is expected to occur during the March-through-September period in 85 percent of the years.

The Gunnison uplift and the hard, crystalline Precambrian rocks that predominate in the canyon are not conducive to the occurrence of ground water within the study area. Although there are no measurements, ground water probably contributes very little, if any, flow to the Gunnison River between the upstream boundary of

the monument and the North Fork. There are no known wells and only one developed spring within the study corridor. All domestic water used within the monument is brought by truck from outside sources.

The entire reach of the Gunnison River easily meets state water quality standards as well as criteria required for eligibility as part of the National Wild and Scenic Rivers System. Although the Gunnison River is low in dissolved minerals (i.e., low salinity), the entire reach of the study area is high in iron derived from natural sources. Fecal coliform bacteria levels, which are an indication of contamination by warm-blooded animals, are very low and indicate the cleanliness of the water. The pH of the water is a fairly high 8.3, but this is common for natural waters throughout Colorado. There are no known elements in the water in quantities sufficient to be toxic for fish, wildlife, or humans.

Water flow characteristics through the study reach are partially the result of water rights that are held by upstream and downstream appropriators. Within the study segment there is one small diversion located on the west bank of the river about 1/4 mile (0.4 km) upstream from the confluence with the North Fork. Several conditional water decrees have been awarded by the water courts which could affect the reach proposed for designation. Conditional water rights in the segment are held by the City of Delta, Pittsburg and Midway Coal Mining Company, and Colorado-Ute Electric Association, Inc.<sup>1</sup> Since the proposed water development

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1. Awarding of conditional water decrees by the Colorado courts establishes a priority date for storing water should a project ever be constructed and is a preliminary and tentative action before applying to the Federal Energy Regulatory Commission.

projects associated with these decrees generally overlap each other in location, as shown in figure 3-6a, only one, or possible two, of the projects could conceivably be constructed.

Colorado-Ute. Colorado-Ute has a conditional decree for a reservoir with a capacity of 72,650 acre-feet (90 million m<sup>3</sup>) located on the Gunnison River below the confluence with the North Fork. Their Tri-County project would back water to the vicinity of the Smith Fork and inundate about 1 mile (1.6 km) of the eligible river in the lower study corridor. Water from the proposed reservoir would be used for steam electric and power generation. Initially, this project would have a generating capacity of 250 to 500 MW, with a larger ultimate potential as high as 1,400 to 2,000 MW. According to Colorado-Ute, the cost of storage water would be about \$13.00 per acre-foot (\$13/1,222 m<sup>3</sup>) initially, then decreasing to no net cost during the sixth year due to increased power and energy revenues. Total cost of such a facility would be approximately \$32.5 million.

Pittsburg and Midway. One of the Pittsburg and Midway Coal Mining Company's five conditional decrees for the development of Gunnison River main stem water is for a dam and large reservoir of 162,700 acre-feet (200 million m<sup>3</sup>), although revised projections call for a 193,300-acre-foot (237 million m<sup>3</sup>) reservoir. Known as the Cedar Flats project, it would be located approximately halfway between the Smith Fork and North Fork, backing water up to a point just downstream from the monument's northern boundary. Cedar Flats is one feature of Pittsburg and Midway's comprehensive Gunnison Main Project.<sup>1</sup> (Several smaller impoundments, canals,

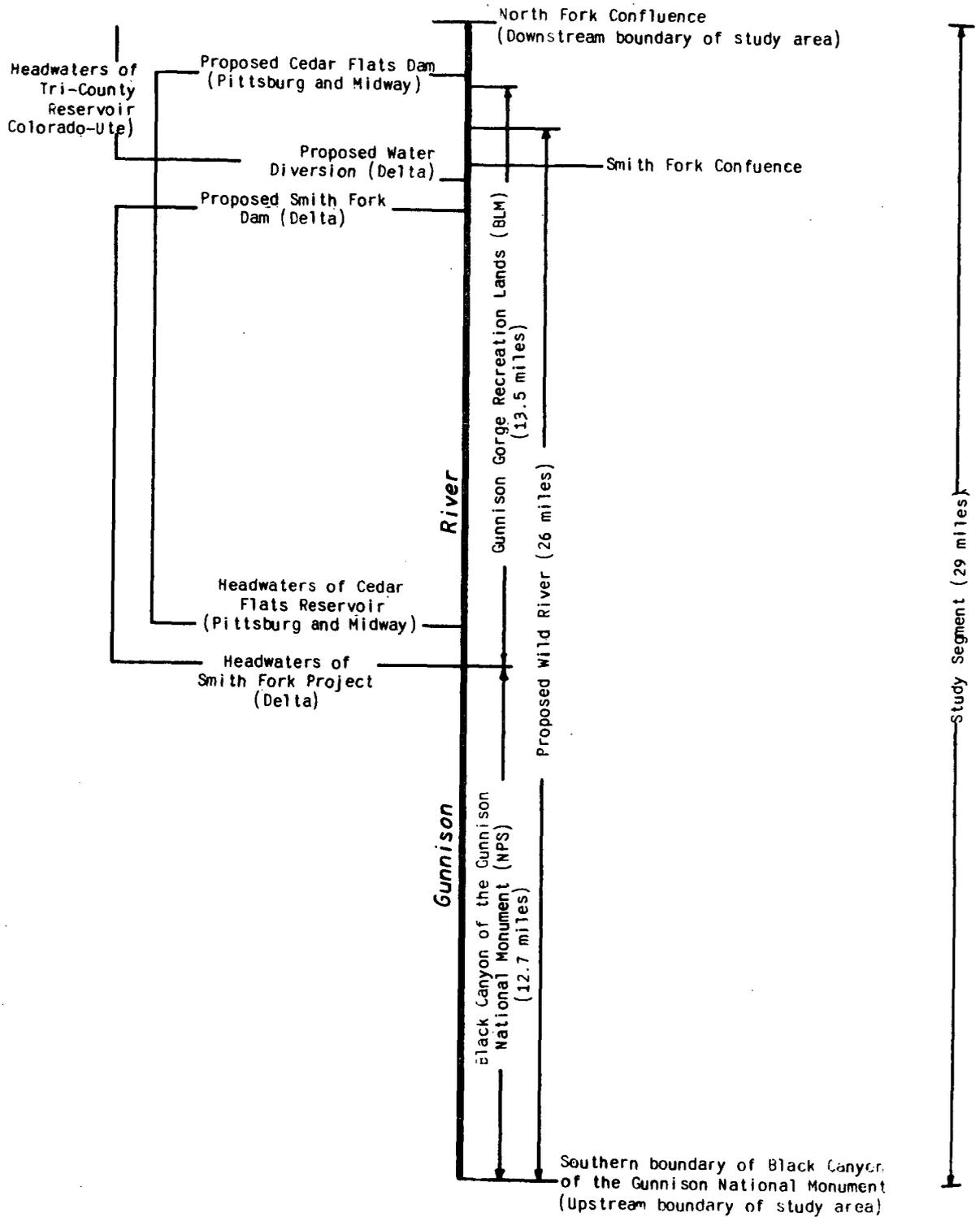
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1. Master Plan for the Gunnison Main Project. Tipton and Kalmbach, Inc., Denver, Colorado. May 1976.

FIGURE 3-6a

# GUNNISON RIVER STUDY AREA

## Schematic Diagram of Proposed Water Development Projects



and pipelines are associated with the decree, but these would be entirely outside the eligible river segments.) The water would be used to generate 60 MW of electric power while making available 100,000 acre-feet (123 million m<sup>3</sup>) of water for coal-fired steam generation and, possibly, coal gasification plants. Based on an economic analysis conducted by the Bureau of Land Management for a similar project in the same area, the cost of water would be about \$100 per acre-foot (\$100/1,233 m<sup>3</sup>). If the reservoir were constructed, it would inundate over 90 percent of the river below the monument that was found eligible for inclusion in the national system. Total construction cost of the Gunnison Main Project is estimated to be \$103.5 million; the Cedar Flats project accounts for \$62.8 million of the total figure.

City of Delta. An absolute decree is held by the City of Delta for the diversion of up to 50 cfs (1.4 m<sup>3</sup>/s) of water from the Gunnison River for domestic water supply. According to the City of Delta, additional domestic water sources will be needed by 1990 if its projected growth rate continues. The decreed point of diversion for their conditional right is located approximately 1.2 miles (2 km) upstream from the confluence with the Smith Fork.

However, Delta is a participant in Project 7, a regional water supply project, and has signed an interim agreement with the Bureau of Reclamation to obtain water from the Curecanti Project. This will be taken from an alternate point of diversion, the Gunnison Tunnel, which is above the study segment. Project 7 is now under construction.

Delta's other proposal--the Smith Fork project--involves a hydroelectric dam within the study segment to provide a replacement power source for their diesel-electric generating facility. The proposed damsite, located about 1 mile (1.6 km) upstream from the confluence with the Smith Fork, was considered

an alternative to the present Curecanti Project location in the late 40's and early 50's.<sup>1</sup> As proposed, the 275-foot (84-m) high concrete arch dam would create a reservoir with 54,000 acre-feet (66.6 million m<sup>2</sup>) which would back water up through the gorge to the downstream border of the monument. The proposed installed generating capacity of 35,500 kilowatts would have an average annual energy output of about 186,000 megawatt-hours. Electrical output from this project would be significantly in excess of the city's own requirements, and it is assumed that such energy would be marketed on a regional basis to meet needs in other areas. Since the proposal for Delta's project was recently made, details of the economic feasibility and adequacy of water supply are not fully known. However, based on a reconnaissance study conducted of the Smith Fork project,<sup>2</sup> the cost of water would be about \$180 per acre-foot (\$180/1.233 m<sup>2</sup>) annually. Preliminary estimates indicate that total investment costs to Delta, including interest during construction, would be about \$40 million. The possibility exists that some arrangement may be made with another project sponsor to accommodate Delta's domestic water supply and electrical needs in their proposed water development project(s).

Sulphur Gulch Alternative. An alternative to the Cedar Flats, Smith Fork, and Tri-County projects has been formulated which would be totally outside the wild river proposal area. It calls for a diversion on the Gunnison River downstream from the North Fork

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1. Reconnaissance Geological Report of the Ridgway Dam Site - Reconnaissance Geology Report of the Smith Fork Dam Site - Gunnison River Project, Colorado. J. Neil Murdock, August 1947.

2. Smith Fork Project Reconnaissance Report, City of Delta, Colorado. R.W. Beck and Associates, Denver, Colorado. August 1976.

and a pipeline to the dam and reservoir at Sulphur Gulch. This alternative is described as National Economic Development Plan B in chapter V.

Federal Energy Regulatory Commission (FERC) Role. Section 7(b)(ii) of the Wild and Scenic Rivers Act places a moratorium on the issuance of permits or licenses by the Federal Energy Regulatory Commission on rivers designated for study as possible additions to the national system. To date the FERC has not issued licenses for development of any of the described proposals. However, FERC (then the Federal Power Commission) received an application for a preliminary permit from the City of Delta in February 1977 for its proposed Smith Fork hydroelectric project. On August 1, 1978, FERC--over the objections of the Department of the Interior--issued a preliminary permit authorizing investigation of this proposal (see appendices A and B in the environmental statement for this study). The preliminary permit, however, does not authorize any construction activity.

In commenting to FERC on the preliminary application for the Smith Fork project, the U.S. Department of the Interior insisted that a permit not be issued until details of the investigatory work to be undertaken are known and an assessment could be made of the resultant effects on the river study area. It was pointed out that ". . . the project would likely have a direct and adverse effect on the values for which the river might be designated" and ". . . that even the study of this project may jeopardize the area's unique values." The project also ". . . has the potential for causing serious adverse environmental impact on the fish and wildlife resources of the Black Canyon area of the Gunnison River," an area that ". . . serves as critical winter range for deer and elk and is a very important raptor area."

Other statements contained in the Department's comments on the Smith Fork Project preliminary application addressed the fact that "even if the wild and scenic river study did not result in a designation of this segment of the Gunnison, our Bureau of Land Management has two additional obligations under the Federal Land Policy and Management Act of 1976. First, it would have to review the Gunnison Gorge Recreation Lands withdrawal for continuation of that land status. Second, BLM would have to review the same area as a potential wilderness if the recreation withdrawal were to be terminated, because it contains roadless areas of more than 5,000 acres."

Fruitland Mesa Project. The Bureau of Reclamation's authorized Fruitland Mesa Project would irrigate lands in Montrose and Delta Counties, east of the study area. Return flows from the project would enter the river via Smith Fork and Crystal Creek in Red Canyon. While the return flows would carry relatively concentrated volumes of leached salts, the small total flows of these tributaries would be diluted by the Gunnison without serious downstream effects on water quality.

#### Fish and Wildlife

Within the study corridor fish and wildlife are relatively abundant and quite diverse. Five basic habitat types provide food and shelter for big game mammals such as elk and deer, small game mammals, fur-bearers, a host of nongame birds and mammals, and a large number of game birds and waterfowl. Raptors are relatively abundant, and several species are represented. Various amphibians, reptiles, and several game and nongame fishes are also present.



Elusive bighorn sheep frequent the rugged canyon area.



Mule deer are occasionally seen in the canyon but are most common above the inner rim.

The river segment provides excellent cold water game fish habitat and an excellent trout fishery. Three species of game fish--rainbow, brown, and cutthroat trout--inhabitat the river. Northern pike, brook trout, mackinaw trout, and kokanee salmon have also been reported, but they are uncommon. Other fish include four species of suckers, two or more hybrid sucker forms, roundtail chub, fathead minnow, sculpin, carp, and dace. Although fishing opportunities are limited by the wild, rough nature of the canyon and river, the fishery provides unique and satisfying angling.

The entire study area is critical winter range for mule deer and elk. Key winter browse species such as sage, mountain mahogany, oak, and bitterbrush are abundant and reveal heavy seasonal use.

Pinyon pine and juniper trees supply a minor amount of nutrition to big game, but function primarily as escape cover adjacent to feeding areas. Additionally, these areas host several species of wintering birds, including the bald eagle. Although not currently on the federal endangered species list, the bald eagle is being considered for such status.

In a recent survey by the Colorado Division of Wildlife, other raptor species found to be residents in the gorge were the golden eagle, red-tailed hawk, prairie falcon, kestrel, and turkey vulture. Nesting sites were found for golden eagles and prairie falcons, and it is believed that with more effort kestrel eyries would also have been found.

Endangered and Threatened Wildlife. The American peregrine falcon and bald eagle are the only species listed in the Federal Register as endangered that may be inhabiting the study segment. Although peregrine falcons were last seen in the monument segment of the study corridor in August, 1976, much of the canyon contains habitat that is ideally suited to this species. Falcon habitat in the

gorge is also excellent from the monument downstream to approximately the Montrose-Delta county line and at intervals below this point wherever high cliffs exist. In addition, the ruggedness and inaccessibility of the gorge limits human disturbance. The monument already is high on the list of potential peregrine reintroduction sites within the state.

The river otter, sighted in July 1974 and again in August 1975, is on the Colorado endangered species list. Six otters were planted within the study segment in August 1976 by the Colorado Division of Wildlife as part of a reintroduction program authorized in 1975; an additional eight otters were released into the outstanding habitat of the canyon in 1978.

The greater sandhill crane and white pelican may stop over within the eligible segment for a brief period during their spring migration.

## CULTURAL RESOURCES

A complete cultural resource inventory and evaluation has been carried out in the Black Canyon of the Gunnison National Monument and the Gunnison Gorge Recreation Lands by Breternitz (1973, 1974, and 1976) (unpublished); Carpenter and Stiger (1975); and Olivieri (1976) in accord with Executive Order 11593, the National Historic Preservation Act of 1966, and National Park Service historic preservation policies.

Based on these recent surveys, many historic and archeologic sites were located, none of which is listed on the National Register of Historic Places. Also, there are no National Historic, Natural, or Environmental Education Landmarks in the study corridor.



Remnants of several historic sites are located in the gorge.

## Prehistory

Aboriginal settlement patterns indicate that the Black Canyon region was used by both prehistoric and historic Indians on a seasonal basis. Winters along the canyon rim are severe, so habitation was limited to temporary camps and tool production areas that were probably used during the spring, summer, and fall. Movement in this area was governed by the seasonal availability of edible vegetation and by the transitory movement of game. Many of the narrow points of land that jut into the canyon and have very steep sides may have been used as game traps, as is suggested by the presence of several isolated projectile points found on these prominences.

Remains of 38 campsites were discovered primarily on sandy soils. Only two above-ground archeological structures were identified. The remaining 36 sites give no indication of the depth of stratigraphy. All the sites located in the monument are on the canyon rim; none has been found in the river study corridor. Analysis by Stiger and Carpenter (1975) showed that 90 percent of the flakes collected from these sites were produced by soft hammer percussion and that some of the rock used for tool production was subject to heat treatment during preparation.

An archeological survey was conducted in the lower river study corridor through the Gunnison Gorge Recreation Lands in the summer of 1976 (Breternitz 1977). At the time of this writing, the results of this survey were not yet available.

## History

Though the Gunnison River is named for Captain John W. Gunnison who explored the region in the early 1850's, he and others before

him carefully avoided the inhospitable canyon. It was not until 1874 that the Middle Division of the Hayden Survey skirted the length of the north rim, establishing several survey stations within what is now the monument.

Byron H. Bryant, in charge of construction for the Uncompahgre Extension of the Denver and Rio Grande Western Railroad, was requested to explore the Black Canyon for a possible railway route. Early in December of 1882, Bryant proceeded with a survey from Grizzly Gulch to Cimarron. Completed in the spring of 1883, it indicated the canyon was impractical for a railway line.

In September 1900, William W. Torrance assembled a group of five volunteers to survey the Black Canyon to determine if a water diversion would be feasible. Four weeks later they gave up after confronting what appeared to be impassable cascades.

Probably the most famous trip through the canyon was made by William W. Torrance and A. Lincoln Fellows, irrigation engineer and resident hydrographer of the U.S. Geological Survey at Montrose. The trip, which started on August 12, 1901, was an extremely rugged journey covering 33 miles (53 km) in 9 days. The data they accumulated made possible the construction of the Gunnison Tunnel which provides irrigation water for the Uncompahgre Valley.

After 1900 there was increasing recognition of the scenic value of the Black Canyon by local conservationists and civic leaders. In the late 1920's, citizens of Montrose, led by Reverend Mark Warner, began efforts to have the canyon preserved. On March 2, 1933, a Presidential Proclamation established the Black Canyon of the Gunnison National Monument.

The Great Depression of the 1930's brought miners into the depths of the canyon. During the period from the 1940's to the early

1970's, there was limited use of the canyon for grazing, and cattle were driven through the lower end over the Ute Trail. Prospecting continued in parts of the Gunnison River canyon, excluding the monument segment. However, the silver and gold prospects were abandoned and replaced by uranium prospect pits along the west rim of the canyon and up the Smith Fork. Gypsum was mined along Buttermilk Ridge. These industries failed during the mid-1950's for lack of profits.

An historic structures survey carried out in the Black Canyon of the Gunnison National Monument in 1976 (Olivieri 1976) indicated that the majority of structures located here were built after the monument was established and possess little historical or architectural value. Structures located on the north rim include several utilitarian buildings constructed of frame and corrugated sheet metal, some dating from the early 1930's; Quonset huts; and framed privies. Several frame and corrugated sheet metal utilitarian structures, trailer homes, and a simple frame and weatherboard structure, also dating from the early 1930's, are located on the south rim. None of these are located within the river's visual corridor.

A recent preliminary field survey of the lower study segment through the gorge (Athearn 1976) recorded a number of historic sites, including the Ute Trail and eight cabins, three of which may qualify for inclusion on the National Register of Historic Places. These structures are generally no older than 30 or 40 years and represent limited use. Although there may be other historic values in the area, an additional survey will be needed to locate them.

