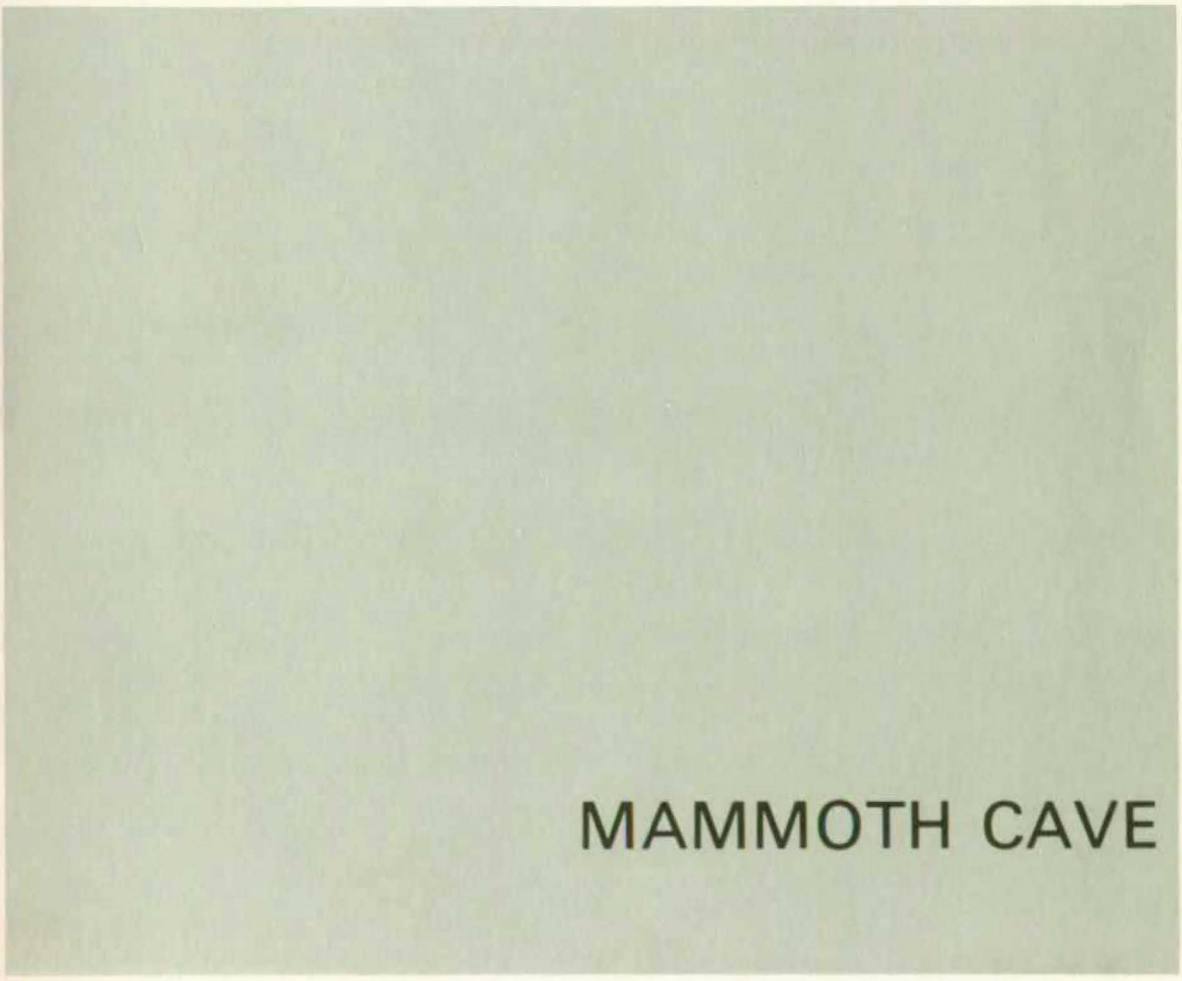
3023

final environmental statement

FES 76-27

NATIONAL PARK SERVICE
DENVER SERVICE CENTER
BRANCH OF MICROGRAPHICS
LIBRARY COPY





MAMMOTH CAVE

NATIONAL PARK / KENTUCKY

Department of the Interior

Final

Environmental Statement

FES 76-27

Mammoth Cave National Park Master Plan and Wilderness Suitability Study Kentucky

Prepared by

Denver Service Center

National Park Service

Department of the Interior

Raymond L. Freeman

Acting Director, National Park Service

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS vii

SYNOPSIS x

SUMMARY xvi

I. DESCRIPTION OF THE PROPOSAL 1
- A. Mammoth Cave Plateau 2
  - 1. Expand Cave Trips 5
    - a. Present Condition 5
    - b. Ultimate Action 6
    - c. Interim Action 9
  - 2. Relocate Staging Area to Peripheral Site 10
    - a. Present Condition 10
    - b. Ultimate Action 10
    - c. Interim Action 12
  - 3. Extend Transit System 12
    - a. Present Condition 12
    - b. Ultimate Action 13
    - c. Interim Action 13
  - 4. Retain Existing Facilities Without Expansion 14
    - a. Present Condition 14
    - b. Ultimate Action 19
    - c. Interim Action 19
  - 5. Utilize New Source of Domestic Water 20
    - a. Present Condition 20
    - b. Ultimate Action 20
    - c. Interim Action 21
- B. River Valleys 22
  - 1. Provide Additional Sites for Picnicking and Primitive Camping 25
    - a. Present Condition 25
    - b. Ultimate Action 26
    - c. Interim Action 27
- C. Hilly Country 28
  - 1. Build Bridge and Improve Houchins Ferry Road 28
    - a. Present Condition 28
    - b. Ultimate Action 29
    - c. Interim Action 30

2. Establish Trail System 30
a. Present Condition 30
b. Ultimate Action 31
c. Interim Action 32
3. Develop Primitive Campsites 32
a. Present Condition 32
b. Ultimate Action 32
c. Interim Action 32
D. Land and Cave Passage Classifications 33
1. Land Classification 33
a. Present Condition 33
b. Ultimate Action 34
c. Interim Action 40
2. Cave Passage Classification 40
a. Present Condition 40
b. Ultimate Action 41
c. Interim Action 41
3. Wilderness Study 43
a. Background Data 43
b. Field Study 44
c. Conclusions 51
E. Interrelationship With Other Projects 53

II. DESCRIPTION OF THE ENVIRONMENT 56
The Region 56
The Park 69
A. Mammoth Cave Plateau 69
1. Natural Resources 69
2. Cultural Resources 75
3. Recreational Resources 80
4. Great Onyx Civilian Conservation Center 92
B. River Valleys 94
1. Natural Resources 94
2. Cultural Resources 97
3. Recreational Resources 99
C. Hilly Country 101
1. Natural Resources 101
2. Cultural Resources 104
3. Recreational Resources 105
D. Probable Future Environment Without the Proposal 106

III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION 107
A. Mammoth Cave Plateau 107
1. Expand Cave Trips 107
2. Relocate Staging Area to Peripheral Site 110
3. Extend Transit System 115
4. Retain Existing Facilities Without Expansion 116
5. Utilize New Source of Domestic Water 117
B. River Valleys 117
1. Provide Additional Sites for Picnicking and Primitive Camping 117
C. Hilly Country 119
1. Build Bridge and Improve Houchins Ferry Road 119
2. Establish Trail System 120
3. Develop Primitive Campsites 120
D. Land and Cave Passage Classifications 121
1. Land Classification 121
2. Cave Passage Classification 122
3. No Wilderness 122
E. Summary of Cumulative Environmental Impacts of the Major Proposals of Significant Resources 123

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION 132
A. Mammoth Cave Plateau 132
1. Expand Cave Trips 132
2. Relocate Staging Area to Peripheral Site 133
3. Extend Transit System 135
4. Retain Existing Facilities Without Expansion 137
5. Utilize New Source of Domestic Water 138
B. River Valleys 138
1. Provide Additional Sites for Picnicking and Primitive Camping 138
C. Hilly Country 140
1. Build Bridge and Improve Houchins Ferry Road 140
2. Establish Trail System 142
3. Develop Primitive Campsites 143
D. Land and Cave Passage Classification 143
1. Land Classification 143
2. Cave Passage Classification 143
3. No Wilderness 144
E. Summary of Measures to Mitigate Adverse Effects of the Plan 144

V. ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED 150
A. Mammoth Cave Plateau 150
1. Expand Cave Trips 150
2. Relocate Staging Area to Peripheral Site 150
3. Extend Transit System 152
4. Retain Existing Facilities Without Expansion 152
5. Utilize New Source of Domestic Water 152
B. River Valleys 152
1. Provide Additional Sites for Picnicking and Primitive Camping 152
C. Hilly Country 153
1. Build Bridge and Improve Houchins Ferry Road 153
2. Establish Trail System 154
3. Develop Primitive Campsites 155
D. Land and Cave Passage Classification 155
1. Land Classification 155
2. No Wilderness 155

VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY 156
A. Mammoth Cave Plateau 156
1. Expand Cave Trips 156
2. Relocate Staging Area to Peripheral Site 157
3. Extend Transit System 157
4. Retain Existing Facilities Without Expansion 158
5. Utilize New Source of Domestic Water 158
B. River Valleys 159
1. Provide Additional Sites for Picnicking and Primitive Camping 159
C. Hilly Country 159
1. Build Bridge and Improve Houchins Ferry Road 159
2. Establish Trail System 159
3. Develop Primitive Campsites 160
D. Land and Cave Passage Classification 160
1. Land Classification 160
2. No Wilderness 160
E. Trade-Offs 160

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED 163
A. Mammoth Cave Plateau 163
1. Expand Cave Trips 163
2. Relocate Staging Area to Peripheral Site 163
3. Extend Transit System 163
4. Retain Existing Facilities Without Expansion 164
5. Utilize New Source of Domestic Water 164
B. River Valleys 164
1. Provide Additional Sites for Picnicking and Primitive Camping 164
C. Hilly Country 164
1. Build Bridge and Improve Houchins Ferry Road 164
2. Establish Trail System 165
3. Develop Primitive Campsites 165
D. Land and Cave Passage Classification 166
1. Land Classification 166
2. No Wilderness 166

VIII. ALTERNATIVES TO THE PROPOSED ACTION 167
A. Mammoth Cave Plateau 167
1. Expand Cave Trips 168
2. Relocate Staging Area to Peripheral Site 168
3. Extend Transit System 174
4. Retain Existing Facilities Without Expansion 175
5. Utilize New Source of Domestic Water 176
B. River Valleys 178
1. Provide Additional Sites for Picnicking and Primitive Camping 178
C. Hilly Country 178
1. Build Bridge and Improve Houchins Ferry Road 178
2. Establish Trail System 180
3. Develop Primitive Campsites 181
D. Land and Cave Passage Classification 181
1. Land Classification 181
2. Cave Passage Classification 181
3. No Wilderness 185

IX. CONSULTATION AND COORDINATION WITH OTHERS 202
A. Consultation and Coordination in the Development of the Proposal and in the Preparation of the Draft Environmental Statement 202
B. Coordination in the Review of the Draft Environmental Statement 204

BIBLIOGRAPHY 223

APPENDIX 228

LIST OF ILLUSTRATIONS

Title	Page
Overflow parking occurred at Historic Entrance almost daily from mid-June to Labor Day 1970. This condition has worsened since.	ix
Visitors queued up waiting to buy tickets for cave trips and bus transportation on Easter Sunday 1971. Queue lines form daily when cave visits exceed 4000.	ix
Location Map	xv
A Development Plan	xvii
Zones for Management and Use	3
Historic Entrance Area	15
Government and Concession "Housekeeping" Area	17
Great Onyx Civilian Conservation Center	18
Proposed Domestic Water Supply System	23
Land Classification Plan	35
Wilderness Study (Roadless Areas)	47
Travel Influence Area	57
The Vicinity	59
Visitor Service Area	61
Water Flow Diagram	71
Grassed areas adjacent to the visitor center and the "Hercules" exhibit are used regularly for overflow parking	86

Ruts in the sod adjacent to the visitor center at Historic Entrance caused by overflow parking when the ground is wet 86

Cedar karren in Woolsey Valley on the Mammoth Cave Plateau 103

Flood debris deposited at upstream end of island in the Green River 103

Peripheral Site 111

Forested bluffs along a slackwater segment of the Green River 139

Antiquated Houchins Ferry 139

Wilderness Plan for Mammoth Cave National Park (Plate 1) 187

Underground Wilderness Plan for Mammoth Cave National Park (Plate 2) 188

Surface and Underground Wilderness Plan for Mammoth Cave National Park (Plate 3) 195

Surface and Underground Wilderness Plan for Mammoth Cave National Park (Plate 4) 200



Overflow parking occurred at Historic Entrance almost daily from mid-June to Labor Day 1970. This condition has worsened since.



Visitors queued up waiting to buy tickets for cave trips and bus transportation on Easter Sunday 1971. Queue lines form daily when cave visits exceed 4000.

SYNOPSIS

This environmental impact statement provides the rationale for the major conclusions set forth in the 1975 master plan for Mammoth Cave National Park. The master plan, in turn, is based upon the three zones for management and use defined in the Southern Appalachian National Park Commission's report to the Secretary of the Interior, which culminated in the act of Congress of May 25, 1926 (44 Stat. 635) authorizing establishment of Mammoth Cave National Park:

- Mammoth Cave Plateau, beneath which the major cavern systems are situated
- The beautiful valleys of the Green and Nolin Rivers
- Hilly Country, an area of rugged topography clothed with a deciduous hardwood forest

The area containing these features, according to the commission's report, offered "exceptional opportunity for developing a great national recreational park of outstanding service in the very heart of our nation's densest population." Congress stipulated that the area would be administered, protected, and developed as a national park under the direction of the Secretary of the Interior and the National Park Service subject to the provisions of the act of August 25, 1916, entitled "An Act to establish a National Park Service, and for other purposes," as amended.

Following cession of jurisdiction over park lands by the Commonwealth of Kentucky and acquisition of sufficient lands in fee simple, the park was established formally on July 1, 1941. Since then scientific exploration has disclosed that the park contains outstanding underground and surface features, including the longest limestone cave system in the world, cave formations noteworthy for their proportions and diversity, a large population of cave animals, some of which are found nowhere else, a highly developed karst topography, and rare vegetative communities.

Yet, Mammoth Cave has enjoyed the reputation for generations and is today the "foremost tourist attraction" in Kentucky. Situated in south-central Kentucky, the park is equidistant (about 90 miles) from Louisville to the north and from Nashville, Tennessee, to the south. These cities are connected by Interstate Highway 65 (I-65), which passes within 2.3 miles of the park entrance. Mammoth Cave is the hub of "Cave Country," a vacation region containing resorts, state parks, theme parks, museums, commercial caves, and other visitor attractions. Overnight lodgings, campgrounds, and tourist services are expanding greatly to meet the needs of vacationers and travelers alike.

Mammoth Cave National Park contains roadways, trails both on the surface and underground, auto parking lots, a campground, primitive campsites, picnic area, guided

tours, and a variety of interpretive activities provided by the National Park Service. Concessioners operate overnight lodgings, food services, curio sales, grocery store, automotive service station, a sightseeing boat cruise on the Green River, and a shuttle-bus service to cave entrances. Government guides lead the walking tours conducted in the passages of Mammoth Cave. The park is 51,354.40 acres in extent.

Of the 1.9 million park visitors in 1973, the peak year, over 675,000 entered Mammoth Cave. The vast majority of the other visitors participated in motor sightseeing mostly while traversing state route 70 (Ky-70), which crosses the south side of the park from east to west.

Through the master plan, the National Park Service seeks

- to relieve automobile and visitor congestion over Mammoth Cave
- to diversify park use
- to provide a quality experience for all visitors

This is to be done in the context of the park's invaluable natural resources, increasing travel, changing visitor needs, and the growing tourist industry developing in the region surrounding the park.

To accomplish this, the master plan contains an interrelated series of actions, to be accomplished over a period of 10 to 20 years. These are addressed in this environmental impact statement under nine headings.

Actions affecting the Mammoth Cave Plateau are:

1. Expand number and variety of cave trips.
2. Create a new staging area on the park's periphery.
3. Transport all visitors by transit from this location.
4. Retain existing facilities at Historic Entrance without expansion.
5. Cease use of spring water, which feeds the caves.

Actions affecting the River Valleys are:

6. Provide additional sites for picnicking and primitive camping.

Actions affecting the Hilly Country are:

7. Build bridge and improve Houchins Ferry Road.
8. Establish a trail system.
9. Develop primitive campsites.

The following paragraphs relate, in capsule form, the interrelationship of the first four actions listed above:

From 1960 to 1974, visits to Mammoth Cave increased at an average annual rate of 30,000. Concomitantly, the number of automobiles bringing these people increased

proportionately to the point that the parking lot overflowed regularly, creating unsightly conditions, and eroding park values. The visitor center was overcrowded. Cave trip parties were unwieldy and they were rushed through with little opportunity to observe, and even shorter time for explanation by the guides. The quality of the park experience was deteriorating. This saturation of the park's facilities and services was occurring from mid-June through Labor Day and increasingly on weekends and holidays the rest of the year.