## RECREATION RESOURCES

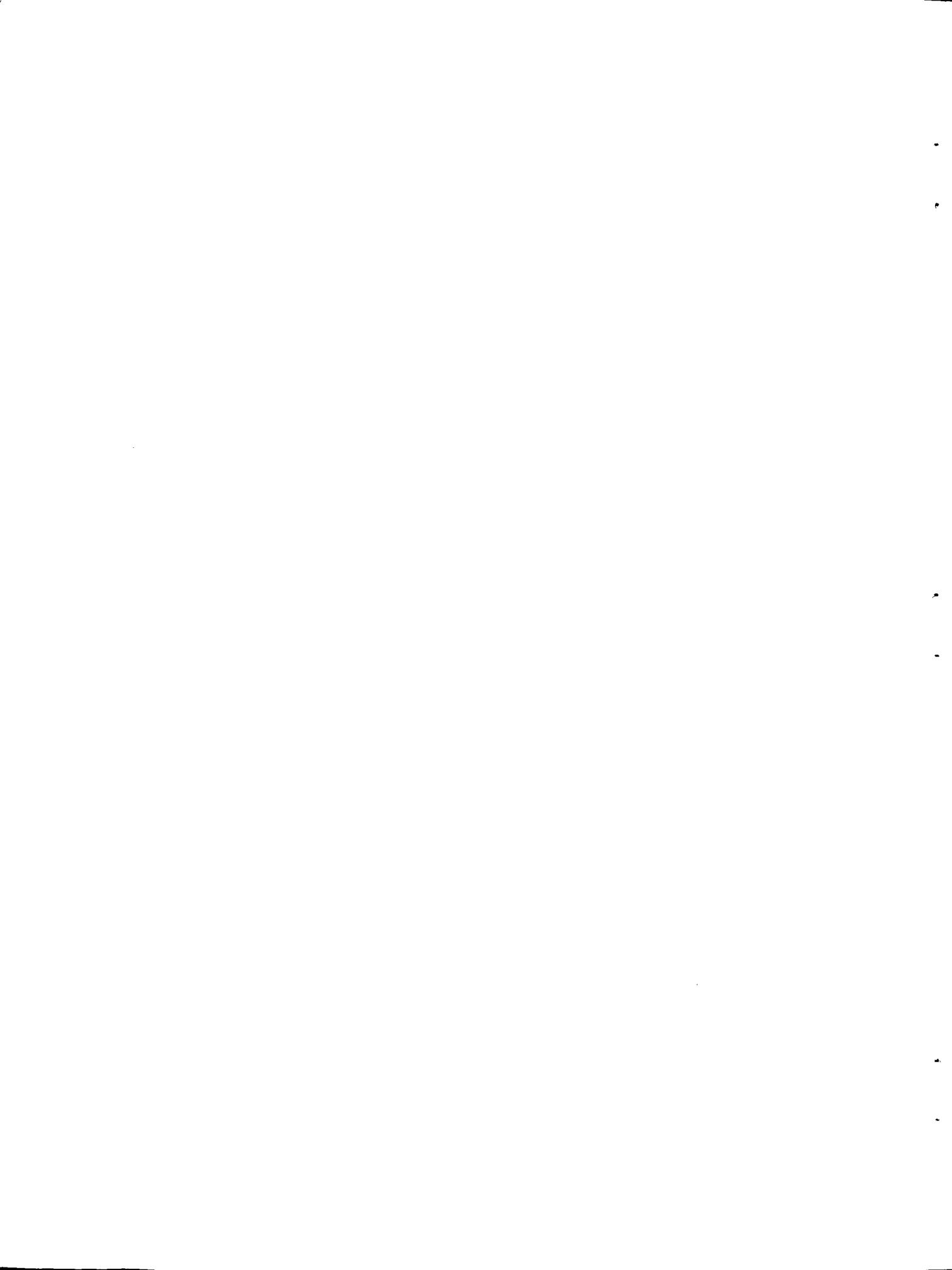
Throughout the study corridor there are a limited number of established recreation facilities, as shown in figure 3-7. The river itself is inaccessible except in a few areas. Aside from the monument segment, the river is not nationally known for its recreational values.

A major portion of the monument, including the study corridor, is now part of the National Wilderness Preservation System. Primitive camping for small groups of people is possible along the river at several locations limited by the sheer vertical rise of the canyon walls to occasional sandbars and other relatively level areas.

River trips through the monument, which involve more scrambling over rocks and portaging than actual floating, are feasible for individuals with considerable experience. The 1-mile (1.6-km) segment between The Narrows and Chasm View is the wildest and most scenic in the entire canyon, but it is also the most arduous and potentially the most hazardous.

Immediately downstream from the monument the gorge provides opportunities for hiking, fishing, rock collecting, whitewater river floating, and hunting for waterfowl and chukar. There are three existing trails here--the Chukar Canyon, Duncan, and Ute Trails. The ruggedness and limited accessibility of the gorge have limited man's use, thereby preserving much of its wild character.

In the gorge, fishing and hiking represent the greatest amount of use as measured in visitor days. Fishing is confined mostly to the North Fork area and to the vicinity of the Ute, Duncan, and Chukar Canyon Trails where they meet the Gunnison River. Estimates of current use are given in table 3-4.



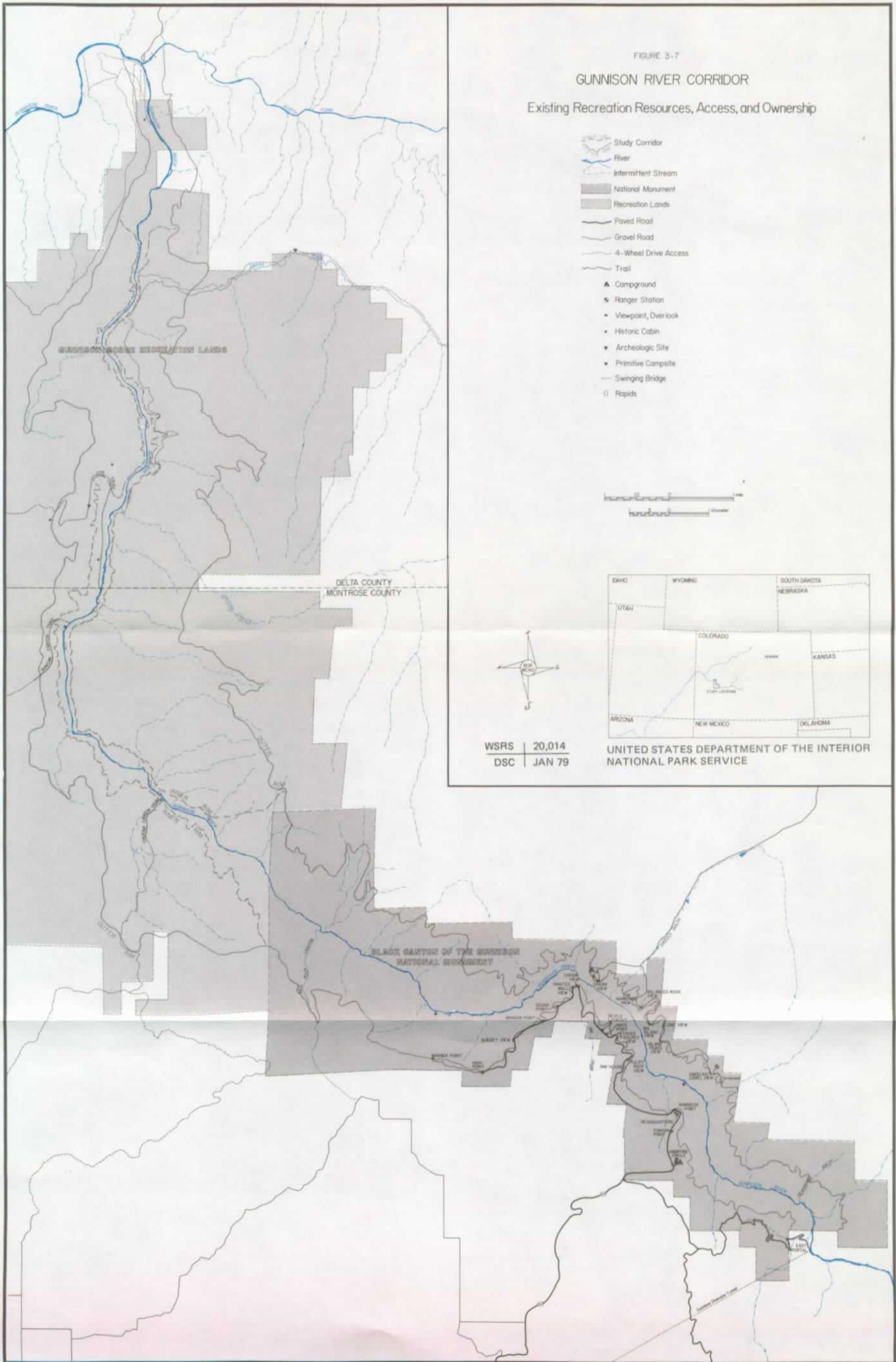


FIGURE 3-7

GUNNISON RIVER CORRIDOR

Existing Recreation Resources, Access, and Ownership

- Study Corridor
- River
- Intermittent Stream
- National Monument
- Recreation Lands
- Paved Road
- Gravel Road
- 4-Wheel Drive Access
- Trail
- Campground
- Ranger Station
- Viewpoint, Overlook
- Historic Cabin
- Archeologic Site
- Primitive Campsite
- Swinging Bridge
- Rapids



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NATIONAL PARK SERVICE



Table 3-4

GUNNISON RIVER CORRIDOR  
Canyon Visitation

Activity	1975 Visitation	
	Monument <sup>1</sup> (Visitor Days)	Gorge <sup>2</sup>
Canyon viewing	349,872	2,450
Inner canyon hiking	2,276	600
Inner canyon camping	2,143	100
Technical rock climbing	32	--
Fishing	1,500	1,500
River floating	--	50
Hunting	--	100
<b>TOTALS</b>	<b>355,823</b>	<b>4,800</b>

- 
1. Actual Visitation
  2. Estimated Visitation

Most of the river through the gorge is outstanding for river floating using small rafts with oars, inflatable canoes, decked canoes, or kayaks. A challenging series of rapids exists in the 3-mile (5-km) reach above the Smith Fork with flows of approximately 400 cfs ( $10 \text{ m}^3/\text{s}$ ). Below these rapids the river is essentially placid and lacks features which require great floating skills. The hike required to carry boats and other equipment to the river--about 1 mile (1.6 km)--tends to deter individuals in poor physical condition and to eliminate those with very heavy or large rafts. Also, depending on the boater's skill, some portages are required.

A flow of 400-600 cfs ( $10\text{-}20 \text{ m}^3/\text{s}$ ) is optimal for river floating. With less flow the river is too rocky for easy boating, making



Large boulders and sheer canyon walls limit use of the river through the monument.

Fishing and related hiking use account for the greatest amount of visitation along the river.



portages frequent and laborious. Above 600 cfs ( $20 \text{ m}^3/\text{s}$ ), landings become difficult and chances for a spill are increased. However, the river through the gorge has been run at a flow of 1,100 cfs ( $30 \text{ m}^3/\text{s}$ ).

## ACCESS

Except at the extreme lower end of the corridor and at East Portal immediately upstream from the study area, there are no roads that enter the canyon. As previously discussed, all access is by trail. Although there are unimproved jeep roads that parallel the outer canyon rim in the lower section of the river between the monument and the Smith Fork, these are not visible from the river and are otherwise inconspicuous to those within the visual corridor. Downstream from the Smith Fork, near the confluence of the North Fork, there are unimproved jeep roads on both sides of the river for varying distances. Because of their proximity to the river, these roads provide easy river access and are visible from it at various locations.

The Ute Trail, shown in figure 3-7, is the only improved trail providing river access in the entire 29-mile (47-km) study corridor. This trail and the Duncan and Chukar Canyon Trails are the usual access routes to the river in the gorge. There are no designated trails in the canyon within the monument, and those using the river must enter and leave at their own risk.

## LANDOWNERSHIP

In the monument the visual corridor averages about 0.9 mile (1.5 km) in width, and through the gorge segment 0.8 mile (1.3 km). Within this visual corridor is an average of 580 acres per mile (15



River floating provides many challenges in the gorge.



The Ute Trail provides river access in the gorge.

ha/km) for the monument and an average of 402 acres per mile (101 ha/km) for the gorge. This represents a visual corridor with an overall average of 491 acres per mile (123 ha/km) for the entire 29-mile (47-km) study segment.

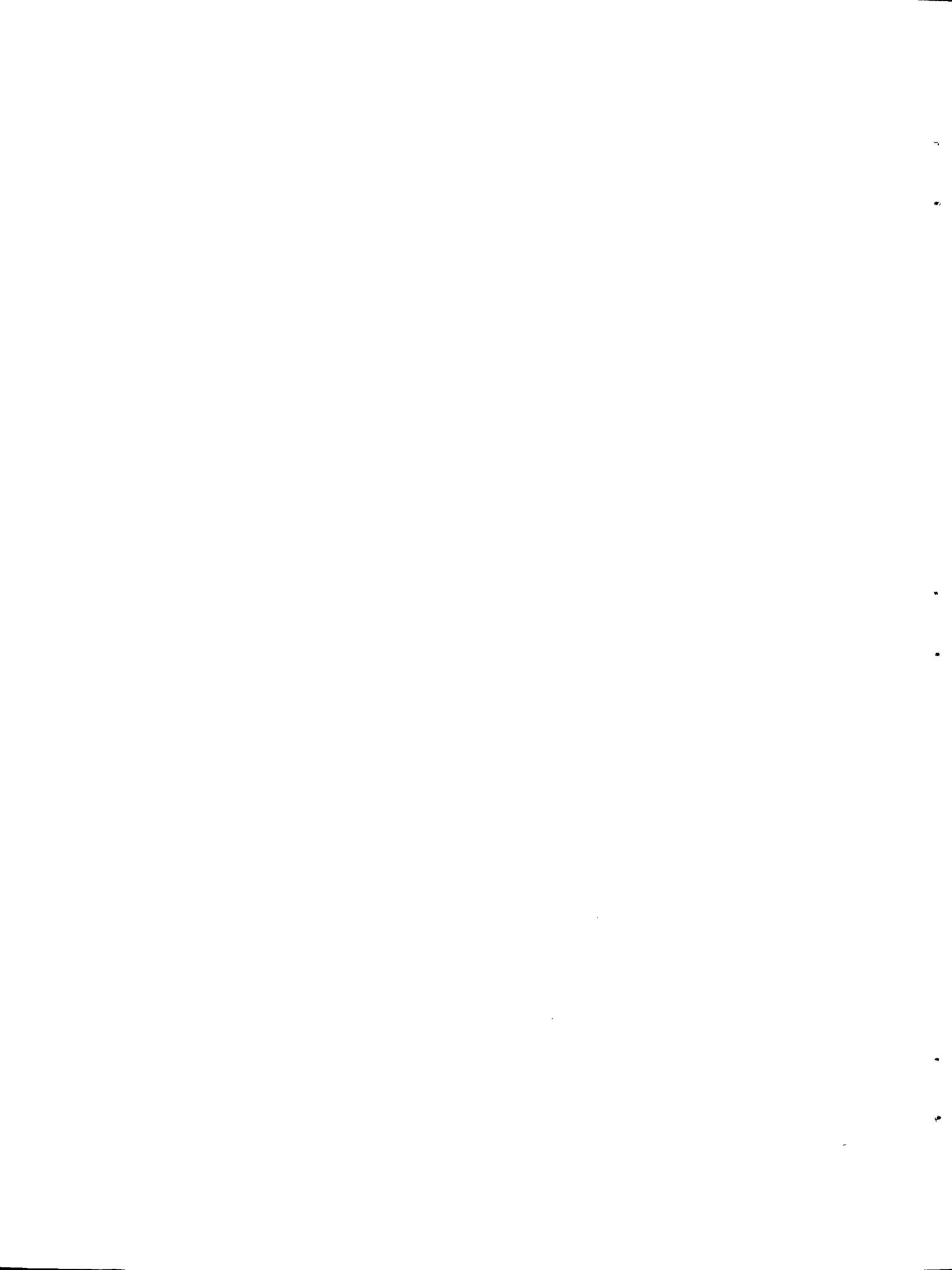
As shown in table 3-5, almost all of the land within the study area, which includes that portion within the visual corridor, is administered by the National Park Service or the Bureau of Land Management. Only a very small amount of private agricultural land exists within this corridor, as table 3-5 reveals, and none is located in the eligible segment. Combined, the lands within the study corridor represent a small fraction of the region's overall recreation acreage-256,000 acres (103,600 ha).

Table 3-5  
GUNNISON RIVER CORRIDOR  
Landownership

<u>Ownership</u>	<u>Acres</u>	<u>(Hectares)<sup>1</sup></u>	<u>Percent</u>
Federal:			
National Park Service	7,540	(3,051)	54
Bureau of Land Management	6,073	(2,458)	43
Private	<u>366</u>	<u>(148)</u>	<u>3</u>
TOTALS	13,979	(5,657)	100

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1. Estimate



## CHAPTER IV ELIGIBILITY AND CLASSIFICATION

Determination of wild and scenic river eligibility and classification is derived objectively on the basis of requirements specified in the Wild and Scenic Rivers Act and joint Interior/Agriculture Guidelines for Evaluating Wild, Scenic and Recreational River Areas. These documents dictate the general characteristics of rivers to be included in the system and outline the approach to be used in evaluating them.

### SEGMENT LOCATION AND LENGTH

The entire 29-mile (46.7-km) Gunnison River study segment was considered as a unit in determining eligibility. Within this unit, two segments were identified as a result of differences in physical and biological features. These segments were (1) the approximately 26-mile (41.8-km) reach from the upstream (southern) boundary of the Black Canyon of the Gunnison National Monument to about 1 mile (1.6 km) below the Smith Fork within the Gunnison Gorge Recreation Lands, and (2) the approximately 3-mile (4.8-km) lower reach from about 1 mile (1.6 km) below the Smith Fork to the confluence of the North Fork of the Gunnison River, about half of which is in the Gunnison Gorge Recreation Lands and half in private ownership. Since the lower segment contains no outstanding features, only the outstanding values of the upper segment are summarized in the following section. Evaluation of these values is based on information presented in chapter III.

## OUTSTANDINGLY REMARKABLE VALUES

Within the upper segment of the Gunnison River study corridor, there are a number of outstanding values of national importance--scenic, geologic, wildlife, and recreational.

### Scenic Values

Especially noteworthy among the canyon's outstanding scenic features is its physiography. The deeply entrenched canyon is an awe-inspiring spectacle. Within the upper reaches of the canyon, the walls rise almost vertically to the canyon rim; farther downstream the walls first ascend steeply to an inner rim, then flare outward and upward to an outer rim several hundred feet above.

Steep gradients create a number of rapids and waterfalls that contribute greatly to the area's scenic value. Comparable gradients on streams the size of the Gunnison are quite rare.

### Geologic Values

The geologic features of the upper segment are outstanding. At a number of locations along the river the dark gray base rock of Precambrian granite and schist is interlaced with an abundance of light orange pegmatite dikes and sills. The oldest rocks in the Black Canyon complex, dating back 1.75 billion years, are in the gorge, while the ones in the monument are 1.25 billion years old.

One of the most impressive and best-exposed faults in the entire Black Canyon area, the Ute Indian Fault, is found here. Its clarity of exposure and dramatic topographic expression are

outstanding characteristics. Another outstanding feature is the Uncompahgre Unconformity; found during the Pennsylvanian-to-mid-Jurassic periods, it represents a time gap in geologic history of more than 1.5 billion years.

Although various planar and linear structures are common features in most metamorphic rocks, they are especially well-developed in the lower part of Chukar Canyon. In addition, large regional fractures, like the ones seen from Island Peaks downstream to Grizzly Gulch, occur in both walls of the canyon. Finally, the greatest local relief in the entire Black Canyon region is at a site just below the monument.

#### Fish and Wildlife Values

The study segment, like numerous other streams in the basin and elsewhere, is an excellent trout fishery. The study corridor also supports a number of important big game and other wildlife species, including the mule deer, elk, and waterfowl.

Sightings of the American peregrine falcon were made in the monument in 1974 and 1976, and large numbers of bald eagles are attracted annually to the gorge during the winter months. Both of these species are listed as endangered in the Federal Register.

The river otter, sighted in 1974 and 1975, is on the Colorado State Endangered Species List. Several other otters were released within the study segment in 1976 and 1978 by the Colorado Division of Wildlife as part of a continuing reintroduction program authorized in 1975.

### Cultural Values

There are numerous historic and archeologic sites that are of local significance, but none are listed on the National Register of Historic Places. No National Historic, Natural, or Environmental Education Landmarks are in the corridor. There are several historic sites within the gorge segment that may qualify for inclusion on the National Register after further evaluation.

### Recreation Values

The quality of the recreational experience, whether it involves hiking, horseback riding, fishing, rafting, or other use, is directly related to the scenic, geologic, fish, wildlife, cultural, and other values of the upper segment of the Gunnison River corridor. Thus, the outstandingly remarkable quality of any one or more of these values significantly contributes to making the recreation experience outstanding and memorable.

Considering its relatively short length, there are few other rivers in the nation whose technical difficulty for floating, danger, solitude, and scenery are comparable to the Gunnison's. Those with some similar attributes include the upper canyon of the Salt River in Arizona, the Upper Taos Box Canyon of the Rio Grande River in New Mexico, Cross Mountain Canyon on the Yampa River in Colorado, and Gore Canyon on the Colorado River in Colorado.

Boaters familiar with these rivers and the Gunnison study segment report the Gunnison possesses unique and outstanding recreation values.

## ELIGIBILITY DETERMINATION

The Wild and Scenic Rivers Act requires that rivers included in the national system shall possess one or more of outstandingly remarkable scenic, geologic, fish, wildlife, historic, cultural, recreational, or other similar values. However, if a river segment does not possess one or more of these qualities or it contains elements that are clearly inconsistent with the purpose or intent of the act, then that segment is ineligible for designation. This is true whether that segment is at the beginning, middle, or end of the entire prescribed study segment; such a determination of ineligibility, however, would not affect the eligibility of any other segment. Characteristics that were evaluated in determining the Gunnison River's eligibility for possible inclusion in the national system are discussed in the following text.

### Outstanding Values

Although no definition of what constitutes an "outstandingly remarkable value" is given in the act or Guidelines, it was assumed by the study team that such values must be of national or state importance or be unique or rare when compared to similar areas. Based on the summary of outstandingly remarkable values presented earlier in this chapter, it was determined that the upper 26-mile (41.8-km) reach of the study area possesses outstanding scenic, geologic, wildlife habitat, and recreational values.

### Free-Flowing Characteristics

As defined in the act, free-flowing means "without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway. However, low dams, diversion works, and other minor

structures will not automatically preclude the river unit from being included." The study team determined that this language applies only to the river segment being evaluated. The Gunnison, like several other rivers already designated as components of the national system, does have major upstream impoundments; but, within the meaning of "free-flowing" contained in the Wild and Scenic Rivers Act and the Guidelines, they were not considered to affect significantly the study segment's free-flowing characteristics.

### River Length

The Guidelines state that "The river or river unit must be long enough to provide a meaningful experience. Generally, any unit included in the system should be at least 25 miles (40.2 km) long." The segment of the Gunnison River that was determined eligible is approximately 26 miles (41.8 km) long, exceeding the minimum length criterion.