Forecasts of travel to the park by the year 2000 are 2½ times greater than present average daily loadings in the peak season. Could Mammoth Cave accept visitation of this magnitude? Bearing in mind physical, ecological, and psychological factors, and methods of use, it was determined that from 4 to 5 times the present average daily visitation could be admitted to the cave without unacceptable deleterious effects by providing new entryways and reopening unused passages. A greater variety of cave trips would be offered and parties would be smaller; thus improving the quality of the experience.

Having concluded that the family automobile will continue to be the basic mode of transportation for the foreseeable future, a suitable location was sought for a parking area large enough to store them. Space for expansion at Historic Entrance is too limited and more people there will only add to the present congestion. Likewise, space is insufficient at each cave entrance to provide separate parking lots. Moreover, even if such was possible physically, it would be too costly in dollars and environmental damage, both to the surface and underground.

Upon due consideration, a peripheral site was selected for a staging area on Joppa Ridge along Ky-70 at a place labeled Union City on early park maps, 3/4 mile within the park from its main entrance at Chaumont. This site is best logistically and will have minimal environmental impacts. From here visitors will be carried in transit vehicles to cave entrances, sightseeing boat dock, and to other points of interest in the southeast part of the park. By closing some segments of existing roads, these transit vehicles will use them for their roadbed without competing in traffic with visitors' automobiles. Transit vehicles will lessen air and noise pollution, and result in significant savings in energy for propulsion. More cave trips of greater variety and with smaller parties will enhance the visitor's enjoyment.

In addition to storing visitors' cars, the staging area would contain a terminal building wherein space will be provided for visitor orientation/information, rest rooms, snack bar food service, ranger station, and the like, and a transit loading dock. Tickets for all cave and boat trips will be sold here.

Patrons of the overnight lodgings, food services, curio store, campground, picnic area, administrative offices, and related facilities at Historic Entrance may continue to drive

there over Ky-70 and Sloans Crossing Road. These functions will continue without expansion and the buildings housing them will remain through their economically useful life. Their disposition will be determined through application of administrative procedures under the Historic Preservation Act of 1966. The tentative objective is, however, to restore the Historic Entrance area to its c. 1800 appearance except for minimum visitor facilities such as transit roadbed and station, trails, and the like.

The master plan addresses itself, also, to the problem of water supply. Presently it is collected from springs and wells on Flint Ridge in the park. Spring water is essential to the geologic development of the caverns and supplies nutrients to the cave fauna. At periods of low flow, virtually all the water is withdrawn from the springs for park use. The National Park Service will correct the problem by tapping Green River, treating the water, and distributing it within the park.

The objective of diversifying park use is met in the master plan by:

- Providing for a greater variety of cave trips
- Encouraging sightseeing on the Green and Nolin Rivers and camping at selected locations
- Making the Hilly Country more accessible through
- Building a bridge across Green River at Houchins Ferry and upgrading the road, and by
- Establishing a new trail system with designated primitive campsites

The impacts of these and their alternates appear in the body of the statement.

One of the first steps in the master planning process, developed by the National Park Service, is to locate and evaluate the park's natural and cultural resources. Congress, through its act of August 25, 1916, charged the Park Service with perpetuating these resources and providing for their compatible use. Sites for the foregoing developments were selected that were in harmony with the national significance of the resources affected. To this end, park lands were mapped using the government-wide classification system, which recognizes six categories of use and preservation, and a cave passage zoning system was innovated. These systems are explained in the appropriate part of this environmental statement.

As required by the Wilderness Act, the Park Service also studied the lands of Mammoth Cave National Park to determine whether or not they were suitable for designation as wilderness. Four roadless areas 5,000 acres or larger in extent were delineated. Prior to the park's establishment in 1941, its lands had been exploited for a century and a half. Evidences of these past uses are still generally apparent in the form of farmlands, wagon roads, fence lines, chimneys, foundations, gullies, and the like. Because the lands in the park have not retained their "primeval character and influence," and "the imprint of man's works" is still noticeable, none were found suitable for wilderness designation. However, some lands may revert sufficiently over a period of time to

qualify for wilderness, and these were identified in the master plan on the land classification plan drawing.

Although the Wilderness Act makes no reference to "underground wilderness," the cave passages were studied as to their suitability. Over 150 miles have been mapped and much more remains to be explored. Moreover, a great deal more is yet to be learned about the natural history of the cave system. The Park Service concludes that more study is required before any part of the undeveloped passages could be recommended for a single, restricted use. Meanwhile, the caves will be managed and protected under existing statutes.

In assessing the impacts of the master plan proposals upon the region and the park, it should be borne in mind that exploitation of Mammoth Cave began in 1809 with the mining of cave dirt and the extraction of saltpeter from it, and that surface lands have been farmed and logged for generations. Nonetheless, the 30 years that have elapsed since the park's establishment in 1941 have brought to light much knowledge about relict vegetative types, Indian occupation, and mostly the vast extent of the cave passages. In sum, it is believed that having weighed the impacts, both favorable and adverse, the changes and developments called for in the master plan are in the public interest, and the visitor will have a higher quality experience.


LOCATION MAP
MAMMOTH CAVE NATIONAL PARK
KENTUCKY
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Denver Service Center
Elizabethtown
Glasgow
Bowling Green
Cave City
Mammoth Cave
HART COUNTY
BARREN COUNTY
HARDIN COUNTY
Nolin R
Green R
Barren R
Mammoth Cave
Flint Ridge
Sand Hill
Sunnyside
Mount Victor
Bowling Green Municipal
Western Kentucky Parkway
Illinois Central
Louisville & Nashville
Pennyrile Parkway
Numerous depressions
Numerous sinkholes
5 0 5
SCALE MILES
135 | 40,003
MAR 74 | DSC

SUMMARY

( ) Draft (X) Final **Environmental Statement**

United States Department of the Interior, National Park Service, Southeast Region

1. Type of Action: **(X) Administrative** **( ) Legislative**

2. Brief Description of Actions:

A new staging area for Mammoth Cave National Park, Kentucky, is to be built for storage of visitors' cars. In an orientation facility, visitors may select the activities (such as cave trips, hikes, sightseeing boat ride) that they desire to pursue, and then board a transit vehicle to their destination. New entrances to Mammoth Cave will be built and trails extended to accommodate greatly increasing visitation. Existing concessioner and government facilities will remain without expansion. Natural flow of spring water is to be restored to the cave system on Flint Ridge by using water from Green River for domestic use. The Green River is to be bridged and a transpark road built to make the scenic hilly country more accessible to visitors. Through the techniques of land classification and cave zoning, the intensity of use and degree of preservation accorded park lands and cave passages has been defined. No lands were found suitable now to be proposed for inclusion in the National Wilderness Preservation System because of past exploitation by farmers and loggers. Some may qualify in the future when man's works become less noticeable through the "healing processes of nature." Cave passages were studied for their potential as "underground wilderness," but this was not recommended pending further exploration and study of the resources.

3. Summary of Environmental Impacts and Adverse Environmental Effects:

Retaining overnight accommodations – hotel and campground – and other visitor services in the park at present levels will encourage private enterprise to expand further and to provide additional facilities outside the park to meet public demand. Transportation of all park visitors by transit will reduce pollutants entering the cave systems and forestall the widening of park roads, which are becoming increasingly congested with traffic. Obtaining water from Green River is recommended to halt the diversion of spring water, which is essential to the geologic development of caves and sustains the life forms therein. While the staging area and transpark road require an irreversible commitment of resources, more people may use the park and enjoy its features without deleterious effect.

4. Alternatives Considered:

Continue present use patterns and "freeze" travel at present level; expand development at present site; several sites considered for peripheral staging area; various sources of domestic water; transit roadbed paralleling existing public roads; one-way motor trails vs. hiking trails; temporary bridge to replace ferries; establishing wilderness now; resource-based cave passage classification system.

5. Comments have been requested and received from the following:

(Continued on page xiv)

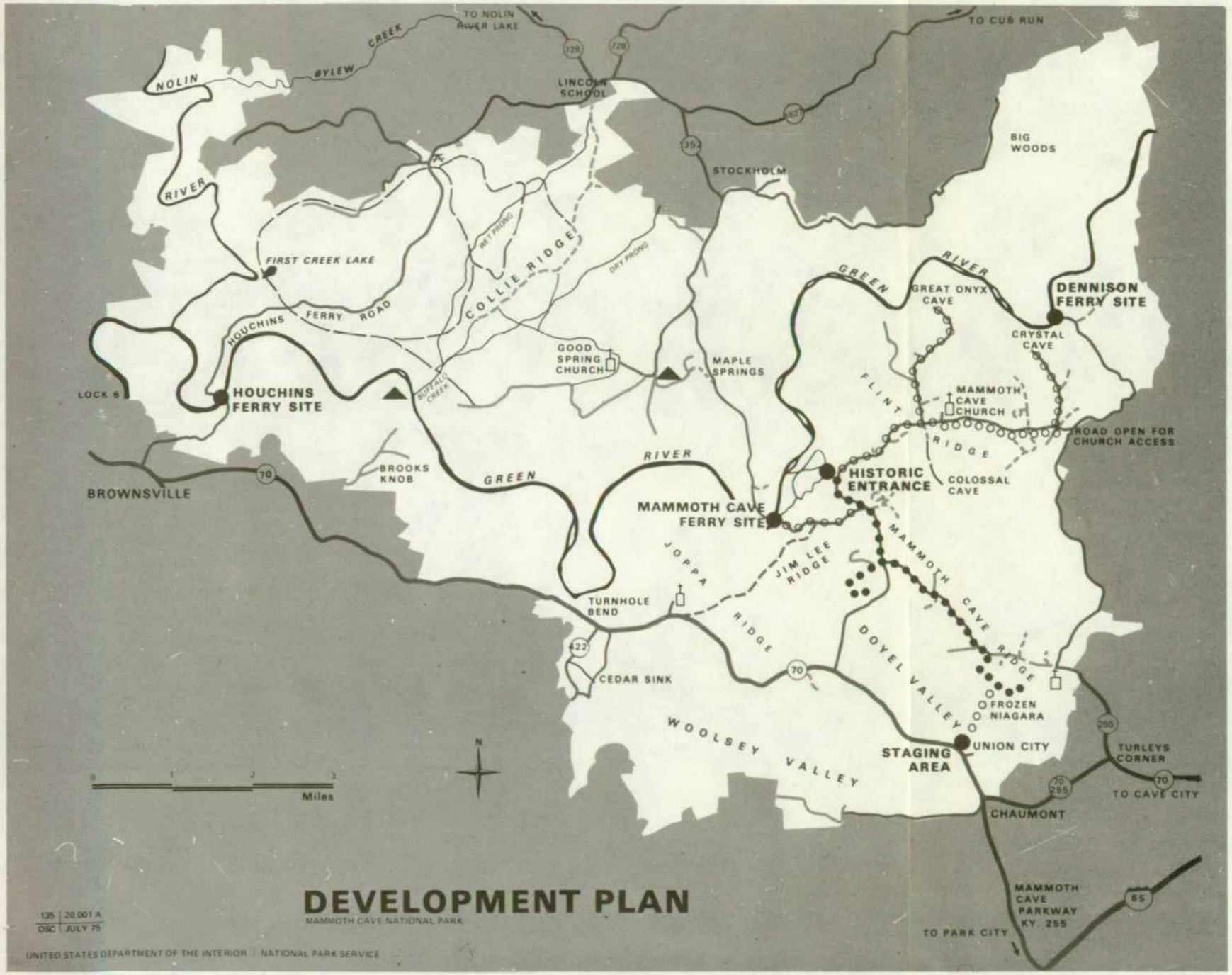
6. Date Statement made available to CEQ and the public:

Draft: April 18, 1974
Final: MAY 20 1976

5. **Comments have been requested and received from the following:** (Continued from p. xiii)

Department of the Interior: *Bureau of Outdoor Recreation, *Bureau of Sport Fisheries and Wildlife, *Bureau of Mines, *Geological Survey
Department of Agriculture: Forest Service, *Soil Conservation Service
Department of Defense: *Corps of Engineers
Department of Transportation: Federal Highway Administration
Department of Commerce: Economic Development Administration
***Environmental Protection Agency**
***Advisory Council on Historic Preservation**
Commonwealth of Kentucky: State Clearing House, *State Historic Preservation Officer, Barren River Area Development District, County Judge of Barren County, Edmonson County, and Hart County, City Council of Brownsville, Cave City, Horse Cave, and Park City
The Wilderness Society
National Parks and Conservation Association
Sierra Club
National Audubon Society
Cave Research Foundation
National Speleological Society
National Park Concessions, Inc.
Miss Green River **Boat Concession**
Mammoth Cave National Park Association

* **Comments received and attached**



SITE DEVELOPMENTS

● EXISTING ◒ PROPOSED ◑ EXPAND

HOUCHINS FERRY SITE

- ◑ PICNICKING
- ◑ BOAT LAUNCHING
- ● PRIMITIVE CAMPING
- ● FISHING
- ◑ PARKING
- ◒ INTERPRETATION
- ◒ BRIDGE

DENNISON FERRY SITE

- ◑ PRIMITIVE CAMPING
- ● BOAT LAUNCHING (hand-propelled only)
- ● FISHING

HISTORIC ENTRANCE

- ● LODGINGS, FOOD SERVICES, CURIO SALES, CAMPER'S STORE
- ● CAMPGROUND
- ● PICNIC AREA
- ◒ TRANSIT STATION
- ● TRAILS
- ◑ ADMINISTRATIVE OFFICES (NPS)

STAGING AREA

- ◒ PARKING
- ◒ ORIENTATION
- ◒ TRANSIT TERMINAL
- ◒ SNACK BAR FOOD SERVICE

MAMMOTH CAVE FERRY SITE

- ● SIGHTSEEING BOAT TRIP
- ● FISHING
- ● BOAT LAUNCHING (north bank only)
- ◑ PARKING (north bank only)
- ◒ PRIMITIVE CAMPING (north bank only)

LEGEND

	EXISTING	PROPOSED	OBLITERATE
PUBLIC ROADS	———	— —	- - - -
MANAGEMENT ROADS	———	— —	- - - -
TRANSIT SYSTEM	●●●●●	○○○○○	
TRAILS HIKING	———	— —	
PRIMITIVE CAMPING		▲	
PICNIC AREA		🚻	

ON MICROFILM

FINAL ENVIRONMENTAL STATEMENT
MASTER PLAN

For

Mammoth Cave National Park, Kentucky
United States Department of the Interior
National Park Service
Denver Service Center

I. DESCRIPTION OF THE PROPOSAL

A master plan is the conceptual planning document which, consistent with congressional and administrative policies, establishes the guidelines for the overall use, preservation, management, and development of an area in the National Park System. It identifies the purposes of the area; its resource values; its relationship to regional environs; what human needs it should meet; the objectives for its management; management category; a land classification plan; and the general development plan for its management and interpretation. In a sense, these master plans are zoning plans. They define not only the areas for developments; they define also the areas in which no developments are to be permitted.

Preparation of a preliminary draft master plan is the responsibility of an interdisciplinary team of professional planners employed by the National Park Service. Guidelines for their work are contained in the Park Service's publication titled *PLANNING STANDARDS.*

Before a master plan is adopted, the views of other government agencies, private organizations, and citizens are sought. These views and the environmental impacts of the proposals are considered carefully by the Regional Director in which the park is situated. He reconciles the various viewpoints and the revised plan is published.

Change occurs constantly, hence master plans must be dynamic documents. They are reviewed and updated periodically else they would be of little value to management officials and technicians in their day-to-day work. From the master plan, specific action plans are developed dealing with such matters as interpretation, resources management, and design of facilities.

The preliminary draft master plan for Mammoth Cave National Park was completed in December 1970, following 2 years of intensive study by a team of National Park Service professionals and citizen consultants (see list in the master plan). Because of opposition from local citizens during a series of about 25 informal presentations of the plan, the Park Service deleted from the proposal a team recommendation that the park be expanded to include more of the land recommended to the Congress in 1926 by the Southern Appalachian National Park Commission. To date, 51,354.40 acres have been

acquired for the park, mostly by purchase, of the 70,618 acres authorized by Congress.

Following public review of the preliminary draft master plan and draft environmental impact statement, the proposal that concessioner and government facilities at Historic Entrance be phased out on a given schedule was also deleted. The Park Service has also decided to obtain its domestic water from Green River rather than to buy it from a local water district. Extending a water main to the park boundary would stimulate development, in the absence of land-use controls, that could result in pollution of underground streams, force the closing of some cave passages to public tours, and destroy irreplaceable and endangered cave fauna.