### Water Volume

The act states that "There should be sufficient volume of water during normal years to permit, during the recreation season, full enjoyment of water-related outdoor recreation activities generally associated with comparable rivers." Crystal Reservoir will discharge a minimum flow of 200 cubic feet per second ( $5.7 \text{ m}^3/\text{s}$ ). This minimum flow ensures that there will be adequate water volume at all times for the full enjoyment of appropriate river-oriented recreation activities.

## Water Quality

The joint Interior/Agriculture Guidelines for wild river areas as they pertain to the quality of water state "The river should be of high quality water or susceptible of restoration to that condition." Water quality is excellent for the entire reach of the study area; the Gunnison River easily meets Colorado Water Quality Standards for recreation and fisheries, as well as the U.S. Environmental Protection Agency's recommended criteria.

Based on the specified criteria, the study team determined that the 26-mile (41.8-km) segment of the Gunnison River is eligible for inclusion in the national system. Table 4-1 summarizes how these characteristics were evaluated in determining eligibility of the river segment under study.

## CLASSIFICATION DETERMINATION

An eligible river must be evaluated to determine the appropriate level of classification for which it qualifies. Characteristics and criteria considered in determining the classification for the 26-mile (41.8-km) eligible segment are taken from section 2(b) of the Wild and Scenic Rivers Act and the joint Interior/Agriculture Guidelines.

## Wild River Criteria

According to the act, wild rivers are "Those rivers or sections of river that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America."

Table 4-1  
 GUNNISON RIVER STUDY  
 Summary of Eligibility

<u>Outstandingly Remarkable</u>	<u>Monument to approx. 1 mile (1.6 km) below Smith Fork</u>	<u>Approximately 1 mile (1.6 km) below Smith Fork to North Fork</u>
Geologic Values	Yes	No
Scenic Values	Yes	No
Recreation Values	Yes	No
Wildlife Values	Yes	No
Fishery Values	No	No
Cultural Values		
Archeological	No	No
Historical	No	No
 <u>Free-Flowing Nature Affected by:</u>		
Impoundments (Number)	None	None
Diversions (Number)	None	One
Roads (Number)	None	Two
 <u>Water Quality Characteristics - meet criteria for:</u>		
Primary Contact Recreation	Yes	Yes
Secondary Contact Recreation	Yes	Yes
Water Aesthetics	Yes	Yes
Fish & Aquatic Life Propagation	Yes	Yes
 Length (approximate)	 <u>26 miles (41.8 km)</u>	 <u>3 miles (4.8 km)</u>
 ELIGIBILITY FOR NATIONAL WILD AND SCENIC RIVERS SYSTEM	 Eligible	 Not Eligible

### Scenic River Criteria

According to the act, scenic rivers are "Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads."

### Recreational River Criteria

According to the act, recreational rivers are "Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past."

### Evaluation of Study Area

Access to the river, except for the paved road just upstream from the study area in the vicinity of East Portal, is limited mainly to trails. There are no developed trails in the monument and only three trails in the gorge section; therefore, the eligible segment meets the "wild" accessibility criterion.

The eligible segment is primitive in character, and its watershed is natural in appearance except for several inconspicuous historic sites and observation areas. The latter are located generally above the rim of the canyon in the monument and are barely visible from certain points along the river as obscure guard rails on the skyline hundreds of feet above. A steel cable suspended about 100 feet (30.5 m) above the river near the Smith Fork is the only other intrusion visible from the river. Consequently, this segment is essentially primitive and thus meets "wild" river criteria.

Water quality throughout the eligible segment is rated high. The river is virtually unpolluted and can support a cold water fishery and body contact recreation. The entire study reach meets both Colorado and U.S. Environmental Protection Agency water quality standards for recreation and fisheries. The eligible segment meets "wild," "scenic," and "recreational" criteria for water quality.

The Gunnison meets the most restrictive river classification criteria contained in the act. Thus, the recommended wild river designation represents the appropriate classification for the eligible segment.

CHAPTER V  
FORMULATION AND ANALYSIS  
OF ALTERNATIVES

"Principles and Standards" for planning the use of water and related land resources of the United States were established by the Water Resources Council (WRC) in 1973.<sup>1</sup> Studies involving water and related land resources, such as wild and scenic river studies, must comply with these guidelines.

Water resources planning is directed toward the improvement of quality of life. This overall goal may be achieved by contributing to either of two equal objectives--national economic development (NED) or environmental quality (EQ). Plans are formulated which satisfy these two objectives and are then analyzed according to national economic development (NED), environmental quality (EQ), regional development (RD), and social well-being (SWB) accounts; thus, one plan's effect on any of these four accounts may be compared to every other plan's. The process encourages consideration of alternative ways to satisfy either objective (NED or EQ) and, by displaying the advantages, disadvantages, and tradeoffs of each plan, improves the quality and comprehensiveness of the final decision. Results of this analysis, as it was conducted for the Gunnison wild river proposal, are presented in this chapter.

#### PLAN FORMULATION

The irreplaceable natural values of wild, scenic, and recreational rivers resist quantification, but the principles and standards

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1. Federal Register, Volume 38, Number 174, September 10, 1973.

process requires that dollar values be assigned to some of them. The study team made such dollar value assumptions based on findings of similar studies. It was assumed that natural values reflect a traditional demand curve and thus decrease as greater quantities of the experience are made available.

In keeping with WRC guidelines, common outdoor recreation experiences in ordinary settings were assigned lower values than rare experiences in spectacular settings. Recreation demand is expected to increase during the analysis period until the carrying capacity of the resource is reached. It was also assumed that a ceiling will then be imposed on visitation in order to protect the outstanding natural values of the area.

Other assumptions that were made regarding the analysis of all alternatives include the use of (1) a 50-year analysis period, (2) a 6 3/8 percent interest rate as required for FY 1977 by the Water Resources Council, (3) a 14-year development period (1976-1990) for visitation estimates, and (4) 1976 cost price estimates for values of goods and services produced and/or consumed or utilized in each alternative.

Six alternative plans were analyzed that embodied NED or EQ objectives; these encompassed the full range of expressed public opinion during the study. The plans were compared to the existing management (no action) plan which served as a baseline against which other alternatives were evaluated.

Components of the NED plans included recreation, water for coal-based energy development, and hydropower production. Timber harvest and mineral production were excluded, since they do not take place in the study corridor. The EQ plan components included preservation and protection of a free-flowing stream,

preservation of historic and cultural sites, protection of known rare and endangered species of plants and animals, preservation of water quality, preservation of air quality, preservation of freedom of choice, and avoidance of irreversible or irretrievable effects.

### Existing Management Plan

Monument Segment. The upper 12.5-mile (20-km) study segment in the monument is within a designated wilderness area. Uses permitted and precluded in the monument under the Wilderness Act do not differ essentially from those allowed by "wild" designation under the Wild and Scenic Rivers Act. Whatever action is taken under the present study will have no measureable effect on this segment because the Gunnison, by its inclusion in designated wilderness, has become--de facto--a wild river.

The National Park Service management plan for the monument calls for some facility improvements on the canyon rims, but none of these will affect the river corridor. Activities in this portion of the study segment will have no net effect on any of the alternative plans developed for the lower Gunnison River in the gorge, and there is no reason to generate alternative plans for this part of the corridor.

Current and projected use data furnished by the National Park Service for the monument, shown in table 5-1, were assumed to remain constant for all the plans developed for the gorge, including the existing management (no action) alternative.

Gorge Segment. Management guidelines for the lower 13.5-mile (22-km) study segment through the gorge have been outlined, but completion of a final management plan is contingent upon additional

funding. The preliminary guidelines are oriented toward providing a different experience than that offered in the monument; i.e.; the roads would be gravel, there would be one developed campsite at the Pleasant Forks area, and slight improvements would be made to roads and facilities associated with the three major trailheads (Ute, Duncan, and Chukar).

The lack of development would restrict vehicular traffic above the rims and recreation use in the canyon unless the visitor were willing to endure physical hardships. Use of the area would be as primitive and unstructured as safety permits. As shown in appendix table A-1, estimated use would be about 18,550 recreation days in 1990, an increase of more than 15,000 recreation days over 1976 use. Costs for construction and annual administration, operation, and maintenance of the existing management plan appear in appendix table A-2. Impacts associated with this plan are discussed below and summarized in table 5-1, where they are compared with the impacts of the remaining alternative plans.

Summary of Impacts. Recreation use in both the monument and gorge will increase significantly; however, most of the recreational use will be based on visitation to the monument. Impacts will include annual benefits and costs of \$80,100 and \$53,600 respectively, over the 50-year analysis period.

Preservation and protection of the free-flowing stream will be provided by the existing Public Land Order No. 5261 which established the Gunnison Gorge Recreation Lands.<sup>1</sup> Current laws

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1. Although PLO No. 5261 does not provide statutory protection, the Federal Land Policy and Management Act of 1976 requires that all existing (as of date of passage) withdrawals be reviewed and reevaluated within 15 years of the act's passage. Further, the act requires that roadless areas of 5,000 acres (2,024 ha) or more on the public lands be studied for possible inclusion in the National Wilderness Preservation System.

Table 5-1

GUNNISON WILD AND SCENIC RIVER STUDY  
COMPARISON OF ALTERNATIVE PLAN IMPACTS

Accounts	Existing Management Plan (No Action)	IMPACTS OF ALTERNATIVE PLANS <sup>1</sup>					
		National Economic Development Plans			Environmental Quality Plans		
		Reservoir in Upper Gorge (Plan A)	Reservoir Below Gorge (Plan B)	Reservoir in Lower Gorge (Plan C)	Wild River Option <sup>2</sup> (Wild Mon/Wild Gorge)	Scenic River Option (Wild Mon/Scenic Gorge)	Recreational River Option (Wild Mon/Rec Gorge)
National Economic Development	Use in the gorge will increase from about 3,400 to 18,500 recreation days annually by 1990, with some minor increase in costs. Annual recreation benefits will be \$80,110 over a 50-year period, annual costs will be \$53,600, based on visitation in the monument.	Use below the monument will reach about 63,700 recreation days annually by 1990, an increase of 45,450 over existing management. Lake boating and fishing would replace some activities now possible. Annual recreation benefits and costs would be \$181,700 and \$62,400, respectively. Construction costs for a dam in the corridor would total \$103,499,800 (1976 dollars); net annual benefits to exceed \$16 million, with costs approaching the same. Energy production stimulated. Cost of water would be about \$100 per acre-foot (1,233 m <sup>3</sup> ).	Insufficient data exist to evaluate recreation use associated with this plan. Estimated costs and benefits of reservoir development alone would total about \$3.3 million annually. As with NED Plan A, an estimated 100,000 acre-feet (123 million m <sup>3</sup> ) of water would be available annually for coal-based energy development. Increased electrical energy output would be possible without adversely affecting the "no action" and environmental quality alternatives. However, cost of water would be about \$33 per acre-foot (1,233 m <sup>3</sup> ), which may escalate due to increased costs of energy needed to pump water for project operation.	Insufficient data exist to evaluate recreation use associated with this plan. The reservoir project has the capability of providing conventional hydropower, pumped storage hydropower, and cooling water for coal-fired steam power. Consumptive water uses, including agriculture, municipal, and industrial, could be accommodated with the reservoir which would have a capacity of 72,650 acre-feet (89,613,800 m <sup>3</sup> ). Cost of storage water would be about \$13.00 per acre-foot initially, then decreasing to no net cost during the sixth year due to increased power and energy revenues. Generally, there would be increased electrical energy output with limited adverse impacts on the environment in the gorge below the Smith Fork confluence.	By 1990, use in the gorge will total about 24,700 recreation days annually, an increase of 8,100 over existing management. Annual benefits would be \$112,200, about \$32,100 more than with "No Action." Estimated annual costs to continue at the same level as with existing management.	Annual use in the gorge will total about 52,600 recreation days by 1990, some 34,000 recreation days greater than with existing management. Benefits would be about \$189,900 annually as compared to \$81,000 in costs; net increases in benefits and costs would be \$109,800 and \$27,400, respectively.	About 156,500 recreation days of use annually in the gorge, some 137,950 days of greater than with "No Action." Associated benefits and costs would be \$327,400 and \$156,800, respectively, with net increases of \$247,800 and \$103,200, resulting in minimal recreation benefits.
Environmental Quality	Free-flowing stream preserved and protected by Public Land Order No. 5261. <sup>3</sup> Protection and restoration of historic and cultural sites and protection of rare, endangered or threatened plants and animals. No degradation of air and water quality expected.	Loss of 13 miles (21 km) of free-flowing stream in the gorge below the monument due to water resource development, as well as some historic and archeologic sites. If existing air quality standards are met, no reduction in air quality is expected. Water quality would be essentially unchanged.	Since this alternative involves proposed projects outside the eligible river study corridor, no adverse impacts are expected. Specific data on reservoir sites and locations are incomplete for this alternative, making it impossible to fully describe impacts.	Loss of 1 mile (1.6 km) of free-flowing stream in the gorge below the monument due to water resource development, as well as some historic and archeologic sites, threatened and endangered plants and animals. If existing air quality standards are met, no reduction in air quality is expected. Water quality would be essentially unchanged.	Congressional designation would provide the highest level of protection for the 26-mile (42-km) eligible river corridor. Preservation of historic/cultural resources and protection of endangered and threatened species. Water and air quality preserved in conformity with established State and Federal standards.	A higher degree of protection would be afforded the eligible river segment than with existing management. Levels of protection and preservation similar to those afforded by the wild river option, with possible minor loss of some plants in the gorge.	National designation would provide a lower level of protection for the gorge. Increased vandalism of cultural resources likely. Greater loss of plants and interference with wildlife. Some reduction in air and water quality but still within tolerable limits.
Regional Development <sup>4</sup>	Income generated in the region would total \$795,500 by 1990, gross regional product about \$999,200, and employment about 96.1 man-years.	Regional income generated would be \$974,800 by 1990, about \$179,300 greater than the existing management plan. Gross regional product would be over \$1.2 million, an increase of about \$229,000. Employment would be 118.8 man-years, about 22.7 man-years greater than with existing management.	Insufficient data are available to fully evaluate impacts on the regional economy. However, it is expected that regional income would be increased beyond that which may occur with any one of the environmental quality plans since each of these individual alternatives would be mutually compatible and could coexist with NED Plan B.	Same as NED Plan B, except that this plan would be mutually compatible with the EO plans only to the extent that 1 mile (1.6 km) of the river gorge in the lower gorge would be inundated by a reservoir. There would be increased regional income resulting from development in this segment, and environmental losses.	Generation of \$819,700 in regional income by 1990, which represents an increase of \$24,200 over the existing management plan. Gross regional product of more than \$1.0 million, an increase of over \$31,000. Employment of 99.1 man-years, or 3 man-years greater than with existing management.	Increase of \$131,300 in regional income generated by 1990, resulting in a total of \$926,800 compared to existing management plan. Gross regional product increase of \$167,700 to total about \$1.2 million. Employment of 112.3 man-years, 16.2 man-years greater than with existing management.	Regional income of \$1,314,600 or about \$519,100 increase over existing management. Gross regional product of \$1.6 million representing an increase of \$650,400. Employment of 159.7 man-years, 63.6 man-years greater than with "No Action."
Social Well-being	Minor changes or impacts would result from implementation of current management guidelines in the gorge. Income generated by increased visitation would improve the economy somewhat and a much wider array of recreational opportunities would be available.	Educational, cultural, and recreational opportunities may increase but quality may decrease due to loss of outstanding natural and cultural values. Increased income to service and recreational supply industries.	Insufficient data are available to evaluate impacts on social well-being. The combination of this alternative with any one of the EO plans would likely increase educational, cultural, and recreational opportunities, except for the loss of natural river environment in the project area below the eligible study corridor.	Same as NED Plan B, except that the loss of natural river environment would include an additional mile (1.6 km) of corridor in the lower gorge.	Although the availability of opportunities is increased somewhat, it is not expected to generate any noticeable impacts.	Some increased use and income generated but little or no impact discernible.	Provide greatest opportunity for people to view or experience the natural resources and some increase in local values and quality of experience diminished. This "intensive" development is inconsistent with local values and opinions, both those who support designation and those who oppose it.

<sup>1</sup>Use in the monument is expected to reach 639,300 recreation days annually by 1990, an increase of about 253,750 recreation days over 1976 use, regardless of the alternative. Thus, as a result of the existing management and wilderness designation in the monument which dictate that visitation remain within the carrying capacity of the resource, use, benefits, and costs will remain relatively constant and have no overall impact on the alternatives considered.

<sup>2</sup>An environmental quality plan emphasizing the protection and preservation of endangered and threatened species of wildlife and plants was evaluated in addition to the wild river option. However, since the wild river option accomplished essentially the same objectives as this plan, it was omitted.

<sup>3</sup>The Federal Land Policy and Management Act of 1976 requires that all existing (as of date of passage) withdrawals, such as the one embodied in Public Land Order No. 5261 for the gorge segment, be reviewed and reevaluated within 15 years of the Act's passage. Further, the Act requires that roadless areas of 5,000 acres (2,024 ha) or more on the public lands, such as those contained in the study area, be evaluated for possible inclusion in the National Wilderness System.

<sup>4</sup>High income and employment producing activities for each plan include, among others, service stations and other retail sales, as well as rentals and finance, transportation, other services, electric energy, other utilities, food and related services, lodging, etc.

and management plans will also provide for protection and restoration of cultural sites and provide for protection of endangered and threatened species of plants and animals. No degradation of air and water quality is expected if energy and other developments in the general area are able to meet state standards before the required project permits are issued. Effects on air quality due to increased visitation to the area are expected to be minimal both for hydrocarbons and dust.

Regional income generated under the existing management plan is expected to total about \$800,000; of this, service stations and other retail sales are expected to account for \$700,000. Income from service stations and other retail sales also would account for over 80 percent of the \$999,200 in value added, with attendant increases resulting in additional employment of more than 96 man-years in the region.

When the Gunnison Gorge Recreation Lands management plan is completed and implemented, there will be only minor changes or impacts affecting social well-being. The plan's major effect will be the provision of a wider array of recreation opportunities, and the attendant generation of additional income will create some secondary well-being effects.

#### National Economic Development Plans

Three plans for maximizing electric energy production and domestic water supply were evaluated: Plan A involves the development of a hydropower reservoir within the eligible river study segment; Plan B includes water resource development immediately downstream from the study area; and Plan C would back water about 1 mile (1.6 km) into the eligible river corridor to the vicinity of the Smith Fork.

National Economic Development Plan A. This alternative is based on existing plans to utilize the water resources of the gorge segment to generate hydroelectric power (66 megawatts total capacity), while producing 100,000 acre-feet (123 million m<sup>3</sup>) of water annually for coal-fired steam generation power and possibly coal gasification plants. The national/regional electric power market situation and existing demand for natural gas, or a substitute for it, indicate that electrical energy or gas could be sold at prices above existing market prices as soon as the production facilities could be developed. Major project features, as shown in figure 5-1, would include the following.

- (1) Cedar Flats Dam and Reservoir. This facility would be located about 1 mile (1.6 km) upstream from the confluence of the Gunnison and North Fork Rivers. The company's conditional decree is for a reservoir which would have a total capacity of 162,700 acre-feet (200.7 million m<sup>3</sup>). Revised projections call for a 193,300-acre-foot (237 million m<sup>3</sup>) reservoir backing water up to a point just downstream from the monument's northern boundary.
- (2) Rabbit Gulch Pipe Line and Sulphur Gulch Reservoir. These components include a pipe line with a nominal capacity of 200 cfs (5.7 m<sup>3</sup>/s), conveying water from the Cedar Flats Reservoir to a small reservoir (16,150 acre-feet--19.9 million m<sup>3</sup>--capacity) constructed in the above-named drainages northwest of the confluence of the Gunnison and North Fork Rivers. Water used for coal-related power generation and coal gasification would be drawn from this reservoir.
- (3) Austin Dam and Reservoir. This facility would include a dam across the main stem of the Gunnison below the confluence with the North Fork but upstream from the town of Austin. A reservoir with a high water elevation of 5,100 feet (1,554 m)

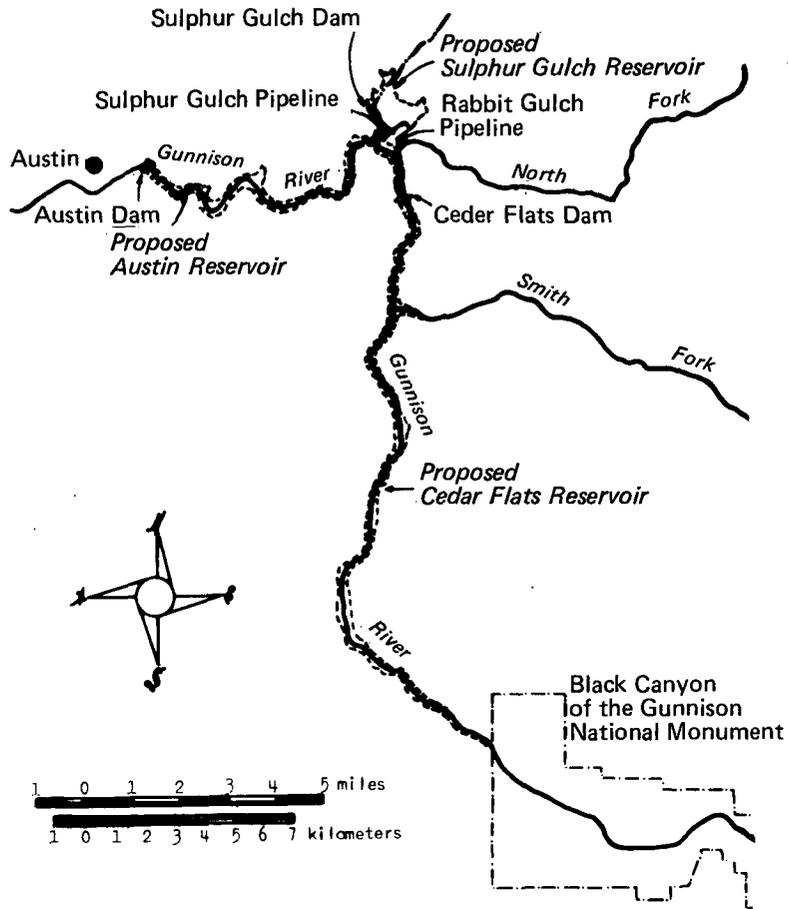


FIGURE 5-1

NED PLAN A - RESERVOIR IN UPPER GORGE

and a maximum capacity of 27,400 acre-feet (33.8 million m<sup>3</sup>) would back water up to the Cedar Flats Dam. It would serve primarily as an afterbay for peaking power generation from the Cedar Flats facility and also to regulate stream flow below it.

This alternative could provide power and water to the City of Delta consistent with their expressed needs and could make water available to the Colorado-Ute Electric Association consistent with their stated need for additional coal-fired steam generating

capacity. Although there presently are no plans to develop the project, if constructed it would have an estimated maximum coal-related generating capacity of 3,000 megawatts.<sup>1</sup>

This alternative would preclude the City of Delta's proposal for a 275-foot-high (84-m) dam across the Gunnison River just above its confluence with the Smith Fork. Delta's Smith Fork project would back water nearly to the boundary of the monument, and would include facilities for hydropower generation while providing a possible source of municipal water.

The second project--Colorado-Ute Electric Association's proposed Tri-County project--would also be precluded by this alternative. The Colorado-Ute currently holds a conditional decree for the storage of 72,650 acre-feet (89.6 million m<sup>3</sup>) of water, and is in the early planning process for a power project in this area. Resources are available here for a coal-fired steam generating complex. Initially, this complex could have a capacity of 250 to 500 megawatts, with a larger ultimate potential development capacity of perhaps as high as 1,400 to 2,000 megawatts.

Summary of Impacts - Construction costs for this project would total an estimated \$105,449,800. As table 5-1 indicates, net annual benefits would exceed \$16 million, and costs would approach the same figure. Energy production would be stimulated substantially. That energy is in demand and can be sold as soon as production occurs.

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1. Gunnison Main Project.

About 13 miles (21 km) of free-flowing stream outside the monument would be lost. Some historic and archeologic sites would be inundated. The river otter along this stretch would be extirpated, and there would be a negative impact on some of the endangered and threatened raptor species which depend for prey on species inhabiting the streambank. Further, if motorboats were allowed to travel to the upper portion of the canyon, they would disturb the nesting habitat of some raptor species.

Water quality would be essentially unchanged. If existing standards are met, no reduction in air quality is expected. The two mainstem reservoirs would provide limited opportunities for lake boating and fishing in place of some of the activities associated with a stream environment that would be eliminated. Some recreation and cultural sites would be covered by the reservoirs. Realignment of Colorado Highway 92 would be required.

A total of \$974,800 in regional income would be generated by this plan, an increase of about \$179,000 over the existing management plan. The greatest income would accrue from service stations and other retail sales. Value added to the regional economy would total about \$1.2 million, or some \$229,000 greater than would be provided by the existing management plan.

National Economic Development Plan B. This alternative, as shown on figure 5-2, would maximize the available water supply. It includes the Sulphur Gulch Reservoir described briefly in Plan A and would cost about \$18.2 million to construct. However, instead of combining it with the pipe line from the Cedar Flats and Austin Reservoirs, a small diversion structure would be constructed in the Gunnison River below its confluence with the North Fork. Assuming that necessary legal authority could be obtained to do so, water would be pumped from this small impoundment into the Sulphur Gulch Reservoir when stream flow exceeded the amount

required to meet prior downstream rights. In order to assure that the 100,000 acre-feet (123.3 million m<sup>3</sup>) per year could be obtained during low flow years, water would be purchased from the Curecanti project for release to augment low flow conditions. According to the Bureau of Reclamation, this additional water is available from Blue Mesa Reservoir; but its use for downstream projects must first be approved by the controlling authorities.

This proposal would require only slight changes in access to the Pleasant Forks recreation site and would not affect or impact the study segment. A change in the alignment of Colorado Highway 92 would be required. Thus, this alternative could be combined with any of the environmental quality or existing management alternatives.

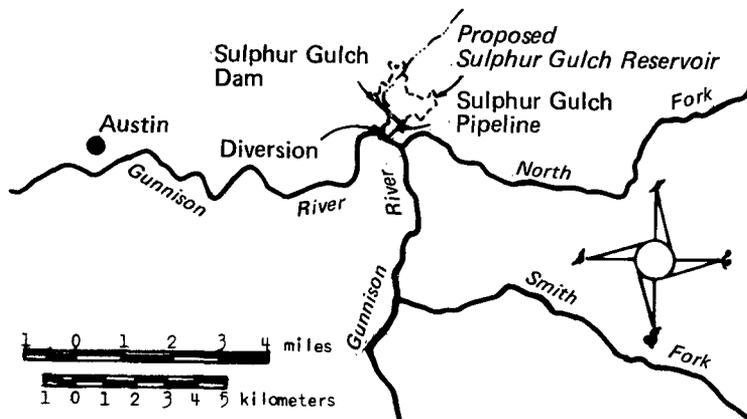


FIGURE 5-2  
NED PLAN B - RESERVOIR BELOW GORGE

Summary of Impacts - Since this alternative would be totally outside the area determined to be eligible for designation, no adverse impacts are expected. As it involves reservoir development and operation, this plan would have estimated costs and benefits of \$3,290,000 annually. As with National Economic Development Plan A, an estimated 100,000 acre-feet (123.3 million m<sup>3</sup>) of water would be available annually for coal-based energy development. The plan would provide the basis for an increased output of electrical energy without infringing upon the recreation benefits yielded by any of the environmental quality and existing management alternatives. This alternative yields water for energy development at a lower cost than National Economic Development Plan A--approximately \$33/acre-foot (3¢/m<sup>3</sup>) vs. \$100/acre-foot (8¢/m<sup>3</sup>) after the hydropower costs and benefits have been deducted. However, this cost may escalate due to the possibility of increased energy costs to pump water for project operation. Another possibility exists that water and power may be made available from this project to the City of Delta.<sup>1</sup>

National Economic Development Plan C. Another water resources development plan involving the construction of a dam to store 72,650 acre-feet (90,613,800 m<sup>3</sup>) with a drawdown capacity of 69,150 acre-feet (89,296,500 m<sup>3</sup>) has been proposed by the Colorado-Ute Electric Association, Inc. The dam would be located 6 miles (10 km) below the confluence of the North Fork, as shown on figure 5-3, and would back stored water approximately 1 mile (1.6 km) into the 26-mile (42-km) river segment determined eligible for possible inclusion in the National Wild and Scenic Rivers System.

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1. See Report to the Bureau of Land Management by Colorado-Ute, August 1976, and Smith Fork Project Reconnaissance Report, August 1976, for detailed information concerning the tentative Colorado-Ute and City of Delta proposals.

An afterbay dike would be constructed downstream from the main dam to moderate river flow resulting from drawdown associated with peaking operation at the main reservoir. The plan has the capability of providing conventional hydropower, pumped storage hydropower, and cooling water for coal-fired steam power.

Based on information provided by the Colorado-Ute Electric Association, in the sixth year after construction is completed there would be no net annual cost of water for consumptive use. At that time, annual revenues from hydroelectric generation would offset annual costs (assuming full utilization annually of the 69,150 acre-feet [85.3 million m<sup>3</sup>] drawdown capacity for hydroelectric generation). Initially the cost of water would be \$13.00 per acre-foot (1¢/m<sup>3</sup>). During the sixth year the cost of power and energy would fall below anticipated rates, tending to reduce electricity costs to the consumers.

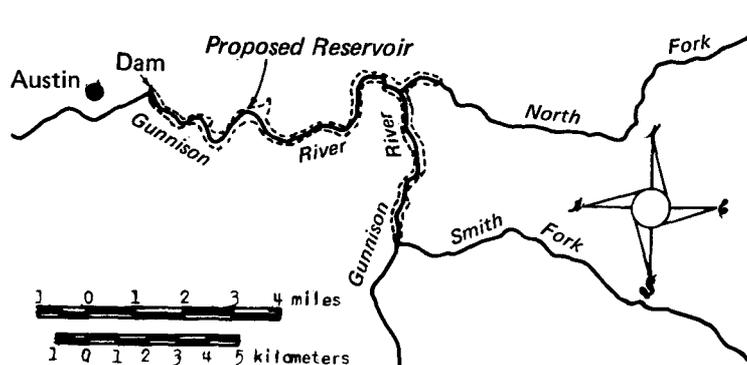


FIGURE 5-3  
NED PLAN C - RESERVOIR IN LOWER GORGE

Summary of Impacts - Except for its encroachment on the eligible river segment, this alternative would not affect the wild river proposal. Water that would impact the eligible river corridor would extend 1 mile (1.6 km) into the downstream segment to the vicinity of the Smith Fork confluence. Within this area there are no known historic or archeologic sites, but there is habitat suitable for the endangered river otter and American peregrine falcon. Although inundation of this lower corridor could adversely affect some of its outstanding natural values, including the geologic features found here, the impacts would be limited to a small portion of the eligible river segment.

### Environmental Quality Plans

Three plans or alternatives<sup>1</sup> that would provide protection and preservation of natural as well as historic and cultural features were considered. These plans vary in their classification of the gorge segment as either wild, scenic, or recreational.<sup>2</sup> Impacts associated with each are displayed in table 5-1 and appendix tables A-1 and A-2. A fourth environmental quality alternative that would emphasize protection of endangered and threatened plants and animals was also evaluated; however, it was found to accomplish essentially the same objectives as the wild river option and was included as part of that plan.

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1. The Environmental Quality alternatives are referred to as "options" in the various principles and standards analysis tables.

2. Although three different classification alternatives are presented here to show a comparison of effects and impacts, wild and scenic river segments should be classified only at the appropriate (most protective) level for which they qualify; in this case, that is "wild."

Wild River Alternative. This alternative assumes a "wild" designation for the full 26-mile (42-km) eligible portion of the study segment. The management philosophy and detailed facility plans are the same as the existing management alternative. Designation is expected to "advertise" the existence of the area somewhat and will increase use levels in the gorge segment by 6,000 recreation days over the existing management alternative, to a total of 24,600 recreation days.

Summary of Impacts - Estimated annual recreation costs would continue at the same level as the existing management plan (see table 5-1). Benefits would increase from \$80,100 to \$112,200, representing an estimated increase of \$32,100 annually.

Congressional designation would provide the highest level of protection for the 26-mile (42-km) eligible river corridor. Historic and cultural resources would be preserved; endangered and threatened species would be protected. Although use levels are not expected to create any major adverse impacts, it may be necessary to curtail human activity in the canyon during the critical breeding and rearing seasons of the American peregrine falcon and river otter. Also, critical habitat would be identified and protected. Water and air quality would be preserved since even nonstudy area development projects would require state approval and are expected to meet the applicable emissions standards.

Impacts on regional development would be the generation of \$819,700 in income, or \$24,200 more than with existing management. Value added to the economy would total about \$1 million, an increase of about \$31,200. Employment would increase by 3 man-years to about 99 man-years.

Scenic River Alternative. This alternative is based on a "wild" designation for the monument segment and "scenic" designation for the gorge segment. The management approach under this alternative would follow a limited development policy except that expansion of some facilities and a greater emphasis on public access to the scenic attributes of the area would result in a larger amount of use.

Picnic facilities at the Chukar, Duncan, and Ute trailheads would be expanded to 10 tables, with additional parking space provided. Use, as projected in table 5-1, would total 52,600 recreation days for the gorge segment, representing an increase of 34,000 more than the existing management alternative.

Summary of Impacts - By 1990 annual recreation costs would increase to \$81,000 and annual benefits would increase to \$189,900. Net costs would total an estimated \$27,400; net benefits would increase to \$109,800 over the existing management level. Legislative protection would be provided for the 26-mile (42-km) segment; thus a higher degree of protection would be afforded the river than with existing management. Historic and archeologic resources would be protected, but use levels could cause some adverse impacts on endangered and threatened plant and animal species. Water and air quality would be preserved as in the existing management and wild river alternatives.

Greater income would be generated in the region than with the wild river option, amounting to \$926,800 or a difference of \$131,300 over the existing management plan.

Value added to the economy would be \$167,700, to total \$1.2 million. Similarly, employment would increase by 16.2 man-years to 112.3 man-years.

Increased use and local income generated in the region would provide some positive effects on social well-being. Yet, when viewed in total perspective, little or no impact would be discernible.

Recreational River Alternative. This alternative assumes designation of the river as "wild" through the monument and "recreational" for the gorge segment. With a recreational designation, facilities along the gorge segment would be further expanded. (See appendix table A-1.) Accessibility would be improved by higher quality roads and more signs, and a visitor center would be constructed to maximize recreational use consistent with protection of resource values in the segment.

The proximity of the gorge and monument segments would lead some of the visitors to the Black Canyon of the Gunnison National Monument to travel on to view the Gunnison Gorge Recreation Lands. Others seeking an area with fewer visitors and wishing to experience a different setting would come to the gorge as their primary destination.

Summary of Impacts - As shown in table 5-1, the annual recreation benefit would increase to \$327,900 annually, with costs increasing to \$156,800 annually. This net increase in estimated benefits would total \$292,800, and net cost would increase by \$103,000 annually. Thus, this plan would maximize recreation benefits.

Designation of the 26-mile (42-km) eligible river segment, about 13 miles (22 km) of which would be classified as recreational in the gorge, would provide the lowest level of protection for the river corridor. Although they would be protected as required by existing law, use at the assumed levels would probably cause increased vandalism of historic and archeologic sites. Higher use levels would tend to reduce or even eliminate populations and

habitat for endangered and threatened plants and animals. Also, such use would lead to some reduction in water and air quality by increased vehicular traffic and resultant dust problems and hydrocarbon emissions.

Income generated in the region would be greater than with any of the other alternatives. It would reach \$1,314,600, about \$519,100 greater than with existing management. Value added by all activities would exceed \$1.6 million, about \$660,000 greater than that expected with "no action." Employment would total about 160 man-years, an increase of nearly 64 man-years.

More people would be given the opportunity to view or experience the resources of the area than with any of the other plans, tending to improve the local economy somewhat. However, this intensive development is inconsistent with local values and opinions as expressed by those who support designation and those who oppose it.

## EVALUATION OF ALTERNATIVES

An analysis of the alternatives considered in this chapter yields the following results:

1. National Economic Development Plan A (reservoir within study corridor), although providing the highest amount of benefits, also has the highest level of costs. In fact, after the benefits of hydropower plants are subtracted from annual costs, the 100,000 acre-feet (123.3 million m<sup>3</sup>) of water produced for subsequent coal-related energy development would cost an estimated \$99.60 per acre-foot (1,233 m<sup>3</sup>). NED Plan B (reservoir outside study corridor) yields the same amount of

water annually for energy development, but has an annual cost of about \$32.90 per acre-foot (1,233 m<sup>3</sup>) that will escalate with the increased cost of power and energy. Since three ways exist to provide water for energy development, the least-cost alternative is NED Plan C. This eliminates NED Plan A from further consideration.

2. As the earlier narrative and tabular material indicate, there appears to be no conflict between NED Plan B and either the environmental quality or existing management alternatives. Thus, energy development (economic development) and environmental objectives can be achieved simultaneously, although at a higher cost than for NED Plan C.
3. Objectives of EQ Plan No. 4, which emphasized the protection and preservation of endangered and threatened plants and animals, can be satisfied through the wild river alternative. With the latter plan, use levels are low and dispersed for critical habitat areas so that no conflicts are apparent.
4. If NED Plan B or C is implemented, it may be possible for the City of Delta to obtain electrical power and water for domestic purposes from one of the reservoirs. Other options for meeting Delta's needs may be met by possible construction of the Dallas project, which lies outside the study area, or by a combination of purchasing electric power from other sources and installing a water diversion structure between the confluence of the Smith Fork and North Fork, which is outside the proposal area, for domestic water supply purposes.

Although NED Plan B (reservoir below gorge) is removed from consideration because it is not within the study area, it can operate without conflicting with the study segment determined eligible for

designation. While NED Plan C (reservoir in lower gorge) remains in the study area only marginally, it would inundate some of the outstandingly remarkable values found in the lower 1 mile (1.6 km) of the eligible river segment. EQ Plan C (wild monument/recreational gorge) also would cause adverse impacts on the environment as a result of heavy recreation use and was not given further consideration.

Considering that electric power generation and domestic water supply needs can be met by a project outside the study area, three remaining viable plans or alternatives require consideration--two environmental quality and the existing management (no action) alternatives. Each of these reflects differing types and amounts of recreation use, as well as differing degrees of protection. Since their characteristics are already displayed in table 5-1 and appendix tables A-1 and A-2, no additional displays are provided. Selection of a recommended plan is discussed in the following chapter.

## CHAPTER VI RECOMMENDED ACTION

The U.S. Department of the Interior and the Colorado Department of Natural Resources recommend that approximately 26 miles (41.8 km) of the 29-mile (46.7-km) Gunnison River study corridor be included in the National Wild and Scenic Rivers System as a "wild" river. The wild segment contains about 12,900 acres (5,200 ha) and extends from the upstream (southern) boundary of Black Canyon of the Gunnison National Monument to a point 1 mile (1.6 km) below the confluence with the Smith Fork (figure I-1). The remaining 2.7 mile (4.3-km) segment below the Smith Fork was excluded because it lacks outstandingly remarkable values and is therefore ineligible for inclusion in the system.

This recommendation, the Environmental Quality (EQ) Wild River Alternative, is discussed in chapter V. It will provide the greatest degree of protection for the outstanding geologic, scenic, wildlife, and recreation values associated with the river environment. Based on results of the economic-environmental analysis, water will continue to be available for resource development outside the area proposed for designation.

In addition to the protection afforded the Gunnison's outstanding values, designation of the segment is compatible with existing policies and laws affecting use and management of the area.

### MANAGEMENT GUIDELINES

The general management plan for the monument and the management framework plan for the gorge will address the wild river recommendation. These management plans will have as their

objectives the protection and enhancement of those outstanding values for which the river was found eligible for inclusion in the national system.

The National Park Service and the Bureau of Land Management will continue to manage their respective lands within the proposed river management zone. Adjacent lands administered by these agencies will also be managed to protect the natural and cultural values of the river corridor. Additionally, a detailed boundary description will be prepared by the Bureau of Land Management for the corridor in the gorge. A similar boundary description will not be needed for the monument where boundaries already exist for the area.

The river is deeply entrenched in a relatively narrow canyon, and boundaries of the proposed management zone generally coincide with the visual corridor of the river segment. In the monument, this corridor extends to the main canyon rims. Below the monument, where the river flows through a double-rim canyon, the visual corridor is limited to the inner canyon rim. Over the length of the eligible 26-mile (42-km) segment, this corridor averages about 3/4 mile (1.2 km) in width and consists entirely of federally owned land as shown by the following statistics.

<u>Agency</u>	<u>Acres (hectares)</u>	<u>Linear Miles (kilometers)</u>
National Park Service	7,540 (3,051)	12.7 (20.4)
Bureau of Land Management	5,392 (2,182)	13.5 (21.7)
TOTALS	12,932 (5,233)	26.2 (42.1)

Since the river management zone within the monument segment of the corridor is part of a designated wilderness area, the river in this segment will be subject to the provisions of both the Wilderness

Act and the Wild and Scenic Rivers Act. In the case of conflict between the provisions of these acts, the more restrictive provisions shall apply.

Although designation of the Gunnison River is expected to increase the amount of recreation activity in the corridor, this increase will be only slightly greater than present visitation. A major factor limiting use will be the natural ruggedness and inaccessibility to the area. To maintain recreational use at a level consistent with the carrying capacity of the resources, only minimal facilities within the area immediately outside the visual corridor will be allowed.

As provided in Section 13(a) of the Act, "Hunting and fishing shall be permitted on lands and waters administered as parts of the system under applicable State and Federal laws and regulations . . .," except in the case of hunting within the monument where the hunting, killing, wounding, frightening, or capturing of any wildlife is prohibited. The Secretary of the Interior "may, however, designate zones where, and establish periods when no hunting is permitted for reasons of public safety, administration, or public safety, administration, or public use and enjoyment. . . ." Such regulations, if required, will be issued after consultation with the Colorado Department of Natural Resources.

Because of the disturbance to raptors and to recreationists seeking the rugged solitude of this area, it is recommended that the use of helicopters be limited to rescues and minimal administrative use. Overflights of other aircraft, for the same reasons, should not be permitted within the canyon rims.

Cultural resources worthy of preservation but not yet listed in the National Register of Historic Places are accorded the procedural protection of section 2(b) of Executive Order 11593. Any action

affecting the integrity of the cultural resources within the proposed river corridor will be developed in consultation with the Colorado State Historic Preservation Officer and the Advisory Council on Historic Preservation.