This environmental statement is organized like the master plan in that the actions are related to the three zones of management and use recognized as being of national significance in the report of the Southern Appalachian National Park Commission: Mammoth Cave Plateau containing "extensive limestone caverns," the "beautiful" River Valleys, and the Hilly Country with its "rugged landscape clothed in forests" (see drawing on p. 3). Actions of the master plan affecting each of these zones are described in turn, followed by a discussion of land and cave passage classification. The master plan presents a solution to the congestion that has been occurring for a decade at Historic Entrance to Mammoth Cave and seeks to diversify park use by offering new recreational opportunities in the River Valleys and on the Hilly Country.

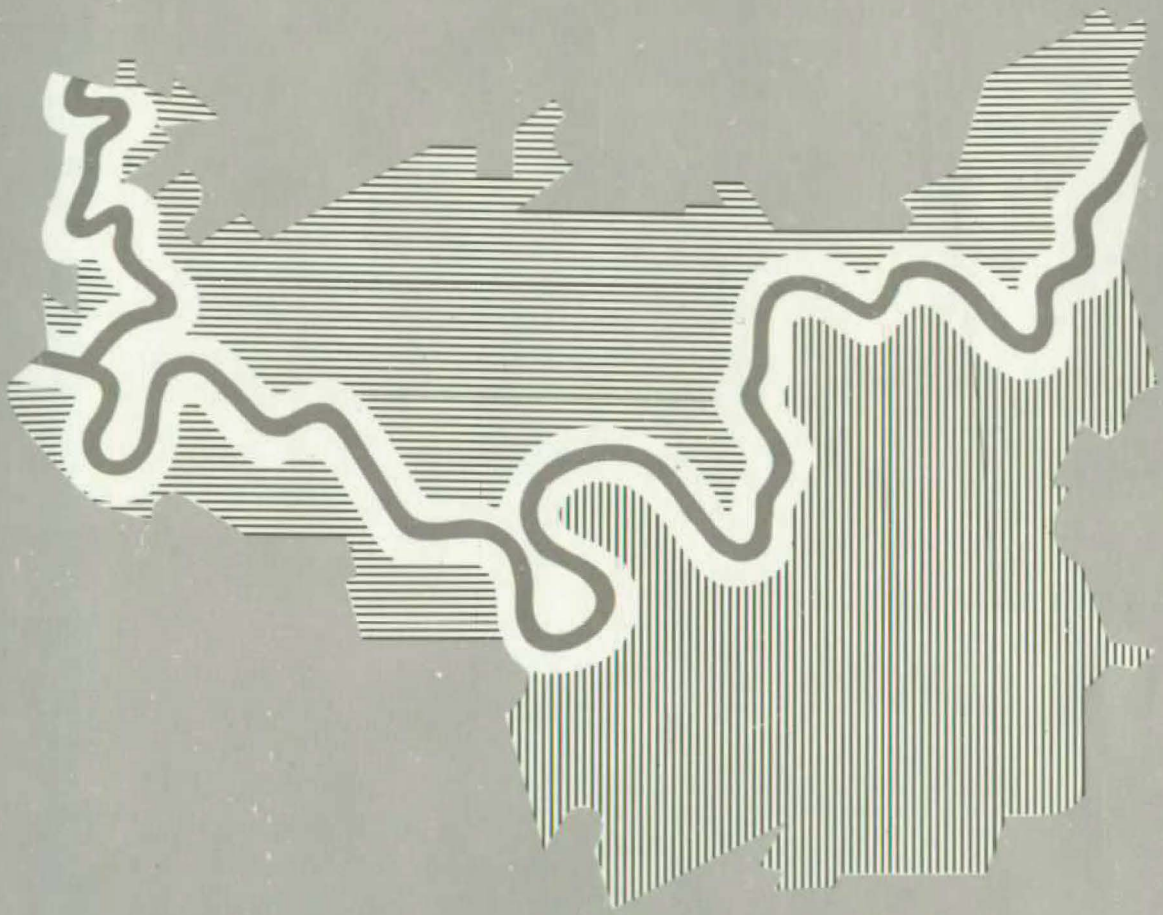
A. MAMMOTH CAVE PLATEAU

This unit comprises the entire southeast part of the park and contains about 45 percent of its acreage. Most of the land surface is in various stages of forest succession and all of it is underlain by cavernous limestones. Mammoth Cave is one of three major cave systems within the park (see II.A.1.).

Adjacent to Mammoth Cave's Historic (natural) Entrance and on the surface above its passages are concentrated virtually all the government and concessioner facilities in the park for the use of visitors and management, including roads, parking lots, visitor center, administrative offices, picnic area, campground, bus loading dock, amphitheater, trailheads, post office, lodgings, food services, curio sales, automobile service station, and the ancillary utility systems.

Some of these facilities predate the park's establishment in 1941, but most were planned in the 1950s, when there were about 200,000 cave visitors per year, and constructed in the 1960s. This was a decade of rapid growth in travel and in 1970, at the end of the decade, visitor entries to Mammoth Cave had climbed to almost 611,000. In 1973, cave travel reached the all-time high of 675,167. This is much more than three times greater than travel during the 1950s. Hence, the physical plant on the surface over the Historic Entrance is overtaxed, facilities are

ZONES FOR MANAGEMENT AND USE
MAMMOTH CAVE NATIONAL PARK



MAMMOTH CAVE PLATEAU

HILLY COUNTRY

RIVER VALLEYS

N

ON MICROFILM

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

135 | 20,026
DSC | JULY 75

deteriorating, and park resources are suffering. Both the National Park Service Visitor Use Study, conducted in August 1966, and the master plan team concluded that the quality of the visitor experience is also lessening as visitation continues to increase.

On the basis of the best information available, it was determined that the number of average daily visits to Mammoth Cave could be increased manyfold without having unacceptable deleterious effects on it. Previous studies by the National Park Service had shown that extending visiting hours would not add significant numbers of visitors. Instead, only an interrelated series of bold actions, spanning 10 to 20 years, would accommodate the increasing numbers of people expected to visit Mammoth Cave. The master plan recommends the following:

- Expand number and variety of cave trips and give visitors a higher quality experience (see I.A.1., p. 5).
- Relocate the staging area from Historic Entrance to a peripheral site where all visitors' automobiles will be stored while their occupants are in caves, hiking on trails, or sightseeing on the Green River. The transit terminal will be situated here also (see I.A.2., p. 10).
- Extend the transit system and transport all visitors to points of interest in the southeast (cavernous) part of the park. Segments of some intrapark roads may be closed to private vehicles so that the transit system may operate on its own roadbed (see I.A.3., p. 12).
- Retain existing concessioner and government facilities at Historic Entrance without expansion. When functions terminate, the area they occupy will be restored to its natural appearance to the greatest extent possible (see I.A.4., p. 14).
- Utilize a new source of domestic water (see I.A.5., p. 20).

1. **Expand Cave Trips**

   a. **Present Condition*** – During June, July, and August 1970, the operating day was 10½ hours and four tours were available, viz. Historic, Scenic, Frozen Niagara, and Lantern. The first listed was self-guiding with a capacity of 650 persons per hour or 5,525 per day; each trip required 1 to 2 hours, depending on the individual or group.

---

* The term "Present Condition" and the words "now" and "today," as used in this statement, refer to the year 1970 when the draft master plan was written, unless stated or implied otherwise in context.

offered six times a day. The Scenic was 4 hours in length with 240 persons per trip or 1,440 per day. The Frozen Niagara trip required 1 hour; capacity was 160 per trip or 960 per day. Two Lantern trips were scheduled with each requiring 3 hours. The maximum was 40 persons per trip or 80 per day. The total daily capacity of Mammoth Cave, if all tours were filled, was 8,005. It should be noted that this is twice the capacity of the visitor center and more than twice the capacity of all the paved parking spaces (see I.A.2.a.).

During July and August 1974, the operating day was extended 2 hours for a total of 12½ hours, to add a Frozen Niagara Tour at 6:30 p.m. Two Wild Cave Tours per day, each of 6 hours duration, were offered from mid-June through August in 1974. They were limited to 15 persons per trip. Thus the total daily capacity of Mammoth Cave was raised from 8,005 to 8,195 per day.