#### ACQUISITION AND DEVELOPMENT COSTS

All the land is federally owned, and there are no acquisition costs for the proposal. Bureau of Land Management and National Park Service management plans call for some facility development outside the proposed wild river management zone. These are independent of the Gunnison's inclusion in the national system; therefore, there are no development costs for the proposal. Although scenic and public use easements will be required outside the river corridor, these and other developments will take place under existing management plans, whether or not the river is designated a component of the National Wild and Scenic Rivers System.



APPENDIX A  
(Continued)

OBJECTIVES

Account	Components	National Economic Development												Environmental Quality							
		Existing Management Plan No Action		Reservoir in Upper Gorge (Plan A)				Reservoir Below Gorge (Plan B)				Reservoir in Lower Gorge (Plan C)				Wild River Option (Wild Mon/Wild Gorge)		Scenic River Option (Wild Mon/Scenic Gorge)		Recreational River Option (Wild Mon/Rec Gorge)	
		1990	Net <sup>1</sup>	1990	Net <sup>1</sup>	1990	Net <sup>1</sup>	1990	Net <sup>1</sup>	1990	Net <sup>1</sup>	1990	Net <sup>1</sup>	1990	Net <sup>1</sup>	1990	Net <sup>1</sup>	1990	Net <sup>1</sup>		
R E G I O N A L I N C O M E G E N E R A T E D <sup>2</sup>	Food and Related Services	\$ 2.4	\$ 5.2	\$ 2.8	(Insufficient data exist on which to base an evaluation of this plan)	(Insufficient data exist on which to base an evaluation of this plan)	\$ 2.8	\$ 0.4	\$ 3.9	\$ 1.5	\$ 6.8	\$ 4.4	\$ 2.4	\$ 5.2	\$ 2.8	\$ 0.4	\$ 3.9	\$ 1.5	\$ 6.8	\$ 4.4	
	Service Stations	533.2	634.5	101.3			545.2	12.0	607.0	73.0	837.5	304.3	533.2	634.5	545.2	12.0	607.0	73.0	837.5	304.3	
	Other Retail	153.7	195.4	41.7			160.7	7.0	186.6	32.9	271.1	127.4	153.7	195.4	160.7	7.0	186.6	32.9	271.1	127.4	
	Lodging	1.6	2.8	1.2			2.4	0.8	4.9	3.3	8.1	6.5	1.6	2.8	2.4	0.8	4.9	3.3	8.1	6.5	
	Other Services	10.3	19.6	9.3			11.0	0.7	13.1	2.8	20.8	10.5	10.3	19.6	11.0	0.7	13.1	2.8	20.8	10.5	
	Transportation	21.0	25.6	4.6			21.6	0.6	24.4	3.4	34.8	13.8	21.0	25.6	21.6	0.6	24.4	3.4	34.8	13.8	
	Electric Energy	9.8	12.1	2.3			10.1	0.3	11.4	1.6	16.1	6.3	9.8	12.1	10.1	0.3	11.4	1.6	16.1	6.3	
	Other Utilities	6.6	8.3	1.7			6.8	0.2	7.8	1.2	11.3	4.7	6.6	8.3	6.8	0.2	7.8	1.2	11.3	4.7	
	Rentals and Finance	42.3	52.5	10.2			43.8	1.5	50.0	7.7	72.1	29.8	42.3	52.5	43.8	1.5	50.0	7.7	72.1	29.8	
	All Other	14.6	18.8	4.2			15.3	0.7	17.7	3.1	26.0	11.4	14.6	18.8	15.3	0.7	17.7	3.1	26.0	11.4	
	Total Regional Income	\$795.5	\$974.8	\$179.3			\$819.7	\$24.2	\$926.8	\$131.3	\$1,314.6	\$519.1	\$795.5	\$974.8	\$819.7	\$24.2	\$926.8	\$131.3	\$1,314.6	\$519.1	
	V A L U E A D D E D <sup>3</sup>	Food and Related Services	\$ 3.2	\$ 6.9	\$ 3.7			\$ 3.7	\$ 0.5	5.2	\$ 2.0	\$ 9.1	\$ 5.9	\$ 3.2	\$ 6.9	\$ 3.7	\$ 0.5	5.2	\$ 2.0	\$ 9.1	\$ 5.9
		Service Stations	635.6	736.4	120.8			649.9	14.3	723.6	88.0	998.3	362.7	635.6	736.4	649.9	14.3	723.6	88.0	998.3	362.7
		Other Retail	210.7	251.9	57.2			220.3	9.6	255.8	45.1	385.4	174.7	210.7	251.9	220.3	9.6	255.8	45.1	385.4	174.7
		Lodging	2.3	3.9	1.6			3.5	1.2	6.9	4.6	11.4	9.1	2.3	3.9	3.5	1.2	6.9	4.6	11.4	9.1
Other Services		15.3	29.2	13.9			16.4	1.1	19.5	4.2	31.0	15.7	15.3	29.2	16.4	1.1	19.5	4.2	31.0	15.7	
Transportation		29.8	36.4	6.6			30.8	1.0	34.8	5.0	49.5	19.7	29.8	36.4	30.8	1.0	34.8	5.0	49.5	19.7	
Electric Energy		19.8	24.5	4.7			20.4	0.6	23.1	3.3	32.7	12.9	19.8	24.5	20.4	0.6	23.1	3.3	32.7	12.9	
Other Utilities		14.1	17.9	3.8			14.7	0.6	16.9	2.8	24.4	10.3	14.1	17.9	14.7	0.6	16.9	2.8	24.4	10.3	
Rentals and Finance		48.4	60.1	11.7			50.1	1.7	57.2	8.8	82.5	34.1	48.4	60.1	50.1	1.7	57.2	8.8	82.5	34.1	
All Other		20.0	25.5	5.5			20.6	0.6	23.9	3.9	35.3	15.3	20.0	25.5	20.6	0.6	23.9	3.9	35.3	15.3	
Total Value Added		\$999.2	\$1,228.7	\$229.5			\$1,030.4	\$31.2	\$1,166.9	\$167.7	\$1,659.6	\$660.4	\$999.2	\$1,228.7	\$1,030.4	\$31.2	\$1,166.9	\$167.7	\$1,659.6	\$660.4	
E M P L O Y M E N T (Man Years)		Food and Related Services	0.5	1.1	0.6			0.6	0.1	0.8	0.3	1.4	0.9	0.5	1.1	0.6	0.1	0.8	0.3	1.4	0.9
		Service Stations	66.4	79.0	12.6			67.9	1.5	75.6	9.2	104.3	37.9	66.4	79.0	67.9	1.5	75.6	9.2	104.3	37.9
		Other Retail	19.8	25.2	5.4			20.7	0.9	24.1	4.3	36.2	16.4	19.8	25.2	20.7	0.9	24.1	4.3	36.2	16.4
		Lodging	0.2	0.4	0.2			0.4	0.2	0.7	0.5	1.2	1.0	0.2	0.4	0.4	0.2	0.7	0.5	1.2	1.0
	Other Services	2.5	4.8	2.3			2.7	0.2	3.2	0.7	5.1	2.6	2.5	4.8	2.7	0.2	3.2	0.7	5.1	2.6	
	Transportation	1.3	1.6	0.3			1.3	--	1.5	0.2	2.1	0.8	1.3	1.6	1.3	--	1.5	0.2	2.1	0.8	
	Electric Energy	0.7	0.9	0.2			0.7	--	0.8	0.1	1.2	0.5	0.7	0.9	0.7	--	0.8	0.1	1.2	0.5	
	Other Utilities	0.7	0.9	0.2			0.7	--	0.8	0.1	1.2	0.5	0.7	0.9	0.7	--	0.8	0.1	1.2	0.5	
	Rentals and Finance	1.5	1.9	0.4			1.6	0.1	1.8	0.3	2.6	1.1	1.5	1.9	1.6	0.1	1.8	0.3	2.6	1.1	
	All Other	2.5	3.0	0.5			2.5	--	3.0	0.5	4.4	1.9	2.5	3.0	2.5	--	3.0	0.5	4.4	1.9	
	Total Man Years	96.1	118.8	22.7			99.1	3.0	112.3	16.2	159.7	63.6	96.1	118.8	99.1	3.0	112.3	16.2	159.7	63.6	
	S O C I A L W E L F A R E	Educational, Cultural, and Recreational Opportunities	Opportunities will remain similar to those at present. However, protection is assured only by managing agency policy in the gorge at the present time.	Opportunities may increase but quality may decrease due to loss of outstanding natural and cultural values.	Opportunities will increase considerably, depending on the type of river classification. However, free-flowing streams below the gorge would be lost.	Same as NED Plan B, except that 1 mile (1.6 km) of free-flowing stream in the lower gorge would be lost in addition to the stream below the gorge.	Opportunities will increase somewhat by national recognition. Quality of opportunities will be preserved by Act of Congress and natural ruggedness of area.	Same as EQ No. 1, except for slightly greater opportunity.	Availability of opportunities will be increased considerably by improved facilities. Quality of opportunities will be diminished by increased use. Inconsistent with local values and opinions.												
		Life, Health, and Safety	This plan is neutral for this component.	This plan is neutral for this component.	Increased sanitary facilities and patrol in gorge above reservoir will improve health and safety.	(Same as NED Plan B)	Increased sanitary facilities and patrol will improve health and safety.	(Same as Wild River Option)	(Same as Wild River Option)												
		Income Distribution	Insufficient data to assess this plan.	Income to service and recreational supply industries increases.	Income to service and recreational supply industries increases considerably, depending on type of river classification in gorge.	(Same as NED Plan B)	Same as NED Plan B but increases generally are less.	Same as NED Plan B but increases generally are less.	Income to service and recreational supply industries greater than NED Plan B provides.												
		Emergency Preparedness	This plan is neutral for this component.	(Same as "No Action")	(Same as "No Action")	(Same as "No Action")	(Same as "No Action")	(Same as "No Action")	(Same as "No Action")												
Freedom of Travel		Travel unaffected, except as it relates to dust created by off-road vehicles and compliance with established State and Federal air quality standards.	Same as "No Action." In addition, realignment of Colorado's Highway 92 would be required as a result of reservoir construction.	(Same as NED Plan A)	(Same as "No Action")	(Same as "No Action")	(Same as "No Action")	(Same as "No Action")													

<sup>1</sup>The net columns for the National Economic Development and Regional Development accounts indicate the expected overall effect of implementing a particular plan or option and represent the difference between 1990 recreation day totals shown for the Existing Management (No Action) plan and 1990 recreation day totals shown for each alternative plan or option.

<sup>2</sup>Since recreation use in the monument segment of the river study area will remain constant for each alternative plan, such use will have no overall effect and was excluded from annual recreation benefit calculations. Depending on the alternative, values used in estimating on-site benefits in the gorge varied as follows: stream fishing (\$5 - \$9); biking (\$2 - \$5); camping (\$2.25 - \$5); photography (\$3 - \$9); horse riding (\$4 - \$8); picnicking (\$2 - \$5); river floating (\$8 - \$25); hunting (\$7.50 - \$15); canyon viewing (\$2 - \$10); lake boating (\$5); lake fishing (\$4); geologic, historic, cultural interpretation (\$3 - \$6).

<sup>3</sup>As with recreation benefits, costs were computed only for the gorge segment of the study area. Annualized values shown are based on a 50-year analysis period, 14-year development period, and 6-3/8 percent interest rate. Included in these computations are costs for archeologic-historic site stabilization, restoration and preservation; recreation facilities development at the Alamosa Forks confluence site and at the head of Ute, Duncan, and Chukar Canyon trails; road construction outside the visual corridor, as well as annual operation, maintenance, and replacement costs. Values of goods and services produced and/or consumed in each alternative were based on 1976 cost/price estimates.

<sup>4</sup>Regional income generated is that portion of the National Economic Development account expenditures that remain in the region as a result of the particular plan being considered.

<sup>5</sup>Value added represents the gross regional product resulting from the particular plan being considered.

APPENDIX B

Table A-2

GUNNISON WILD AND SCENIC RIVER STUDY  
ALTERNATIVE PLAN COST COMPUTATIONS<sup>1</sup>

Construction Costs Recreational Development Features	Cost Per Unit	Existing Management and Wild River Option		National Economic Development			Environmental Quality			
				Reservoir in Gorge (Plan A)	Reservoir Below Gorge (Plan B)	Reservoir in Lower Gorge (Plan C)	Scenic River Option		Recreational River Option	
		Units	Cost	Units	Cost	Cost	Units	Cost	Units	Cost
Archeologic-Historic Site Stabilization and Adaptive Restoration Costs	--	--	\$ 91,500	--	--	--	--	\$ 91,500	--	\$ 91,500
Pleasure Forks/Confluence Site: Campsites w/table, fireings	\$ 1,200	10	12,000		Insufficient data are available on which to base an evaluation of recreation costs associated with this plan.	Insufficient data are available on which to base an evaluation of recreation costs associated with this plan.	10	12,000	20	24,000
Picnic Tables	600	10	6,000				10	6,000	20	12,000
Double Vault Toilet	10,000	1	10,000				1	10,000	2	20,000
Garbage Receptacle	350	2	700				2	700	4	1,400
Signs: Entrance, Directional, Information Interpret	--	--	1,500				--	1,500	--	1,500
Launching, Take-out Ramp 20' x 60' x 40 Sq. Yd.	5,500	1	5,500				1	5,500	1	5,500
Parking Area 250/car	--	20	5,000				20	5,000	40	10,000
Land Purchase 40/acre	--	2,000	80,000				2,000	80,000	2,000	80,000
Road: Hwy. to Rec. Site	--	--	50,000				--	50,000	--	50,000
Head of Ute, Duncan, Chukar Trails										
Picnic Tables	\$ 600	18	\$ 10,800	30	\$ 18,000		30	18,000	54	32,400
Double Vault Toilet	10,000	3	30,000	3	30,000		3	30,000	3	30,000
Garbage Receptacle	350	3	1,050	6	2,100		6	2,100	9	3,150
Signs	--	--	4,500	--	4,500		--	4,500	--	4,500
Parking Area 250/car	--	24	6,000	48	12,000		48	12,000	72	18,000
Trail Improvement 2.50/	--	--	--	--	--		--	--	--	--
Road Construction sq. yd.	5,280	5,280	13,200	5,280	13,200		5,280	13,200	5,280	13,200
Ute	8,000/mi.	5	40,000	5	40,000		5	40,000	5	40,000
Chukar	5,000/mi.	3	15,000	3	15,000		3	15,000	3	15,000
Duncan	5,000/mi.	3	15,000	3	15,000		3	15,000	3	15,000
Visitor Center Building	100,000	--	--	--	--		--	--	1	100,000
Signs	--	--	--	--	--		--	--	--	2,500
Parking Area 250/car	--	--	--	--	--		--	--	25	6,200
Water, etc.	--	--	--	--	--		--	--	--	5,000
Subtotals			\$397,750		\$ 149,800			\$412,000		\$580,850
Recreation Administration, Operation and Maintenance (Annual):										
General AOM Costs										
GS-5 Technician	\$ 833/mo.	6	\$ 5,000	12	\$ 10,000		12	\$ 10,000	18	\$ 15,000
Pickup Truck	217/mo.	6	1,300	12	2,600		12	2,600	18	3,900
Materials, Supplies	--	--	2,000	--	4,000		--	4,000	--	6,000
Admin., General Expenses	--	--	1,660	--	3,320		--	3,320	--	4,980
Porta Potties	360/day	2	720	4	1,440		4	1,440	8	2,880
Helicopter	500/day	13	6,500	26	13,000		26	13,000	52	26,000
Road Maintenance	900/mi.	5	4,500	10	9,000		10	9,000	20	18,000
Trail Maintenance	500/mi.	7	3,500	14	7,000		14	7,000	28	14,000
Visitor Center AOM Costs:										
GS-5 Technician	--	--	--	--	--		--	--	--	5,000
Heat, Lights, Maintenance	--	--	--	--	--		--	--	--	15,000
Subtotals			25,180		50,360			\$ 50,360		\$110,760
Reservoir Development Features:										
Reservoir Construction	--	--	--	--	101,800,000	\$17,200,000	--	--	--	--
Reservoir Easement(s) and Land Acquisition	--	--	--	--	1,500,000	1,000,000	--	--	--	--
Subtotals					\$103,300,000	\$18,200,000				\$32,481,000
Other Reservoir Costs:										
General Overhead					\$ 15,495,000*	\$ 2,730,000*				
Annual Operation and Maintenance					80,000	120,000				
Power (\$20/kwh)					--	340,000				
Energy (\$0.01/kwh)					--	20,000				
Conflicts of Rights					--	--				
Subtotals					\$ 15,960,000*	\$ 3,290,000*				
TOTAL COSTS			\$422,930		\$119,460,160	\$21,490,000		\$462,360		\$691,610

<sup>1</sup>Since costs for the monument segment of the eligible study area will remain constant regardless of the alternative, only costs for the gorge segment are shown.

\*Assumes 15 percent return on investment annually.

APPENDIX C

GUNNISON RIVER REGION

Rivers with Identified Free-Flowing Values

<u>River/Stream</u>	<u>Counties</u>	<u>River Segment</u>	<u>Approximate Total Length (Miles)</u>
Cebolla Creek	Hinsdale, Gunnison	Entire River	48
Cement Creek	Gunnison	Source to East River	16
Cochetopa Creek	Saguache	Source to Tomichi Creek	48
Gunnison River	Gunnison, Mesa, Delta, Montrose	Crystal Reservoir to Grand Junction	96
Lake Fork River	Hinsdale, Gunnison	Lake City to Blue Mesa Reservoir	39
Ohio Creek	Gunnison	Entire River	24
Quartz Creek	Gunnison	Entire Fork	16
Soap Creek	Gunnison	Entire Fork	24
Spring Creek	Montrose, Ouray	Entire Fork	16
Taylor River	Gunnison	Taylor Park Reservoir to Gunnison	30
Tomichi Creek	Gunnison, Saguache	Above Sargents to Gunnison River	40
Uncompahgre River	Ouray, Montrose, Delta	Entire River	72

Source: Western U.S. Water Plan Streams and Stream Systems, Working Document, November 1972.

## APPENDIX D

### Rivers With Similar Recreation Values

The following discussion provides comparative information on recreational opportunities offered by rivers within a 150-mile (240-km) radius of the Gunnison River. Emphasis is on whitewater boating, one of the recreational uses of the study corridor. Basic comparative parameters include: (a) length of river segment, (b) duration of float trip, (c) duration of season, (d) recreational use, (e) difficulty, and (f) scenic, archeological, and other features.

#### UTAH RIVERS

##### San Juan River, Bluff to Mexican Hat

This 30-mile (48-km) reach is considered easy to float by most boatmen, and the trip is usually made in 2 days. There are several intermediate rapids on this reach, but the San Juan's unique "sand waves" provide a high level of recreational enjoyment. Running as high as 4 feet (1.2 m), these waves create a roller coaster-like ride, while offering minimal danger. The San Juan also ranks high in geologic and archeologic interest. After meandering in a gentle valley for a few miles, the river drops into a gorge which reaches a maximum depth of 800 feet (244 m). Numerous pre-Columbian Indian (Anasazi) ruins may be seen en route.

Commercial operators have run the San Juan since the 1930's. The river now supports heavy recreational use--approximately 2,800 visitor days in 1975, with a season that runs from May to September, inclusively. The San Juan is under a permit system initiated by the Bureau of Land Management in 1973.

### Colorado River, Ruby and Horsethief Canyons

This 26-mile (42-km) stretch immediately above Westwater Canyon is currently being studied for inclusion in the National Wild and Scenic Rivers System. It is often run commercially to make the Westwater run below a 2- or 3-day trip; no regulations on use have been established. One-day jetboat trips are offered down to Black Rocks, the only Class I rapid, as explained on the accompanying table, and the most popular campsite. The canyon, two-thirds of which is paralleled by the tracks of the DRG&W railroad, is cut into 400 feet (122 m) of Entrada Sandstone, Kayenta Formation, Wingate Sandstone, Chinle Formation, and several feet of black Precambrian gneiss. Side canyons offer fine hiking. The run has the potential for excellent open canoeing and is frequently run by duck and goose hunters in the fall. Commercial outfitters charge about \$40 per day per person for floating this section of the river.

### Colorado River, Westwater Canyon

Also being studied for possible inclusion in the national system, Westwater Canyon was seldom run until the late 1960's, but it is now one of the most popular trips in the region; visitor days in 1975 totaled 7,677. The run is 17.5 miles (28 km) long and is normally made in one or two days, with a put-in point at Westwater Ranger Station and the take-out point at Rose Ranch. The commercial operation is substantial, as is private use. In addition, various Colorado public school systems are running the river for student seminars. Permits and reservations are required.

Attractions in Westwater Canyon are about evenly divided between scenery, history, geology, and river-running. The canyon is often considered a miniature Grand Canyon, with similar geology on a

lesser scale; it contains upper layers of the red Kayenta Formation and Wingate Sandstone that give way to about 200 feet (61 m) of basement rock, mostly dark gneiss and schist. The heavy volume and high velocity of the Colorado have bored deep potholes and flutings in the rock.

Difficulty depends greatly on flow. Below 7,000 cfs ( $198 \text{ m}^3/\text{s}$ ) it is intermediate; above 13,000 cfs ( $368 \text{ m}^3/\text{s}$ ) Westwater Canyon is for experts only. This canyon can be run from late March through November, but it is run best from May through September.

#### Colorado River, Cisco Pump to Moab

This is a lazy run of 46 miles (74 km) in length, with only a few minor rapids; at high water, these produce large and simple tail waves. Most float parties make the run in two or three days. Permits are required for commercial parties. Use data are not available.