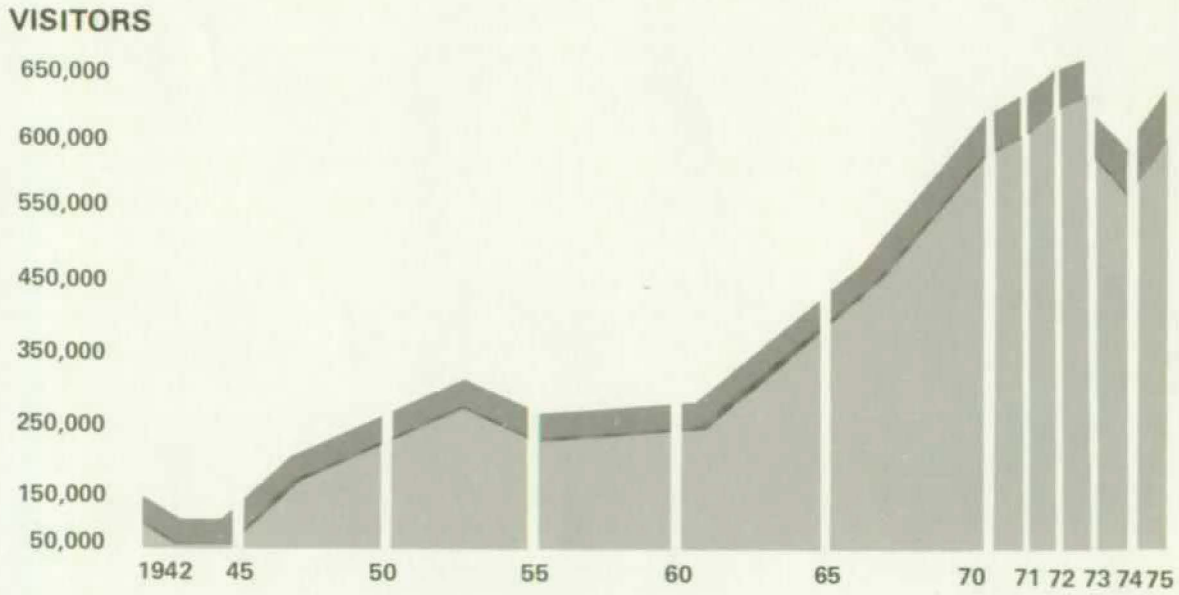
Cave trips were conducted over 6 miles of developed trail and 4 miles of undeveloped trail. The shorter trips of 1- to 2-hour duration were the most popular. Study has shown that the quality of the visitor experience diminishes greatly when there are more than 120 persons* on a guided tour. If this number was established as the peak for guided tours in lighted passages, the daily capacity of Mammoth Cave would drop from 8,005 to 7,045. This is still in excess of peak loadings (except for July 2, 1972, the all-time peak day, when there were 8,013 cave visits) and far in excess of the as-built capacity of the surface facilities, viz. parking lots (3,414) and visitor center (4,000).

Related data concerning visitor use appears in graphic form on the adjoining page of this report.

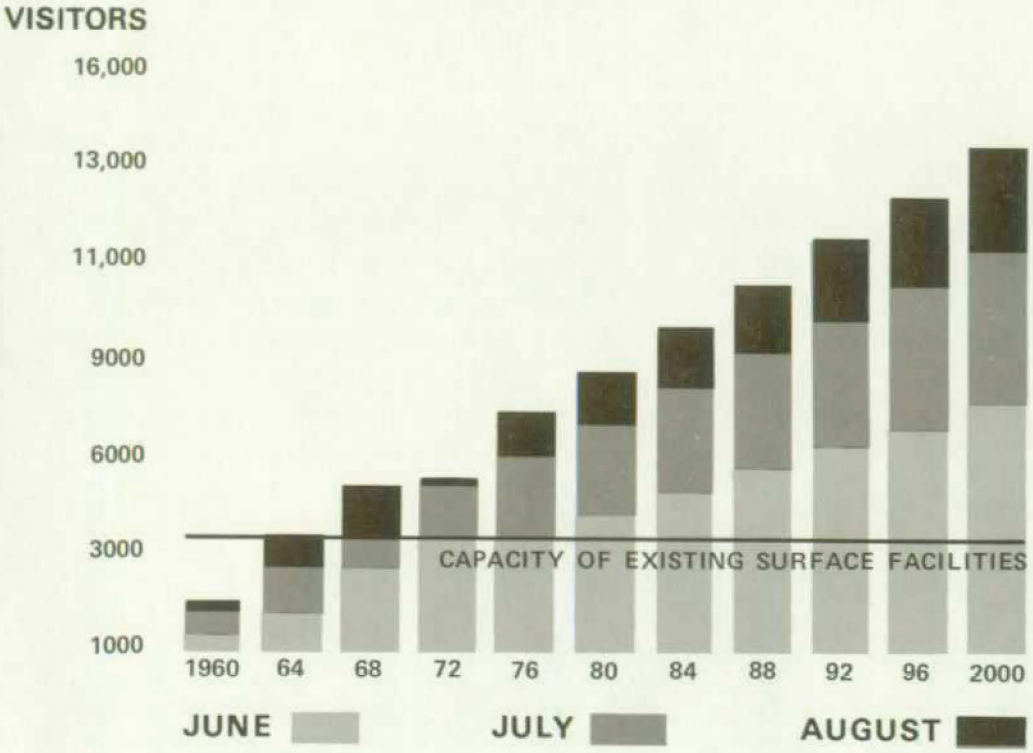
b. Ultimate Action – The conservative projection in the master plan forecasts 13,265 average daily cave visits by August 2000. It has been determined that Mammoth Cave could accept, physically, 26,000 average daily cave visits. This can be accomplished by offering several short trips on a frequent schedule after opening new artificial entries, repairing trails, and lighting passages now dark that have been used in the past. Therefore, it is relatively simple to raise the 5,130 average daily cave visits of 1970 to the 13,265 expected in August 2000.

* See report of National Park Service Visitor Use Study conducted from August 14-20, 1966, in the park's files.

ANNUAL CAVE VISITS actual count



AVERAGE DAILY CAVE VISITATION



MAMMOTH CAVE NATIONAL PARK

c. **Interim Action** – Average daily capacity of Mammoth Cave can be built up to meet the August 2000 level in two steps:

Phase I: New Entrance to Mammoth Cave was closed in 1967 because of unstable rock. By replacing this entry with a tunnel (to be constructed), the Frozen Niagara trip can become one-way and semi-self-guiding with a capacity of 500 persons per hour. The Scenic trip could then be offered seven times a day at 120 per trip (total 840) ending with the Frozen Niagara portion being self-guided. The Frozen Niagara trip would be interrupted at 1:00 p.m. and every hour thereafter for a 15-minute break to allow the Scenic trip participants to exit. With this adjustment, the Frozen Niagara tour would accommodate 3,625 daily. The Lantern trips in the Violet City sector would continue with a capacity of 80 per day, but the Historic tour capacity would drop to 5,040 per day because of the time required for the bus ride from the staging area at Union City. Once these steps are carried out, the daily capacity of Mammoth Cave would be increased to 9,585, requiring 1,676 parking spaces. Projected average daily cave visitation is expected to reach this level in August 1986.

Phase II: By lighting the passages now used for the Violet City Lantern trip and providing a pair of elevators into Star Chamber from the present campground, 120 visitors could enter through the Violet City Entrance every 15 minutes or a total of 3,960 per day. To replace the Violet City Lantern Tour, four hand-lighted trips of 25 each could visit Great Onyx Cave on Flint Ridge for a total of 100. Thus gross daily cave capacity becomes 13,565, which is 300 greater than the anticipated 13,265 average daily cave visits by August 2000. For a visitor load of this magnitude, 2,320 parking spaces would be required, thus achieving ultimate development of the parking lot at the staging area envisioned in the master plan (see I.A.2.b.).

As cave use builds up, the Historic and Frozen Niagara portals, Snowball Dining Room, and places where passages intersect, may become overloaded. This may be corrected by simple logistics through rerouting and rescheduling tours. Park Service personnel intimately acquainted with the arrangement of cave passages and tour operations tested these solutions and determined that they are practical. Future tours of 1 to 2 hours duration, to meet the public's preference, will be both guided and semi-self-guided.

When warranted, Mammoth Cave's capacity can be increased further by providing other tunnel or elevator entries and redeveloping other

passages. Additionally, formerly developed passages in the front portions of Colossal and Crystal Caves may be used for lantern trips with up to 40 persons per trip on a semi-wild-caving experience.

2. **Relocate Staging Area to a Peripheral Site**

a. **Present Condition** – The staging area at Historic Entrance was built to accommodate smaller numbers of people than the present visitor load. Capacity of the parking lot is reached when there are 3,414 visitors per day in Mammoth Cave.