The run is through a spacious red rock gorge cut into the Entrada, Navajo, Kayenta, Wingate, and Cutler Formations, paralleled most of the way by Utah State Highway 128. The Fisher Towers and La Sal Mountains are visible in the southeast, and Arches National Park borders the last 8 miles (13 km) of the west. This is a good family or beginner's trip.

#### Colorado River, Cataract Canyon

This large, steep, dangerous segment of the Colorado in Canyonlands National Park may be reached from two launch points. One put-in point is on the Colorado at the potash docks 20 miles

(32 km) downriver from Moab; the other is on the Green River (which joins the Colorado in the park), at the town of Green River, Utah. The length of the run from below Moab is 112 miles (180 km) and normally takes 3 to 5 days; it is 170 miles (273 km) or a 4- to 6-day trip from Green River. The take-out point is at Hite on Lake Powell.

Cataract Canyon itself is only 15 miles (24 km) long, but the two approaches take boaters through quiet, scenic canyon country before the technical rapids begin. The Green River above the confluence is a long, entrenched meander with walls of Navajo and Wingate Sandstone. Through lower Labyrinth and Stillwater Canyon there are a number of interesting geologic formations and riparian benches with tamarisk, sage, cottonwood, and deer. The 60-mile (96-km) stretch of the Colorado above the confluence is characterized by dark, red rock near the river and the white rim above. Power boat use on these reaches is extensive, particularly during the annual Memorial Day Friendship Cruise, at which time 300 to 400 boaters make a 3-day run from Green River to Moab.

Cataract Canyon, "the Graveyard of the Colorado," begins about  $2\frac{1}{2}$  miles (4 km) below the confluence of the Colorado and Green Rivers at Spanish Bottoms. Trails here lead off to some of the more choice and remote sections of Canyonlands National Park, but most boaters head into the rapids which are severe. These rapids include Mile Long, Big Drop, and Satan's Gut. Below 15,000 cfs ( $424 \text{ m}^3/\text{s}$ ) the run is intermediate; above 40,000 cfs ( $1,130 \text{ m}^3/\text{s}$ ) it is for experts only; and at 70,000 cfs ( $1,980 \text{ m}^3/\text{s}$ ) the canyon is a continuous, gigantic rapid until swallowed by Lake Powell. Between 25 and 30 miles (40 and 48 km) of tedious rowing on flat water completes the trip.

## International River Rating Scale

<u>Class</u>	<u>Definition</u>
I.	Very easy. Wide unobstructed channels, tiny regular waves not over 1 foot (0.3 m), gentle eddies. Beginners' water.
II.	Easy. Maneuvering required. Waves to perhaps 2 feet (0.6 m), courses not obvious, complicated by a few rocks and holes, fairly strong eddies.
III.	Intermediate. Waves to 3 feet (0.9 m), complicated channels, drops, holes, rocks, narrow passages. Shore reconnaissance suggested.
IV.	Expert. Steep gradient, large waves; regular over 5 feet (1.5 m), violent irregular over 3 feet (0.9 m). Many holes, rocks, and tortuous course not easily recognized from shore.
V.	Extremely difficult. Very long continuous drops with few rescue spots, very heavy hydraulics (violent waves over 5 feet/1.5m), extremely tortuous course which must be memorized from shore and followed exactly, raging eddies. Suitable only for a team of experts.
VI.	Difficulties of Grade V carried to the limits of possibility. Suitable only for a team of experts using every possible safety precaution including men stationed through the rapids with throw rings. A strong possibility of losing not merely boats (possible in Grades IV and V), but life. Very rarely attempted even by experts, with successful completions even rarer.

Cataract Canyon can be run by permit only; Park Service policies and dangerous waters limit the private use of this run, but commercial operation is substantial. Four thousand and forty-two people made the run in 1975 during a season that began in March and ended in November. Primary use is from May to September. Fees charged by commercial outfitters average about \$60 per day per person.

### Green River, Desolation and Gray Canyons

There are two launch points for this run--Ouray and Sand Wash. The normal trip covers 127 miles (204 km) to the town of Green River, but since the first 60 miles (96 km) of these are flat and notorious for their mosquitos, many people opt for cutting off 35 miles (56 km) by starting at Sand Wash. The longer trip usually runs about five days, the shorter about three.

From Ouray down, the Green moves in broad curves through alluvial shorelines with tamarisk and cottonwood; gradually the river entrenches itself in the rock of Tavaputs Plateau, and at Jack Creek, 58 miles (93 km) downstream, the rapids begin. Jack Creek is also an area slated for oil shale development. Desolation Canyon contains a deep, spacious cut of 2,700 feet (823 m) which supports one of the largest mule deer herds in Utah. The rapids, especially at high water, are large, but not difficult. Numerous side canyons, several with Anasazi pictographs, are popular for day hikes.

Recreational use of this reach of the Green is moderate; there were 23,195 passenger days in 1975, with permits required.

## COLORADO RIVERS

### Yampa River, Dinosaur National Monument

Below the sage valley of Lily Park, the Yampa River breaches an anticline; it strikes deeply into upfolded strata from the yellow Weber Sandstone, to the red fossiliferous Mississippian Limestones below. Through this canyon, with walls 800 to 2,000 feet (244 to 610 m) high, it meanders for about 50 miles (80 km) to the confluence with the Green River under the towering walls of Echo Park. This is one of the most popular runs in the west; the brief season (May and June, with an occasional year allowing boating into the beginning of July) accounted for about 35,156 boater use days in 1975. Three- to five-day trips are most popular, and most runs end, not at the confluence, but at Split Mountain boat landing, near the Dinosaur Quarry, another 30 miles (48 km) down the Green.

Rapids and scenery are major attractions of the Yampa River. Since it is one of only about three rivers left in the west where people may safely learn to run boats in large whitewater, there is substantial demand for the limited number of permits granted to private boaters. The National Park Service has allocated 65 percent of the use to commercial outfitters and 35 percent to private individuals, but half the private use was guaranteed to educational nonprofit groups. These allocations were changed in 1978 by eliminating guaranteed user days for educational-nonprofit groups. Commercial outfitters charge about \$35 to \$40 per person a day, while private river runners spend about \$10 to \$15 a day (or more).

Of the three major rapids, Warm Springs is most famous and most difficult. At high water this rapid would not be out of place in the bottom of Grand Canyon. The scenery is normally conceded to be

spectacular. When the river is encased in Weber Sandstone, as it is for about 2 days of the 3-or 4-day trip, the views are notable. Sheer walls stretch from the water up and out, overhanging the boats in long curves up to 1,200 feet (366 m) high. Deer are sometimes seen in the groves of box elder along the meander scrolls, and a rare party will startle a mountain lion. Bald eagles and vultures soar in the updrafts set up by heat on the massive walls. Side canyons lead, in some areas, to archeological sites, and in others, to distant views of the wilderness of convoluted stone through which the river flows. This river segment is also being studied for possible inclusion in the National Wild and Scenic Rivers System.

#### Lower Animas River

Beginning at Durango about 55 miles (88 km) east of the town of Dolores, this river is becoming increasingly popular for short half-day or full-day family trips. Whitewater rapids occur in the first mile (1.6 km) of the river below the Highway 160 bridge in Durango. Below this whitewater stretch there is quiet water with short stretches of easy rapids and rocks. About 5 miles (8 km) below the town the river enters a dry shale canyon country with rounded canyon walls and a predominant pinyon, juniper, and oakbrush vegetative cover. There are scattered cottonwoods and willows along the banks.

In most years the river can be run by skilled boatmen from May through July. The river is also run by amateurs using a variety of craft. One aluminum row boat can be seen impaled on a rock just below Durango. There are no use statistics available for this reach of river.

## The Arkansas River, Buena Vista to Canon City

So great is the declivity of the Arkansas River that it traverses about 5 life zones in 60 or 70 miles (96 or 112 km). Starting about 10 miles (16 km) above Buena Vista is what is often thought of as the best kayaking water in the United States. This stretch, which has been the scene of several national championships, is almost never rafted and probably will not be because it is simply too rocky.

Browns Canyon, a Class III stretch with burgeoning commercial use and a long history of private use mostly by kayaks, begins below Buena Vista. This is a pocket wilderness, walled in by rounded granite and monzonite; fishing is good when the rapids permit. Only two camp spots are available, but most use is for one-day trips. The amount and cost of use is not known, but river runners estimate \$30 to \$40 a day for commercial use, and a private/commercial use ratio of about 25 percent to 75 percent, respectively. Tourists along U.S. 50, which closely parallels the run, frequently request the services of local outfitters when floating the river.

Salida to Cotopaxi is the scene of the world-famous Arkansas River race. The 26-mile (42-km) run has good fishing and is beginning to see some commercial use. Since the reach is mostly run in one day, little resource damage is apparent. Most of this run is paralleled by a road, but the road is only close to the river in the initial 8 or 10 miles (13 or 16 km) and the last 4 miles (6 km) out of about 26 miles (42 km). There are two Class III rapids, Tincup and Cottonwood.

The narrow, steep canyons of the Royal Gorge contains a number of Class IV rapids and one diversion dam. Although closed to boating, it is frequently kayaked anyway. The nearly mandatory

portage around the irrigation dam has, so far, mostly precluded commercial use, as has the difficulty of the rapids. Even expert kayakers rarely run the high water stage in this canyon. In a normal year the boating season for the Arkansas is June and July. In unusual years the river may be rafted in August. Kayaks can extend the season until March and October.

#### Colorado River and Tributaries, Glenwood Springs Area

A very popular kayaking area, extending from the power plant outlet to Grizzly Creek, is now floated every weekend from April to October. The brief canyon from Glenwood to Rifle is the center of a rafting rental operation and scene of occasional fatalities in some of the Class II-III rapids located here. Cold water and relatively large waves contribute to the hazardous nature of this segment. Unguided rafts rent for about \$25 to \$30 a day.

#### Upper Colorado, Radium to Dotsero

After an extremely dangerous descent through Gore Canyon, the Colorado River gentles for a 40- to 50- mile (64- to 80-km) stretch. The upper portion is in a redrock gorge, forested by pinyon-juniper and some spruce-fir. Toward the lower end, the canyon opens up in yellowish shales before the river is joined by the Eagle and enters the gray limestone cliffs of Glenwood Canyon.

This run has proven extraordinarily popular. Little data is available on use, but it is known that more than 500 people a day have floated the river during recent Fourth of July weekends, and it is estimated that approximately 50 commercial outfitters, most of them small operations, have proliferated on the river. The two- or

three-day run contains a number of intermediate-type rapids (Class III), so it is a popular paddle trip. Passengers under the direction of a boatman control the rafts. Substantial private rafting use is reported, and there have been complaints about crowding, sanitation, and deteriorating campsites, which seem to have driven most kayakers away from the run. At low water, the area is sometimes used for canoe instruction; kayak use is minimal. Commercial fees for the area are approximately \$30 to \$40 per day.

The season is normally from May to September, although hardy boaters sometimes begin in April and quit in October.

#### The Roaring Fork River

This river gets some raft use near Glenwood Springs and considerable kayak use higher upstream. Woody Creek Canyon near Aspen is a Class IV section. Many outfitters are located in and around Aspen; some offer kayak instruction on this river.

APPENDIX E

TABLE A-3

Water Quality Analysis  
Gunnison River Corridor

Sample Type	GUNNISON RIVER 200 yards (18.3 m) above North Fork 4/4/76	GUNNISON RIVER One Mile (1.6 km) below Smith Fork 4/4/76	GUNNISON RIVER One Mile (1.6 km) below Smith Fork 5/18/76	SMITH FORK near confluence with Gunnison River 5/18/76	SMITH FORK Colorado Highway 92 Bridge 4/4/76	GUNNISON RIVER 100 Yards (91 m) above Smith Fork 4/4/76	GUNNISON RIVER below Gunnison Tunnel 5/20/76
pH	8.4	8.3	-	-	7.8	8.1	-
Total Alkalinity	92	192	-	-	290	90	-
HCO <sub>3</sub> - ppm							
Carbonate Alkalinity	26	16	-	-	0	0	-
CO <sub>3</sub> - ppm							
Total Hardness	152	128	(125)	(1,960)	292	120	(98)
CaCO <sub>3</sub> - ppm (mg/l)							
Calcium	92	84	( 78)	( 880)	100	88	(71)
CaCO <sub>3</sub> - ppm (mg/l)							
Magnesium Mg ppm (mg/l)	15	11	( 11)	( 260)	24	8	( 7)
Conductance Mmhos	287	299	290	4,000	1,374	246	215
Chloride Cl - ppm (mg/l)	7	8	( 7)	( 106)	13	5	( 5)
Sulfate SO <sub>4</sub> ppm (mg/l)	60	58	( 48)	(1,810)	542	39	(23)
Ortho Phosphate							
PO <sub>4</sub> ppm	<.1	<.1	-	-	<.1	<.1	-
Ammonia							
NH <sub>3</sub> ppm	<.2	<.2	-	-	<.2	<.2	-
Cadmium UG/l	0	0	0	0	0	0	0
Copper UG/l	0	0	0	0	0	0	0
Chromium UG/l	0	0	0	0	0	0	0
Iron G/l (mg/l)	500	400	-	( 400)	500	500	(300)
Manganese Mn UG/l	0	0	-	0	900	0	0
Silver AG UG/l	0	0	-	0	0	0	0
Zinc Zn UG/l	0	20	-	0	30	40	0
Total Dissolved Solids MG/l	200	195	200	3,280	1,013	172	160
Suspended Solids mg/l	26	23	14	18	22	27	21
Fecal Coliform #/100 ml (mfn/100 ml)	0	2	-	-	6	0	-
Temperature (°F [°C])	-	-	55.4 (13.0)	69.8 (21.0)	-	-	44.6 (7.0)*
Turbidity Units	-	-	6.5	5.5	-	-	6.7
Total Phosphorus P mg/l	-	-	0.03	0	-	-	0.05
Fluoride mg/l	-	-	0.2	0.4	-	-	0.1
Selenium mg/l	-	-	1	0	-	-	0
Sodium mg/l	-	-	9	150	-	-	6
Arsenic mg/l	-	-	0	0	-	-	0
Lead mg/l	-	-	-	0	-	-	0
Total Alpha Radioactivity pc/l	-	-	15 ± 7	82 ± 59	-	-	IFB
Total Beta Radioactivity pc/l	-	-	IFB	68 ± 55	-	-	IFB
Radium 226 pc/l	-	-	-	-	-	-	-

\* Taken 7/19/76.

SOURCE: Colorado Water Quality Control Division, Department of Health.

Abbreviations:

Mmhos - Milli-mhos	ppm - Parts per Million
mg/l - Milligrams/liter	UG/l - Micrograms/liter
pc/l - Pico curies/liter	C - Degrees Centigrade
IFB - Indistinguishable from Background	F - Degrees Fahrenheit
MPS - Most Probable Number	pH - Hydrogen Ion Concentration

## APPENDIX F

### GUNNISON RIVER CORRIDOR

#### Historic Sites Inventory

All of the following sites, except the lime kiln site, are located on Bureau of Land Management lands in the gorge. Several of these may be eligible for inclusion on the National Register of Historic Places upon further investigation.

A gypsum mine is situated on the east rim of the gorge, near Buttermilk Ridge and consists of a conveyor belt loader and other equipment. It is of no historic value other than being a representative mine in the area.

Open pit uranium mines in the area were developed during the 1950's and are representative of mining during the "uranium boom" but have little historic value.

A mine adit, situated along the Smith Fork, is of interest in that it is a horizontal 1950 uranium tunnel, but it has little historic value.

The Ute Trail is well maintained and extends for about 10 miles (16 km) from the west rim of the canyon to the east side. Since it was used by Ute Indians for transcanyon travel, it has historic value.

Howell's Village was built during the 1930's and is the only "townsite" in the lower end of the canyon. The site is in good condition and is of local historic significance in that John Howell was well known only locally.

The Ute Trail cabin was used by John Howell for the storage of supplies and is typical of the stone cabins in the area.

A lime kiln, situated on private land, is in fair condition and retains historic integrity.

A cabin, located on the banks of the Gunnison River, was built by the Duncan family in the 1930's. The cabin is in fair to poor condition.

Another cabin, located about 3/4 mile (1.2 km) downriver from the Duncan cabin, was probably a forge and blacksmith shop. This stone and wood structure originally was part of a village of four buildings.

The remains of another cabin consist of rocks piled round a shallow pit. There was a building here at one time, but it has long since disappeared.

Another site consists of a miner's cabin built of logs, with a plank roof. It is in fair to poor condition; several prospect pits are nearby.

A rock cabin situated near the Gunnison River has a log and plank roof.

Another rather large stone cabin with wood window frames and no roof may have been a homestead, possibly representing early settlement along the lower Gunnison River.