From June 13 to September 7, 1970, there were more than 3,400 visitors each day except for the period between August 30 and September 5 when there were fewer. The latter period was the first week of school. On 12 days, between July 1 and September 7, cave visits exceeded 6,000, including July 4 when there were 6,501 and September 6 when there were 6,729. In contrast, from June 1 to September 1, 1974, average daily visitation was in excess of 4,200. On 12 of these days, cave visits exceeded 6,000. Maximum visitation in 1974 was 6,672 on July 6.

The parking lot overflowed almost daily each season from 1967 through 1974. Travel is continuing to increase and a reasonable forecast predicts 13,265 average daily cave visits in August 2000, compared with 5,130 in August 1970, and 5,080 in August 1974.

The visitor center at Historic Entrance is now the transit terminal. Its facilities are crowded when there are 4,000 cave visitors per day. As noted in the preceding paragraph, this was of regular occurrence during the 1970 visitor season, and this condition continued through 1974 despite a 6.6 percent drop in travel that season compared with the peak year of 1973. The drop is explained by the energy crisis and economic recession. Travel in 1974, however, was less than that in 1970, but greater than that in 1969.

b. **Ultimate Action** – The master plan calls for relocating the staging area, as quickly as possible, to the periphery of the park at a place called Union City, a road intersection before the park was established. This site is 3/4 mile inside the main park entrance at Chaumont, the name of the junction of Mammoth Cave Parkway (Ky-255) from Park City and Ky-70 from Cave City. Both roads carry two lanes of traffic. Park City and Cave City are communities on I-65. In time, traffic will require widening the segment of Ky-70 within the park (3/4 mile) from two to four lanes with a median, and providing an

interchange at the entry to the staging area to carry the volume of traffic expected well before the year 2000 visitor season.

At the staging area, there will be a tree-shaded parking lot for a maximum of 2,320 vehicles, covering about 30 acres. These vehicles will bring an average of 13,265 cave visitors to the park, as expected in 2000, two and a half times more than the visitors recorded in August 1970. It is assumed that the family automobile will continue into the foreseeable future as the basic transportation vehicle. On the north side of the parking area there will be a terminal building from which visitors will board transit vehicles for cave trips, trailheads for hikes, and the sightseeing boat trip on the Green River. The building will contain space for visitor orientation, rest rooms, ticket sales, snack-bar-type food services, craft sales and demonstrations, nursery, kennel, and a ranger station. Adjacent to the terminal will be a loading dock for transit vehicles. The transit terminal structure has not yet been designed.

Water for the staging area will be piped from the Green River, after treatment at the park's plant. Sewage will probably be piped to the existing plant along the Green River near Historic Entrance and the plant will be upgraded to handle the additional load. Detailed engineering studies have not yet been undertaken for these projects.

The following physical characteristics were considered and evaluated in selecting the Union City site for the peripheral staging area: The site is a nearly level tract of 30 to 35 acres, mostly broomsedge fields with tangles of briers and scattered thickets of hardwood and cedar trees, in various early stages of forest succession. The fields had been farmed before the park was established.

Wet weather swamps flank part of the tract and testify of the impervious Haney limestone, weathered to clay, which underlies the site. This is underlain in turn by the Big Clifty sandstone, 50 to 60 feet thick, also impervious. In the spring, water overflowing from the swamps at Union City follows natural surface channels for short distances and then drops into swallow holes at the bottom of sinks, or enters fissures and drops into the conduits dissolved in the cave-bearing limestones beneath the sandstone. Meteoric water, likewise, after seeping into the ground, moves outward to the perimeter of the ridge and enters the limestone.

About 3/4 mile northwest of Union City is the entry to Proctor Cave. During the period of private ownership, a narrow trail about 1,000 feet

long was built in the front part of the cave for public tours. The owner of the cave also operated a small "hotel" on the ridge top nearby. The tour route was in wet passages that contained some flowstone, but nothing spectacular or unusual, and the trail ended at a small dome. In 1973, at the request of the Park Service, the Cave Research Foundation undertook to explore and map the cave. This resulted in the discovery of more than 3 miles of passages that are similar to the dry portions of Mammoth Cave shown on public tours. One branch of the cave extends southeasterly and lies beneath the proposed parking lot. According to the Geological Survey, the Big Clifty sandstone overlying the cavernous limestone will support any loading proposed for it in the plan.

c. **Interim Action** – Development of the peripheral staging area at Union City will depend on funding. The aim of the Park Service is to make the staging area functional as soon as possible to relieve congestion at Historic Entrance. This will be accomplished by selling all tickets for cave tours and sightseeing boat trips at Union City. After leaving their car in the parking lot here, visitors will be bused to their destination. To begin with, the parking area could have a gravel surface, and transit terminal functions could be housed in a trailer or trailers. Meanwhile, plans and specifications can be drawn up for extending utilities to the site and for construction of the permanent structures. These would be built as funds become available.

Those persons who desire to patronize the concessioner's lodgings, food services, curio shops and store, use the park's campground or picnic area, or transact business with the park superintendent or his staff may still drive their personal vehicles to Historic Entrance.

3. **Extend Transit System**

a. **Present Condition** – There is a network of paved roads in the southeast part of the park including a 7.7-mile segment of a state highway (Ky-70) that serves transpark and intrapark traffic. There are public and management roads to park features and facilities, both paved and unpaved. All existed prior to the park's establishment.

The National Park Service is required by deed reservation to keep some of these roads "open for the usual use by the public."

Segments of some of these roads are used by visitors' cars and by buses that carry cave parties to and from various entrances. For some visitors this amounts to four trips on the same roadway resulting in unnecessary traffic congestion and bus schedule delays.

National Park Concessions, Inc., operates ten 40-passenger and two 33-passenger buses (1974) from Historic Entrance to and from other cave entrances on Mammoth Cave Ridge for which a fee of $.50 per person (except small children) is charged. About 51 percent of the cave patrons used this service in 1973. Bus schedules are delayed often because these vehicles must use, in part, the same roads as do visitors' cars. This was worst when buses were caught in a backup of cars a half mile long unable to find parking space at Historic Entrance. During 1972 and since, rangers relieve this situation by directing visitors to park their cars in unmarked spaces on the grassed areas whenever backups begin to form at the entrance to the paved parking lot.

b. Ultimate Action – When the peripheral staging area is fully operational, the transit system will occupy a roadbed of its own and transport all visitors to their destinations in the southeast part of the park. It is anticipated that the existing roadways on Mammoth Cave and Flint Ridges will be utilized wherever possible by the transit system. Doyel Valley can be crossed generally on the alignment of the old road between Union City and the New Entrance Hotel site. In each vehicle, a recorded message will be heard en route explanatory of park features seen or to be seen. At this point in time, all personal vehicles will be parked in the peripheral staging area (see 1.A.2.b.). The existing road alignments will serve as the route of the transit system, wherever possible, to preclude cutting more timber and making new clearings in the forest. Then the National Park Service will petition the court to amend the road deed so that affected roads may be closed and used by transit vehicles only. These roads are "Old 70," Mammoth Cave Ferry, Northtown, Great Onyx Cave, and Crystal Cave (see inventory on pp.81-83).

Persons desiring to attend church services or visit cemeteries may continue to do so, though the routes of access may differ somewhat from those used today.

The future transit system will cut off private-car access to the Joppa Ridge Motor Nature Trail, so this interpretive feature will be discontinued at that time. It will then be replaced by the Cedar Sink Motor Nature Trail, which will follow abandoned Ky-422. Neither trail is affected by deed reservation.

c. Interim Action – Upon completion of the first stage parking lot at the peripheral staging area, visitors will ride shuttle buses to

the visitor center at Historic Entrance 5.5 miles over existing roads. Upon arrival there, visitors will walk to the natural entrance for the Historic Tour or ride a bus to other cave entries, as at present. Roads affected by deed reservation will not be closed until the ultimate transit system is ready for operation.

4. **Retain Existing Facilities Without Expansion**

a. **Present Condition** – The following facilities are situated above cave passages and in the vicinity of the Historic Entrance to Mammoth Cave (see scaled drawing on p. 15):

(1) Government: Paved parking for 597 cars and buses; bus-loading dock; brick visitor center containing space for visitor orientation/information, rest rooms, ticket sales for cave, bus, and sightseeing boat trips; brick administrative office structure; concrete arch bridge between visitor center and hotel; roadways; network of foot trails on the Green River bluff; paved and lighted path to Historic Entrance; picnic area for about 75 parties and comfort station; 145-site campground fully equipped; and an amphitheater. Most of these were constructed as MISSION 66* projects and cost about $920,000.