APPENDIX G

Wildlife by General Habitat Types

GUNNISON RIVER CORRIDOR

Wildlife Type	Habitat Preference <sup>1</sup>	Wildlife Type	Habitat Preference <sup>1</sup>
BIG GAME MAMMALS		GAME BIRDS	
mule deer ( <i>Odocoileus hemionus</i> )	1, 2	Great Basin Canada goose ( <i>Branta canadensis moffitti</i> )	4, 5
elk ( <i>Cervus canadensis</i> )	1, 2	black brant ( <i>Branta nigricans</i> ) Possible rare migrant	4, 5
mountain lion ( <i>Felis concolor</i> )	2, 3	white-fronted goose ( <i>Anser albifrons frontalis</i> )	4, 5
black bear ( <i>Ursus americanus</i> )		Possible rare migrant	4, 5
* bighorn sheep ( <i>Ovis canadensis</i> )	3	mallard ( <i>Anas platyrhynchos platyrhynchos</i> )	4, 5
SMALL GAME MAMMALS		Gadwall ( <i>Anas strepera</i> )	4, 5
cottontail rabbit ( <i>Sylvilagus auduboni</i> ; <i>S. nuttalli</i> )	1, 2, 3, 4	pintail ( <i>Anas acuta</i> )	4, 5
snowshoe hare ( <i>Lepus americanus</i> )		green-winged teal ( <i>Anas carolinensis</i> )	4, 5
chickaree pine squirrel ( <i>Tamiasciurus hudsonicus</i> ssp)	1, 2, 3, 4	blue-winged teal ( <i>Anas discors discors</i> )	4, 5
FURBEARERS		cinnamon teal ( <i>Anas cyanoptera peptentrion alium</i> )	4, 5
V spotted skunk ( <i>Spilogale putorius</i> )	2, 4	American widgeon ( <i>Mareca americana</i> )	4, 5
V striped skunk ( <i>Mephitis mephitis</i> )	2, 4	shoveler ( <i>Spatula clypeata</i> )	4, 5
beaver ( <i>Castor canadensis</i> )	4, 5	wood duck ( <i>Aix sponsa</i> ) Possible rare migrant	4, 5
muskkrat ( <i>Ondatra zibethicus</i> )	4, 5	redhead ( <i>Aythya americana</i> )	4, 5
ringtail ( <i>Bassariscus astutus</i> )	3, 4	snow goose ( <i>Chen hyperborea hyperborea</i> ) Possible rare migrant	4, 5
weasels ( <i>Mustela erminea</i> ; <i>M. frenata</i> )	1, 2, 3, 4	lesser scaup ( <i>Aythya affinis</i> )	4, 5
mink ( <i>Mustela vison</i> )	4, 5	ring-necked duck ( <i>Aythya collaris</i> )	4, 5
pine marten ( <i>Martes americana</i> )		canvasback ( <i>Aythya valisineria</i> )	4, 5
V American badger ( <i>Taxidea taxus</i> )	1, 2	greater scaup ( <i>Aythya marila</i> Nearctica) Possible rare migrant	4, 5
NONGAME MAMMALS		common goldeneye ( <i>Bucephala clangula americana</i> )	4, 5
V white-tailed prairie dog ( <i>Cynomys leucurus</i> )	2	Barrow's goldeneye ( <i>Bucephala islandica</i> ) Possible rare migrant	4, 5
V white-tailed jackrabbit ( <i>Lepus townsendii</i> )	1, 2	bufflehead ( <i>Bucephala albeola</i> )	4, 5
V black-tailed jackrabbit ( <i>Lepus californicus</i> )	2	ruddy duck ( <i>Oxyura jamaicensis rubida</i> )	4, 5
V yellow-bellied marmot ( <i>Marmota flaviventris</i> )	3	hooded merganser ( <i>Lophodytes cucullatus</i> )	4, 5
V Gunnison's prairie dog ( <i>Cynomys gunnisoni</i> )	2	common merganser ( <i>Mergus merganser americanus</i> )	4, 5
V rock squirrel ( <i>Spermophilus variegatus</i> )	2, 3	red-breasted merganser ( <i>Mergus serrator serrator</i> )	4, 5
golden-mantled ground squirrel ( <i>Spermophilus lateralis</i> )	2	common snipe ( <i>Capella gallinago delicata</i> )	4, 5
Northern pocket gopher ( <i>Thomomys talpoides</i> )	2	American coot ( <i>Fulica americana americana</i> )	4, 5
red squirrel ( <i>Tamiasciurus hudsonicus fremonti</i> )	2, 3	Note: The waterfowl listed above use the study area primarily as a resting area during migration with peak usage occurring during the spring and fall. There are a few resident birds that nest in the area and also a few that overwinter close to the confluence with the north fork of the Gunnison River.	
* river otter ( <i>Lutra canadensis</i> ) - included on the Colorado State endangered species list	4, 5	sage grouse ( <i>Centrocercus urophasianus urophasianus</i> )	2
white-tailed antelope squirrel ( <i>Ammospermophilus leucurus</i> )		ring-necked pheasant ( <i>Phasianus colchicus</i> )	2
masked shrew ( <i>Sorex cinereus</i> )	3, 4	chukar ( <i>Alectoris graeca</i> )	2, 3
wandering shrew ( <i>Sorex vagans</i> )	2, 3, 4	band-tailed pigeon ( <i>Columba fasciata fasciata</i> )	2, 3
water shrew ( <i>Sorex palustris</i> )	4	mourning dove ( <i>Zenaidura macroura marginella</i> )	1, 2, 4
desert shrew ( <i>Notiosorex crawfordi</i> )	2, 3	Gambel's quail ( <i>Lophortyx gambelii sanus</i> )	2
fringed myotis ( <i>Myotis lasanodes</i> )	2, 3, 4	Virginia rail	4, 5
long-legged myotis ( <i>Myotis volans</i> )	2, 3, 4	Sona rail	4, 5
silver-haired bat ( <i>Lasionycteris noctivagans</i> )	3	RAPTORS	
western pipistrelle ( <i>Pipistrelle hesperus</i> )	2, 3	turkey vulture ( <i>Cathartes aura meiridionalis</i> )	
hoary bat ( <i>Lasiurus cinereus</i> )		Common summer and rare winter resident	All
Townsend's big-eared bat ( <i>Plecotus townsendii</i> )	3	sharp-shinned hawk ( <i>Accipiter striatus velox</i> )	
Brazilian free-tailed bat ( <i>Tadarida brasiliensis</i> )	3	Uncommon summer but possible rare winter resident	2
big free-tailed bat ( <i>Tadarida macrotis</i> )	2, 3	Cooper's hawk ( <i>Accipiter cooperii</i> ) Common summer and possible rare winter resident	1, 2
Colorado chipmunk ( <i>Eutamias quadrivittatus</i> )	1, 2, 3, 4	red-tailed hawk ( <i>Buteo jamaicensis calurus</i> ) Common resident	1, 2, 4
brush mouse ( <i>Peromyscus boylii</i> )	2, 3	Swainson's hawk ( <i>Buteo swainsoni</i> ) Uncommon migrant and summer resident and possible accidental winter migrant	1
northern grasshopper mouse ( <i>Onychomys leucogaster</i> )	1, 2	rough-legged hawk ( <i>Buteo lagopus s. johannis</i> )	2
Gapper's red-backed vole ( <i>Clethrionomys gapperi</i> )	2, 4	uncommon winter resident	
heather vole ( <i>Phenacomys intermedius</i> )	2, 4	ferruginous hawk ( <i>Buteo regalis</i> ) Status uncertain	
meadow vole ( <i>Microtus pennsylvanicus</i> )	1, 2, 4	Possible rare summer resident	2
montane vole ( <i>Microtus longicaudus</i> )	1, 2	golden eagle ( <i>Aquila chrysaetos canadensis</i> )	Common resident
western jumping mouse ( <i>Zapus princeps</i> )	1, 2, 3	* bald eagle ( <i>Haliaeetus leucocephalus alascanus</i> )	Common winter resident
gray wolf ( <i>Canis lupus youngi</i> ) - extinct		Common winter resident	2, 4, 5
grizzly bear ( <i>Ursus arctos</i> ) - extinct		marsh hawk ( <i>Circus cyaneus hudsonius</i> ) Common resident	2, 5
black-footed ferret ( <i>Mustela nigripes</i> ) - unconfirmed, State and Federal endangered)	2	osprey ( <i>Pandion haliaetus carolinensis</i> ) Possible rare migrant	4
Canada lynx ( <i>Lynx canadensis</i> ) - very rare at higher elevations, State endangered		* prairie falcon ( <i>Falco mexicanus</i> ) Rare migrant, may nest in the area	2, 3, 4
least chipmunk ( <i>Eutamias minimus</i> )	2, 4	pigeon hawk ( <i>Falco columbarius</i> ) Rare winter migrant	2
V coyote ( <i>Canis latrans</i> )	All	† peregrine falcon ( <i>Falco peregrinus anatum</i> ) Very rare migrant, may nest in the area	
V red fox ( <i>Vulpes fulva</i> )	All	sparrow hawk ( <i>Falco sparverius</i> )	2, 3, 4
V kit fox ( <i>Vulpes macrotis</i> )	2, 4	screech owl ( <i>Otus asio</i> ) Possible rare resident	1, 3
V raccoon ( <i>Procyon lotor</i> )	4	great horned owl ( <i>Bubo virginianus</i> ) Common resident	1, 2, 5
V bobcat ( <i>Lynx rufus</i> )	1, 2, 3, 4	pygmy owl ( <i>Glaucidium gnoma Californicum</i> ) Uncommon resident	4
V porcupine ( <i>Erethizon dorsatum</i> )	1	burrowing owl ( <i>Speototo cucularia hypugaea</i> ) Uncommon summer and possible accidental winter resident	2
little brown myotis ( <i>Myotis lucifugus</i> )	3, 4	long-eared owl ( <i>Asio otus wilsonianus</i> ) Uncommon resident	4
long-eared myotis ( <i>Myotis evotis</i> )	2, 3	short-eared owl ( <i>Asio flammeus flammeus</i> ) Uncommon winter migrant and resident	2, 5
small-footed myotis ( <i>Myotis leibii</i> )	3, 4	barn owl ( <i>Tyto alba</i> )	1, 3
big brown bat ( <i>Eptesicus fuscus</i> )	3		
V gray fox ( <i>Urocyon cinereoargenteus</i> )	All		
desert pallid bat ( <i>Antrozous pallidus</i> )	3		
Apache pocket mouse ( <i>Perognathus amplus</i> )	2		
canyon mouse ( <i>Peromyscus crinitus</i> )	2		
western harvest mouse ( <i>Reithrodontomys megalotis</i> )	2, 4		
deer mouse ( <i>Peromyscus maniculatus</i> )	1, 2		
pinion mouse ( <i>Peromyscus truei</i> )	1, 2		
Mexican woodrat ( <i>Neotoma mexicana</i> )	3		
bushytail woodrat ( <i>Neotoma cinerea</i> )	1, 3		
Ord's kangaroo rat ( <i>Dipodomys ordi</i> )	1, 2		
Note: All of the above species, most of which are year-round residents, are common to the study area. Their relative abundance varies greatly by season and cyclic population changes.			

<sup>1</sup>Habitat types: (1) Pinyon-Juniper, (2) Brushland/Grassland, (3) Rocky Cliffs, (4) Riparian, (5) Open water/streams/muddy banks.

\*Indicates unique species. V - Varmint + - Indicates endangered species.

Source: Colorado Division of Wildlife, Denver, Colorado.

NON-GAME BIRDS BY RELATIVE ABUNDANCE

GUNNISON RIVER CORRIDOR

Species	Relative Abundance <sup>1</sup>
common loon	U
horned grebe	O
eared grebe	O
western grebe	O
white pelican	R
double-crested cormorant	R
great blue heron	O
snowy egret	O
black crowned night heron	O
American bittern	U
white-faced glossy ibis	O
whistling swan	U
greater sandhill crane	U*
snowy plover	R
killdeer	C
American golden plover	A
mountain plover	A
long-billed curlew	O
spotted sandpiper	C
solitary sandpiper	U
willet	C
greater yellowlegs	U
lesser yellowlegs	C
least sandpiper	C
dunlin	R
semipalmated sandpiper	U
western sandpiper	C
marbled godwit	U
American avocet	U
black-necked stilt	O
Wilson's phalarope	C
northern phalarope	O
ring-billed gull	U
Franklin's gull	C
Forster's tern	U
black tern	U
rock dove	C
yellow-billed cuckoo	U
black swift	R
white-winged junco	O
pigmy nuthatch	O
white-throated swift	C
black-chinned hummingbird	C
broad-tailed hummingbird	C
rufous hummingbird	C
belted kingfisher	U
common flicker	C
Lewis' woodpecker	U
yellow-bellied sapsucker	C
Williamson's sapsucker	U
hairy woodpecker	U
downy woodpecker	U
northern three-toed woodpecker	R
loggerhead shrike	U

Species	Relative Abundance <sup>1</sup>
eastern kingbird	O
Cassin's kingbird	R
ash-throated flycatcher	C
California gull	U
Say's phoebe	C
Traill's flycatcher	O
Hammonds flycatcher	C
western flycatcher	U
gray flycatcher	U
western wood peewee	C
horned lark	C
violet green swallow	C
tree swallow	C
bank swallow	O
rough-winged swallow	C
barn swallow	C
cliff swallow	C
gray jay	C
Steller's jay	C
scrub jay	C
black-billed magpie <sup>2</sup>	C
raven	C
crow	U
pinyon jay	C
Clark's nutcracker	U
black-capped chickadee	R
mountain chickadee	R
plain titmouse	U
white-breasted nuthatch	U
red-breasted nuthatch	U
brown creeper	C
dipper	C
house wren	C
Bewick's wren	C
marsh wren	R
canyon wren	U
rock wren	C
mockingbird	O
catbird	O
brown thrasher	A
sage thrasher	U
robin	C
verry	O
western bluebird	U
mountain bluebird	U
Townsend's solitaire	U
blue-gray gnatcatcher	C
golden-crowned kinglet	U
ruby-crowned kinglet	C
water pipit	U
Bohemian waxwing	U
cedar waxwing	C
northern shrike	U
starling	C

Species	Relative Abundance <sup>1</sup>
gray vireo	U
solitary vireo	C
warbling vireo	U
orange-crowned warbler	C
Virginia warbler	C
yellow warbler	C
Audobon warbler	O
Townsend's warbler	O
MacGillivray's warbler	C
yellowthroat	U
yellow-breasted chat	C
Wilson's warbler	C
painted redstart	A
house sparrow	C
bobolink	O
western meadowlark	C
yellowheaded blackbird	C
red-winged blackbird	C
Brewer's blackbird	C
northern oriole	U
brown-headed cowbird	C
western tanager	C
black-headed grosbeak	C
blue grosbeak	C
Lazuli bunting	O
evening grosbeak	U
Cassin's finch	C
house finch	C
pine grosbeak	C
gray-crowned rosy finch	C
brown-capped rosy finch	U
black rosy finch	R
pine siskin	C
American goldfinch	C
lesser goldfinch	C
red crossbill	O
green-tailed towhee	U
rufous-sided towhee	C
lark bunting	O
Savannah sparrow	U
vesper sparrow	C
lark sparrow	C
black-throated sparrow	O
sage sparrow	U
western chipping sparrow	C
slate-colored Oregon junco	C
gray-headed junco	C
tree sparrow	R
Brewer's sparrow	U
Harris sparrow	O
white-crowned sparrow	C
white-throated sparrow	O
Lincoln's sparrow	U
dark-eyed junco	U

<sup>1</sup>Relative Abundance: C - common U - uncommon  
R - rare A - accidental  
O - occasional

<sup>2</sup>Varmint

Source: Colorado Division of Wildlife, Denver, Colorado

\*Endangered in Colorado

## AMPHIBIANS AND REPTILES

### GUNNISON RIVER CORRIDOR

#### Amphibians

Arizona tiger salamander	<u>Ambystoma tigrinum nebulosum</u>
red-spotted toad	<u>Bufo punctatus</u>
Rocky Mountain toad	<u>Bufo woodhousei woodhousei</u>
western leopard frog	<u>Rana pipiens</u>

#### Reptiles

northern sagebrush lizard	<u>Sceloporus graciosus</u>
northern plateau lizard	<u>Sceloporus undulatus elongatus</u>
northern side-blotched lizard	<u>Uta stansburiana stansburiana</u>
midget faded rattlesnake	<u>Crotalus viridis concolor</u>
mountain short-horned lizard	<u>Phrynosoma douglassi ornatissimum</u>
northern whiptail lizard	<u>Cnemidophorus tigrus septentrionalis</u>
plateau whiptail lizard	<u>Cnemidophorus velox</u>
wandering garter snake	<u>Thamnophis elegans vagrans</u>
desert striped whip snake	<u>Masticophis taeniatus taeniatus</u>
Great Basin gopher snake	<u>Pituophis melanoleueus deserticola</u>
Utah milk snake	<u>Lampropeltis triangulum taylori</u>
smooth green snake	<u>Opheodrys vernalis blanchardi</u>
yellow-headed collared lizard	<u>Crotaphytus collaris</u>
northern tree lizard	<u>Urosaurus ornatus wrighti</u>
Great Plains rat snake	<u>Elaphei gutta emorvyi</u>
western smooth green snake	<u>Opheodrys vernalis blanchard</u>
Great Basin rattlesnake	<u>Crotalus viridis viridis</u>

Relative abundance comparisons are not available for the amphibians and reptiles.

Source: Colorado Division of Wildlife, Denver, Colorado

FISHES BY RELATIVE ABUNDANCE

TYPE	AREA	RELATIVE ABUNDANCE <sup>1</sup>	
		1964-66 Kinney and Vincent	1973-75 Wiltzius
Black Canyon of the Gunnison National Monument	rainbow trout ( <i>Salmo gairdneri</i> )	A	A
	German brown trout ( <i>Salmo trutta</i> )	C	C
	northern pike ( <i>Esox lucius</i> )	--	R
	white sucker ( <i>Catostomus commersoni</i> )	C	C
	longnose sucker ( <i>Catostomus catostomus</i> )	--	A
	Colorado sucker ( <i>Catostomus discobulus</i> )	A	R
	flannelmouth sucker ( <i>Catostomus latipinnis</i> )	A	R
	Colorado white (hybrid)	--	R
	flannelmouth white (hybrid)	R	R
	roundtail chub ( <i>Gila robusta</i> )	--	R
	*bonytail chub ( <i>Gila elegans</i> )	*R	--
	paiute sculpin ( <i>Cottus beldingi</i> )	--	R
speckled dace ( <i>Rhinichthys osculus</i> )	C	C	
Black Canyon of the Gunnison National Monument to North Fork	cutthroat trout ( <i>Salmo clarki</i> )		R
	rainbow trout ( <i>Salmo gairdneri</i> )		A
	German brown trout ( <i>Salmo trutta</i> )		C
	northern pike ( <i>Esox lucius</i> )		R
	white sucker ( <i>Catostomus commersoni</i> )		C
	Colorado sucker ( <i>Catostomus discobulus</i> )		A
	flannelmouth sucker ( <i>Catostomus latipinnis</i> )		A
	Colorado white (hybrid)		R
	flannelmouth white (hybrid)		R
	roundtail chub ( <i>Gila robusta</i> )		R
	fathead minnow ( <i>Pimephales promelas</i> )		C
	mottled sculpin ( <i>Cottus bairdi</i> )		**C
carp ( <i>Cyprinus carpii</i> )		***C	
speckled dace ( <i>Rhinichthys asculus</i> )			

\*The roundtail chub was not listed in the American Fisheries Society checklist at this time, and those fishes identified as bonytails are believed to have been roundtails.

\*\*Just above North Fork

\*\*\*Below Smith Fork

<sup>1</sup>Distribution and abundance of fishes in the Gunnison River study area compiled by William J. Wiltzius, Colorado Division of Wildlife, May 28, 1976. Relative abundance: A - abundant, C - common, R - rare.

Source: Colorado Division of Wildlife, Denver, Colorado.

APPENDIX H  
GUNNISON RIVER REGION  
ENDANGERED, THREATENED, OR SENSITIVE VASCULAR PLANTS<sup>1</sup>

SPECIES	KNOWN COUNTIES <sup>2</sup>	HABITAT	SPECIES	KNOWN COUNTIES <sup>2</sup>	HABITAT
Endangered or Threatened Species			Sensitive Species (Continued)		
<i>Adoxa moschatellina</i> L.	GN, HN	Streambanks	<i>Crepis nana</i> Richardson	GN	Alpine
<i>Ambrosia jonesii</i> Woodson	ME		<i>Cryptantha bakeri</i> (Greene) Payson	DT, ME, MN	
<i>Aquilegia micrantha</i> var. <i>mancosana</i>	(All)		<i>Cryptantha breviflora</i> (Osterh.) Payson	ME	
<i>Arabis gunnisoniana</i> Rollins	GN, MN (All*)	Possibly extinct	<i>Cryptantha longiflora</i> (A. Nels.) Payson	DT, GN, ME	
<i>Arabis oxyloba</i>	(All)		<i>Cryptantha recurva</i> Couville	ME	
<i>Astragalus anteus</i> M. E. Jones	GN	Sand soil, gravel	<i>Cryptantha virgata</i> (Porter) Payson	SH, MN, SH	
<i>Astragalus detritalis</i>	(All)		<i>Delphinium alpestre</i> Rydb.	SH	
<i>Astragalus humillimus</i>	(All)		<i>Delphinium ranosum</i> Rydb. f. <i>sidal-</i>		
<i>Astragalus linifolius</i> Osterh.	ME (All*)	Possibly extinct	<i>cooides</i> Ewan	SH	
<i>Astragalus microcymbus</i> Barneby	GN (All*)		<i>Draba graminea</i> Greene	GN	
<i>Astragalus naturlensis</i>	(All)		<i>Draba incana</i> Payson	GN	
<i>Astragalus osterhoutii</i>	(All)		<i>Draba streptocarpa</i> A. Gray	SH	Alpine
<i>Astragalus schmollii</i>	(All)		<i>Draba ventosa</i> A. Gray	GN	
<i>Ascriplex plectantha</i>	(All)		<i>Elatine cristata</i> Schubar	GN	
<i>Phrya humilis</i> ssp. <i>ventrosa</i>	SH		<i>Elaccharia rostellata</i> Torr.	DT	
<i>Calypso bulbosa</i> (L.) Reichenb. f.	SH		<i>Emmelopsis nutans</i> (Eastw.) A. Nels.	DT, ME	
<i>Carex dioica</i> L. ssp. <i>gymnocarpos</i>	GN	Peat bogs	<i>Erigeron humilis</i> Gray	GN	
(Wormsk.) Hulien	ME (All*)		<i>Erigeron lanatus</i> Hook	GN	
<i>Cryptantha aerea</i> (Eastw.) Payson	ME		<i>Erigeron vagus</i> Payson	GN, MN	Alpine
<i>Cryptantha elata</i> (Eastw.) Payson	ME		<i>Eriogonum coloradense</i> Small	GN, SH	
<i>Cryptantha osterhoutii</i> (Payson) Payson	ME		<i>Eriogonum pallidum</i> Reveal	DT	
<i>Cryptantha paradoxa</i> (A. Nels.) Payson	MN	Cypsum	<i>Eriogonum aurinum</i> Reveal	ME	
<i>Cryptantha weberi</i>	(All)		<i>Eriophorum altaicum</i> Metsh var. <i>neogaeum</i>	GN	Alpine-subalpine
<i>Cryptogramma stelleri</i> (A.G. Cmelin) Franch	GN	Tundra, subalpine	<i>Raymond</i>	GN	Subalpine
			<i>Eriophorum chamissonis</i> C. A. Mey	SH	
<i>Echinocereus triglochidiatus</i> var. <i>melanocanthus</i> (Engelm.) L. Benson	ME, MN		<i>Forsselia melanocanthus</i> (Kuhn) Hall	DT, ME, MN	
<i>Echinocereus triglochidiatus</i> var. <i>triglochidiatus</i>	ME		<i>Helictotrichon montanum</i> (Scribn.) Herard	GN, SR	Alpine
<i>Echinocereus triglochidiatus</i> var. <i>inermis</i>	(All)		<i>Hymenopappus newberryi</i> (A. Gray) Johnston	MN, SH	Alpine
<i>Eriogonum sphaeroides</i>	(All)		<i>Ipomopsis raccata</i> (Rydb.) V. Grant	ME	
<i>Eriogonum peltophyllum</i>	(All)		<i>Juncus tracyi</i> Rydb.	GN, ME	Alpine
<i>Eutrema penlandii</i>	(All)		<i>Kobresia sibirica</i> Turcz.	SH	
<i>Festuca dasyclada</i>	(All)		<i>Lesquerella alpina</i> (Nutt.) S. Wats.	GN	
<i>Gaura neomexicana</i>	(All)		<i>Lewisia triphylla</i> (S. Wats.) Robinson	DT, ME, MN	
<i>Gentianopsis chamaelitis</i> (Kuntze) Gentiana	DT, GN, OR	Cliffs, rimbanks	<i>Ligularia aplectena</i> (A. Gray) W. A. Weber	DT, GN, MN, SH	Alpine
<i>Gilia pentstemonidea</i> Jones	GN, ME		<i>Lomatium concinnum</i> (Osterh.) Math.	GN, OR	
<i>Haplophragma fremontii</i> ssp. <i>monocephala</i>	(All)		<i>Lupinus crosseus</i> Payson	GN, ME	
<i>Codyera oblongifolia</i> Raf.	OR		<i>Meyanthes trifoliata</i> L.	GN, OR, SH	Very moist grounds
<i>Juncus vaseyi</i> Engelm.	(All)		<i>Monarda uniflora</i> (L.) A. Gray	(All)	
<i>Lesquerella pruinosa</i>	(All)		<i>Parthenium ligulatum</i>	(All)	
<i>Ligularia holmii</i> (Greene) W. A. (Semec) Weber	GN, MN, SH	Alpine	<i>Pedicularis knovltonii</i>	(All)	
<i>Ligularia soldanella</i> (A. Gray) (Semec) W. A. Weber	GN, OR	Alpine	<i>Pedicularis whipplei</i> (Engelm. and Bigel) Atp.	ME	
<i>Lomatium concinnum</i> (Osterh.) Math.	GN, OR		<i>Penstemon retrofractus</i> Payson	GN (All*)	
<i>Lupinus crosseus</i> Payson	GN, ME		<i>Petalostemum sagittata</i> (Pursh) A. Gray	GN, SH	Wet meadows
<i>Meyanthes trifoliata</i> L.	GN, OR, SH	Very moist grounds	<i>Phacelia formosula</i>	(All)	
<i>Monarda uniflora</i> (L.) A. Gray	(All)		<i>Phacelia submissa</i> J. T. Howell	ME (All*)	
<i>Parthenium ligulatum</i>	(All)		<i>Phlox abbreviata</i> E. B. ssp. <i>petterocentri</i>	GN	Alpine
<i>Pedicularis knovltonii</i>	(All)		(vaseyi) Love, Love, and Kapoor	GN	
<i>Pedicularis whipplei</i> (Engelm. and Bigel) Atp.	ME		<i>Polypodium hesperium</i> Maxon	GN, OR, SH	
<i>Penstemon retrofractus</i> Payson	GN (All*)		<i>Primula parryi</i> A. Gray	GN, MN, SH	
<i>Petalostemum sagittata</i> (Pursh) A. Gray	GN, SH	Wet meadows	<i>Psoralea sromatica</i> Payson	GN	
<i>Phacelia formosula</i>	(All)		<i>Ranunculus pygmaeus</i> Wahlb.	GN	
<i>Phacelia submissa</i> J. T. Howell	ME (All*)		<i>Ranunculus scitellus</i> Greene	ME	
<i>Phlox abbreviata</i> E. B. ssp. <i>petterocentri</i>	GN	Alpine	<i>Sclerocactus glaucus</i>	(All)	
(vaseyi) Love, Love, and Kapoor	GN		<i>Sclerocactus mesa-verdae</i>	(All)	
<i>Polypodium hesperium</i> Maxon	GN, OR, SH		<i>Senecio hallii</i> A. Gray var.	SH	
<i>Primula parryi</i> A. Gray	GN, MN, SH		<i>discoloratus</i> W. A. Weber	(All)	
<i>Psoralea sromatica</i> Payson	GN		<i>Senecio porteri</i>	GN, MN, MN	
<i>Ranunculus pygmaeus</i> Wahlb.	GN		<i>Stellaria irrigua</i> Runge		
<i>Ranunculus scitellus</i> Greene	ME				
<i>Sclerocactus glaucus</i>	(All)				
<i>Sclerocactus mesa-verdae</i>	(All)				
<i>Senecio hallii</i> A. Gray var.	SH				
<i>discoloratus</i> W. A. Weber	(All)				
<i>Senecio porteri</i>	GN, MN, MN				
<i>Stellaria irrigua</i> Runge					
Sensitive Species <sup>3</sup>					
<i>Adiantum capillus-veneris</i> L.	ME, MN, OR		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Adiantum pedatum</i> L.	OR		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Allionia incarnata</i> L.	ME		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Allium nevadense</i> S. Wats.	ME		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Anemone parviflora</i> Michx.	GN	Sagebrush	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Arabis erandallii</i> Robinson	GN, MN, MN	Dry hills, mesas	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Arabis densata</i> Greene var. <i>densata</i>	GN	Alpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Arabis lemmonii</i> S. Wats.	GN, MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Arabis pulchra</i> M. E. Jones	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Arnica longifolia</i> D. C. Eaton	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Artemisia michauxiana</i> Bess.	MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Asclepias cryptoceras</i> S. Wats.	DT, ME, MN	Clay- shale hills	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus asclepiadoides</i> M. E. Jones	DT, ME, MN	Clay- shale gypsum	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus brandegei</i> Porter	SH		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus cerussatus</i> Sheld	SH		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus chamaeleuce</i> A. Gray	ME		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus cottonii</i> M. E. Jones var. <i>monbensis</i> M. E. Jones	ME, MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus desperatus</i> M. E. Jones	ME		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus hallii</i> A. Gray	GN	Alpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus iodoalatus</i> Greene	DT, GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus polydemus</i> Barneby	DT, GN, ME, MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus ooptonus</i> S. Wats.	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus robbinsii</i> (Dahse) A. Gray var. <i>minor</i> (Hook) Barneby	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus secherii</i> M. E. Jones	MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Astragalus wintgenianus</i> S. Wats.	DT, ME, MN, SH		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Ascriplex graciliflora</i> M. E. Jones	ME		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Avenochloa hookeri</i> (Scribn.) Holub	GN, MN, OR, SH	Alpine, subalpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Besseyia citteriana</i> (Eastw.) Rydb.	GN, MN, OR, SH		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Bothriochloa barbinodis</i> (Lag.) Hart (Andropogon)	MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Bouteloua simplex</i> Lag.	SH		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Bryckelia longifolia</i> S. Wats	ME		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Calochortus flemingii</i> S. Wats	MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex atherodes</i> Spreng.	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex capitata</i> L. ssp. <i>arctogena</i> (H. Smith) Bocher	MN	Alpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex engelmannii</i> L. H. Bailey	GN	Alpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex geophila</i> Mick	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex limosa</i> L.	GN	Pond shores,	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex obtusata</i> Litj.	GN, GN, SH	subalpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex pelocarpa</i> F. J. Hermann	GN	Tundra	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex ptyophylla</i> Mack	ME, MN	Foothills	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex pseudocryptoides</i> Rydb.	GN	Alpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Carex stenoptila</i> F. J. Hermann	GN	Dry Creeks	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Chamaenactis alpina</i> (A. Gray) M. E. Jones var. <i>leucopsis</i> (Greene) Howell	GN	Alpine	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Chamaenactis scaposa</i> (Eastw.) Rydb.	ME, MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Chamaesepium canadense</i> (L.) (Cormos) Asch. and Graeb.	GN, ME, OR, SH		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Chenopodium chenopodioides</i> (L.) Hallen var. <i>degenianum</i> Melles	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Citrusium hesperium</i> (Eastw.) Patrak	MN	Clay-gypsum	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Citrusium perplexans</i> Rydb.	MN, MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Cleistanium acanthoides</i> Patrak	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Clematis nuttalliana</i> Greene	MN	Cypsum	<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Comarum palustre</i> L.	GN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	
<i>Corydalis racemosa</i> A. Gray ssp. <i>bradecta</i> (S. Wats.) G. Omsbey	DT, GN, MN		<i>Thalictrum flavum</i> (L.) Gussone	GN, MN, SH	

<sup>1</sup> Except as noted by an asterisk (\*), this inventory is based on the "Provisional List of Endangered, Threatened, or Sensitive Vascular Plants of Colorado," May 1976, as compiled from Dr. W. A. Weber's list, with modifications by the Endangered Plant Subcommittee of the Colorado Native Plant Society.

<sup>2</sup> County abbreviations: DT - Delta; GN - Gunnison; MN - Montrose; ME - Mesa; OR - Ouray; SH - Saguache.

<sup>3</sup> Species which are rare and/or endemic to Colorado and adjacent States and which merit further study.

\* Included on the U. S. Fish and Wildlife Service list of proposed "Endangered and Threatened Species--Plants," as published in the Federal Register, Part IV, June 16, 1976.

† Endemic to Colorado or Colorado and adjacent States.

‡ Listed as endangered on Smithsonian List.

§ Listed as threatened on Smithsonian List.

## APPENDIX I

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APPENDIX J

Official Comments on the  
March 1978 Draft Report



## State of Colorado

EXECUTIVE CHAMBERS  
136 State Capitol  
Denver  
80203

RICHARD D. LAMM  
Governor

839-2471

July 10, 1979

The Honorable Cecil D. Andrus  
Secretary of the Interior  
Department of the Interior  
18th and C Streets, N.W.  
Washington, D.C. 20240

Dear Mr. Andrus:

This communication presents my comments on the proposal described in the Gunnison Wild and Scenic River report and in its draft Environmental Impact Statement. I note that both documents result from a cooperative study in which the Colorado Department of Natural Resources was a full partner with the participating federal agencies.

In the proposal, about 26 miles of the Gunnison River, beginning at the upstream boundary of the Black Canyon of the Gunnison National Monument and extending downstream to about one mile above the mouth of the Smith Fork, would be included in the National Wild and Scenic River System as a "wild river." This has generated considerable controversy among our citizens. Some, particularly those living in the Delta area, are concerned about the impacts this action would have on water resource development. Others are concerned about the constant degradation of the natural environment.

Because of this controversy, I directed the Department of Natural Resources to re-examine the conclusions and recommendations included in the two reports. The major issue involves the intended construction of the Smith Fork Project by the City of Delta. It would supply the city's electrical needs by generating about 36 MW of hydro-electric power while damming and inundating about 11 miles of the proposed wild river. Of course, including the Gunnison River in the national rivers system would preclude construction of the Smith Fork Project. It was found that, although the project was feasible from an engineering standpoint, viable alternatives exist for supplying Delta's power needs.

This society clearly possesses the capacity to dam every river and valley in Colorado; however, the benefits of resource development must be weighed against other values important to society. We must choose to protect those

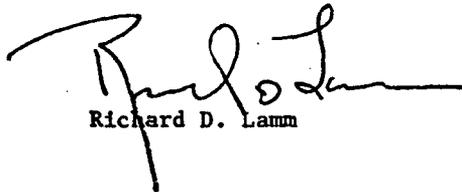
Andrus  
7/10/79

p. 2

rivers that are truly unique and contain remarkable natural values. The qualities and characteristics of the Gunnison have been carefully evaluated. Although the river is regulated at several points above the segment in question, the proposed designation is a unique and valuable stretch of river and canyon that deserves protection. As you probably know, many other river segments in the United States that have been designated or studied for wild and scenic river status are affected by upstream dams. This river qualifies in every respect under the Wild and Scenic River Act.

There is no more difficult task than to weigh competing values. This state has worked diligently to meet the electrical power and water storage needs of its citizens. In this case there are realistic alternatives to the Smith Fork Project which can provide necessary electrical power and at the same time preserve this unique stretch of river. Therefore, I fully support the proposal to include the 26-mile segment of the Gunnison as a wild river in the National Wild and Scenic Rivers System.

Sincerely,

A handwritten signature in black ink, appearing to read "Richard D. Lamm". The signature is fluid and cursive, with a large initial "R" and "L".

Richard D. Lamm



DEPARTMENT OF THE ARMY  
OFFICE OF THE UNDER SECRETARY  
WASHINGTON, D.C. 20310

Honorable Cecil D. Andrus  
Secretary of the Interior  
Washington, D. C. 20240

ES-42394

130 - No reply required. For info  
and file. cg-190-10/13

Dear Mr. Secretary:

I am responding to your recent request for comments on your Department's proposed report on the Gunnison River, Colorado, in accordance with Section 4(b) of the Wild and Scenic Rivers Act.

The draft report concludes that approximately 26 miles of the Gunnison River are eligible for inclusion in the National Wild and Scenic Rivers System as a wild river. There are no projects or anticipated water resource developments of the Department of the Army in the area which would be affected by the addition of this river segment.

We have not received the draft environmental statement to accompany the report. When the environmental statement is available, we will provide additional comments on that document.

I appreciate this opportunity to comment on the draft report.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Blumenfeld", is written over a horizontal line.

Michael Blumenfeld  
Deputy Under Secretary

ES-42266



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII  
1060 LINCOLN STREET  
DENVER, COLORADO 80295

130 for info and file.

cg-190-9/28

Ref: 8W-EE

Mr. Cecil D. Andrus  
U.S. Department of the Interior  
Office of the Secretary  
Washington, DC. 20240

Dear Mr. Andrus:

The Region VIII Environmental Protection Agency has reviewed the draft environmental impact statement proposal to designate a 26-mile segment of the Gunnison River in Colorado as a "wild" river. We wholly support this action as there are no rivers in Colorado protected under the 1968 Wild and Scenic Rivers Act. This particular stretch of river, because of its outstanding scenic attributes and water quality certainly warrants such a designation.

We appreciate the opportunity to offer our comments.

Sincerely yours,

A handwritten signature in black ink that reads "Alan Merson".

Alan Merson  
Regional Administrator



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
WASHINGTON, D.C. 20410

OFFICE OF THE ASSISTANT SECRETARY  
FOR COMMUNITY PLANNING AND DEVELOPMENT

IN REPLY REFER TO:

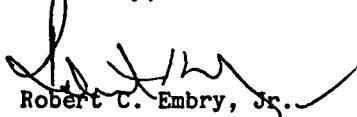
Honorable Cecil D. Andrus  
Secretary of the Interior  
Washington, D. C. 20240

Dear Mr. Secretary:

Your letter of June 30, 1978, to Secretary Patricia Roberts Harris enclosed a copy of the draft report on the Gunnison River, Colorado, for review and comment.

We have forwarded the report to our Denver Regional Office which will forward this Department's comments, if any, directly to you by the due date of September 30, 1978.

Sincerely,

  
Robert C. Embry, Jr.  
Assistant Secretary



OFFICE OF THE SECRETARY OF TRANSPORTATION  
WASHINGTON, D.C. 20590

Honorable Cecil D. Andrus  
Secretary of Interior  
Washington, D.C. 20240

Dear Mr. Secretary:

This is in response to your request for this Department's review and comment on the following reports:

- o Youghiogheny State and National Wild and Scenic River (draft report and draft environmental impact statement).
- ✓ o Gunnison River, Colorado (proposed report).
- o Lower Wisconsin River (draft report).

This office has no specific comments on these reports. We have sent copies of these reports to the DOT Secretarial Representative in the appropriate region for their consideration. They will forward their comments, if any, directly to your Department. Thank you.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Chester Davenport', is written over a faint, circular stamp or watermark.

Chester Davenport  
Assistant Secretary for Policy  
and International Affairs



It's a law we  
can live with.



# United States Department of the Interior

ADDRESS ONLY THE DIRECTOR,  
FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE SERVICE  
WASHINGTON, D.C. 20240

In Reply Refer To:  
FWS/ES/EC

OCT 4 1978

Memorandum

To: Director, National Park Service  
ACTING DEPUTY ASSOCIATE  
From: Director, Fish and Wildlife Service  
Subject: Gunnison River (Colorado) Wild and Scenic River  
Study--Comment on Proposed Report of the Department of the Interior

In response to Secretary Andrus' memorandum of June 30, we have reviewed the subject report.

We have no comments to offer except one, which was also made in our memorandum of comment, dated November 28, 1977, on the preliminary draft of this study report. Scientific names of plant and animal species should be underlined (or typed in italics). This correction of the preliminary draft has been made on such names listed in the body of the report but not in the Appendices where most of them appear.

We appreciate the opportunity for review and comment on the Gunnison River report.

*R. X. Robinson*



# United States Department of the Interior

BUREAU OF INDIAN AFFAIRS  
WASHINGTON, D.C. 20245

IN REPLY REFER TO:  
Trust Services  
Wildlife & Parks  
459

## Memorandum

To: Director, National Park Service  
Attention: Robert L. Eastman

From: Director, Office of Trust Responsibilities

Subject: Draft - The Gunnison River, Colorado  
A Potential Addition to the National Wild and  
Scenic Rivers System

This is in reply to the Secretary's June 30 letter File: L58(410) to the Administrator, Environmental Protection Agency, requesting comments on the subject document.

Following our cursory review of the draft report, we are of the opinion that our trust responsibilities will not be involved. Thank you for providing us with the opportunity to review the report.

*Samuel Q. Jordan*





# United States Department of the Interior

BUREAU OF RECLAMATION  
WASHINGTON, D.C. 20240

IN REPLY  
REFER TO: 727  
121.

SEP 29 1978

## Memorandum

To: Director, National Park Service

From: ~~Acting Assistant~~  
Commissioner of Reclamation

Subject: Proposed Report on the Gunnison River, Colorado

We have reviewed the subject document and offer the following comments for your consideration.

References are made in the report to the Gunnison Basin, regional area, and region. These areas should be defined; for example, it is confusing when the Colorado squawfish is mentioned as an inhabitant of the region. Recent studies have failed to locate this species in the Gunnison drainage although in the early 1970's this species was recorded in the lower Gunnison River near Whitewater, Colorado.

In discussing recreational resources, it is indicated that most of the reservoirs in the region support limited recreation use. Reservoirs such as Blue Mesa and Taylor Park together support over one million recreation days annually.

Page II - 19, 1st paragraph: The Taylor River is listed as a free flowing river. As the flows of the Taylor River are regulated by Taylor Park Reservoir, we question the listing of the river as free flowing.

Page III - 26, 6th paragraph: Minimum flows below the Gunnison Tunnel will be 200 second-feet, but average flows will be higher. The 144,800 acre-feet of flow, based on a constant 200 second-feet, is therefore incorrect. We suggest deletion of the annual reference.

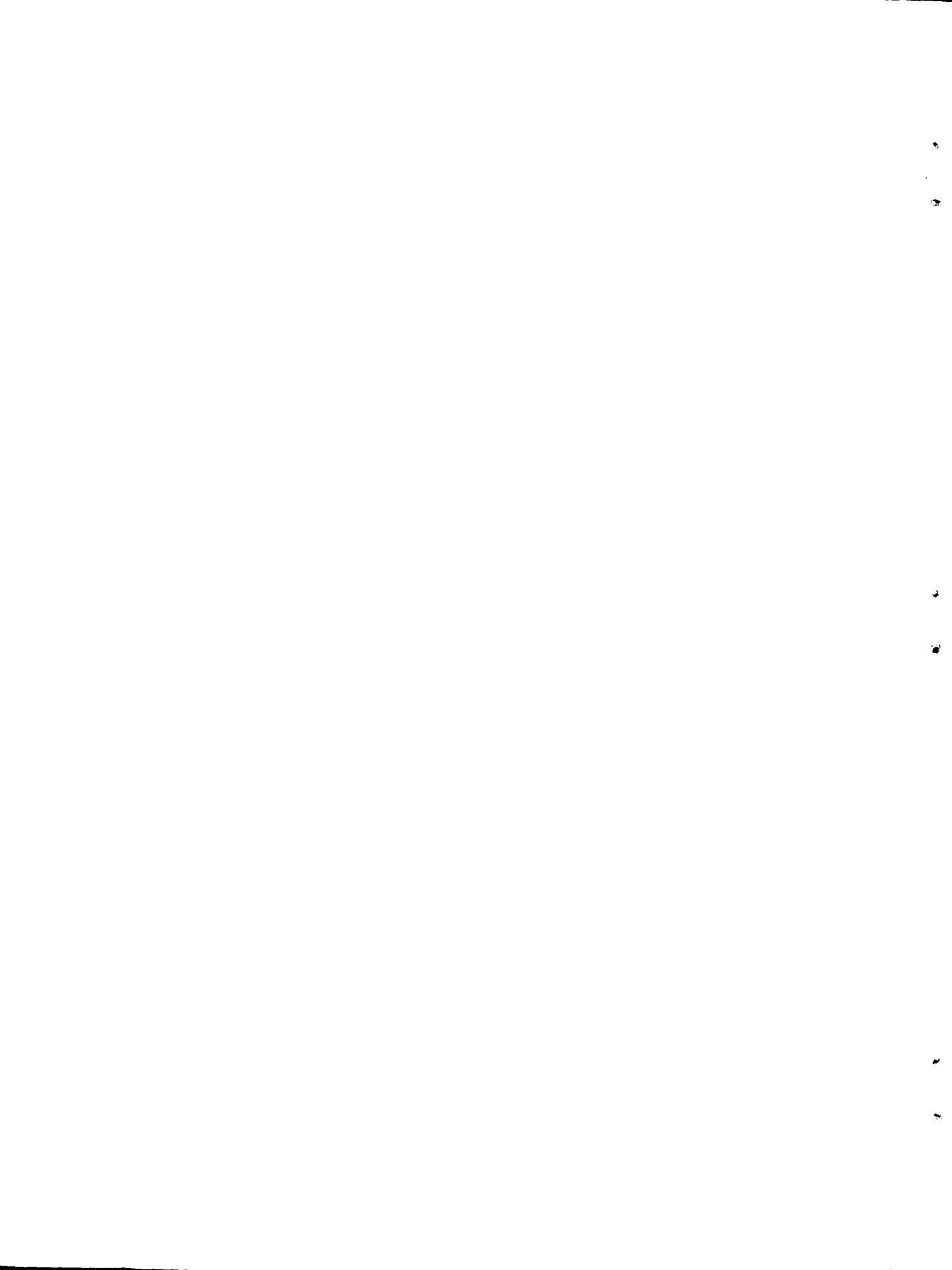
Page III - 26: Under potential water resource projects, the Bureau of Reclamation's Fruitland Mesa Project should be addressed. This authorized project does not impound the Gunnison River, but it does irrigate lands in Montrose and Delta Counties east of the Gunnison River. Return flows would enter the river in the study area by way of Smith Fork and Crystal Creek (Red Canyon). The Fruitland Mesa Final Environmental Statement contains a description of these return flows (FES 77-10, C-12).

Page III - 33, 5th paragraph: Evidence supporting the statement that lowered water temperatures have driven the Colorado squawfish and Humpback sucker from their historical habitat in the Gunnison River should be referenced or stated.

Page V - 3, Table 5-1: Under Plan A, there was no evidence presented in the report that indicates a loss of endangered and threatened plants and animals unless the "State listed" species are included. Also, it is not clear why a dam in the Upper Gorge would require realignment of Colorado Highway 92. Under Plan C, the above comment concerning endangered species is appropriate here. The word "rare" should be changed to "threatened".

We have no objection to the addition of the study reach of the Gunnison River being added to the National Wild and Scenic Rivers System.

J. D. Ellinger



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, and 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.

Publication services were provided by the graphics staff of the Denver Service Center. NPS 1479