(2) Concessioner: 500 beds situated in 158 rooms in a variety of structures (old hotel, 46 rooms; new hotel, 38; Sunset Point Motel, 20; lawn cottages, 10; woodland cottages, 40; huts, 4); dining room seating 190; coffee shop with 65 seats; curio and craft stores; hotel lobby and offices; auto service station; building containing grocery store, shower room, laundry room, and post office; and employee quarters. Of these, the old hotel, lawn cottages, woodland cottages, huts, and employee quarters are wood frame structures many years old, some predating establishment of the park. The newer masonry structures were built by the concessioner towards the end of the MISSION 66 period and his investment is about $500,000. The older buildings are Government-owned.

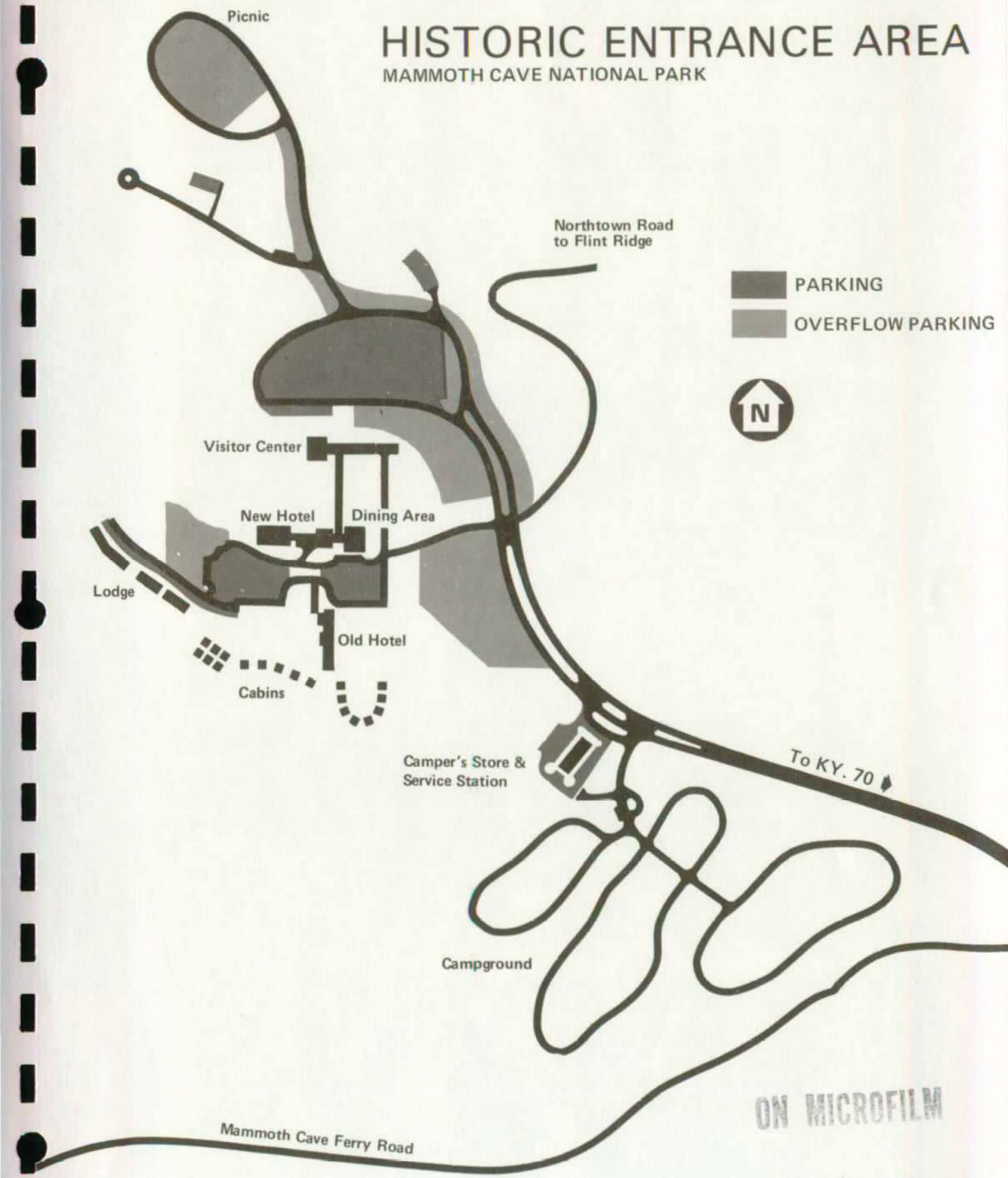
The following structures are situated in the housing and utility areas on Mammoth Cave Ridge about a mile east of Historic Entrance (see scaled drawing on p. 17):

---

* MISSION 66 was a 10-year program, inaugurated in 1956, which provided the resources to bring each National Park Service area up to a consistently high standard of preservation, staffing, and carefully controlled physical development. During the preceding war years, funds had not been available for domestic programs. Renewed interest in areas of the National Park System prompted the Park Service to meet these needs.

HISTORIC ENTRANCE AREA

MAMMOTH CAVE NATIONAL PARK



ON MICROFILM

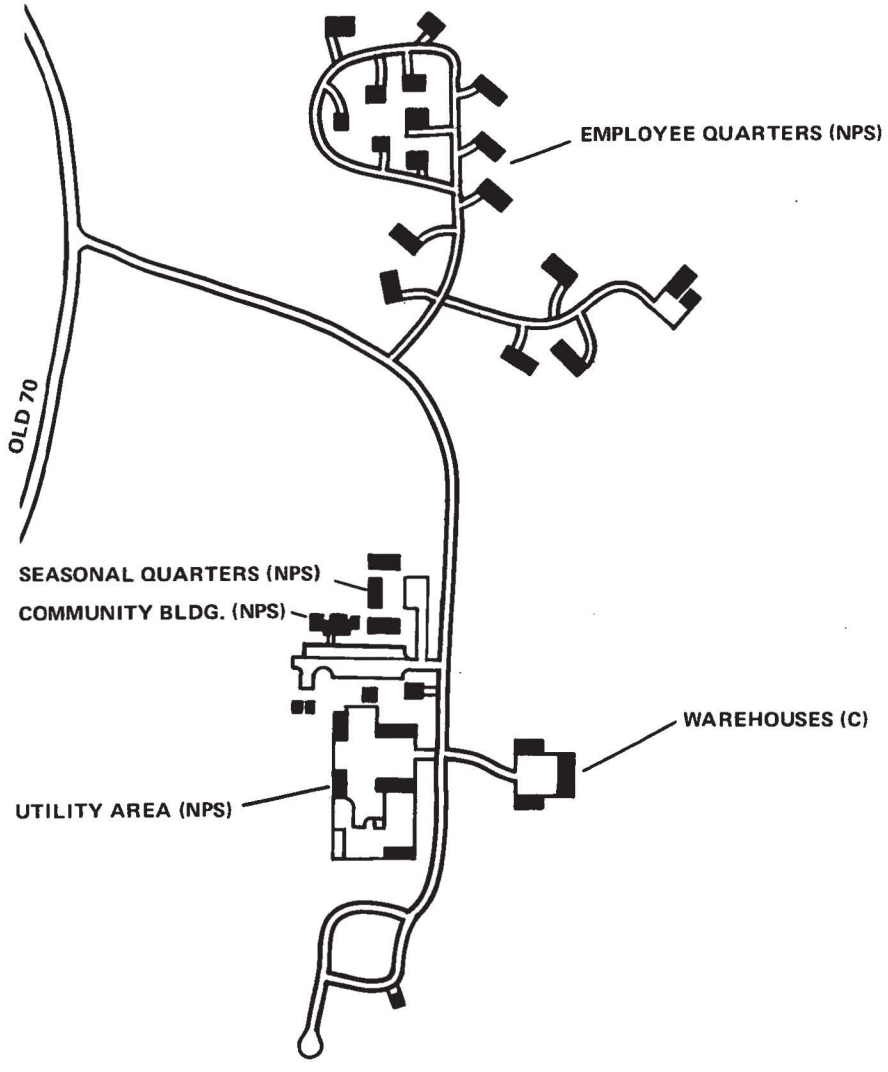
UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

135 | 20,006 A
DSC | JULY 75

GOVERNMENT & CONCESSION "HOUSEKEEPING" AREAS

MAMMOTH CAVE NATIONAL PARK

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

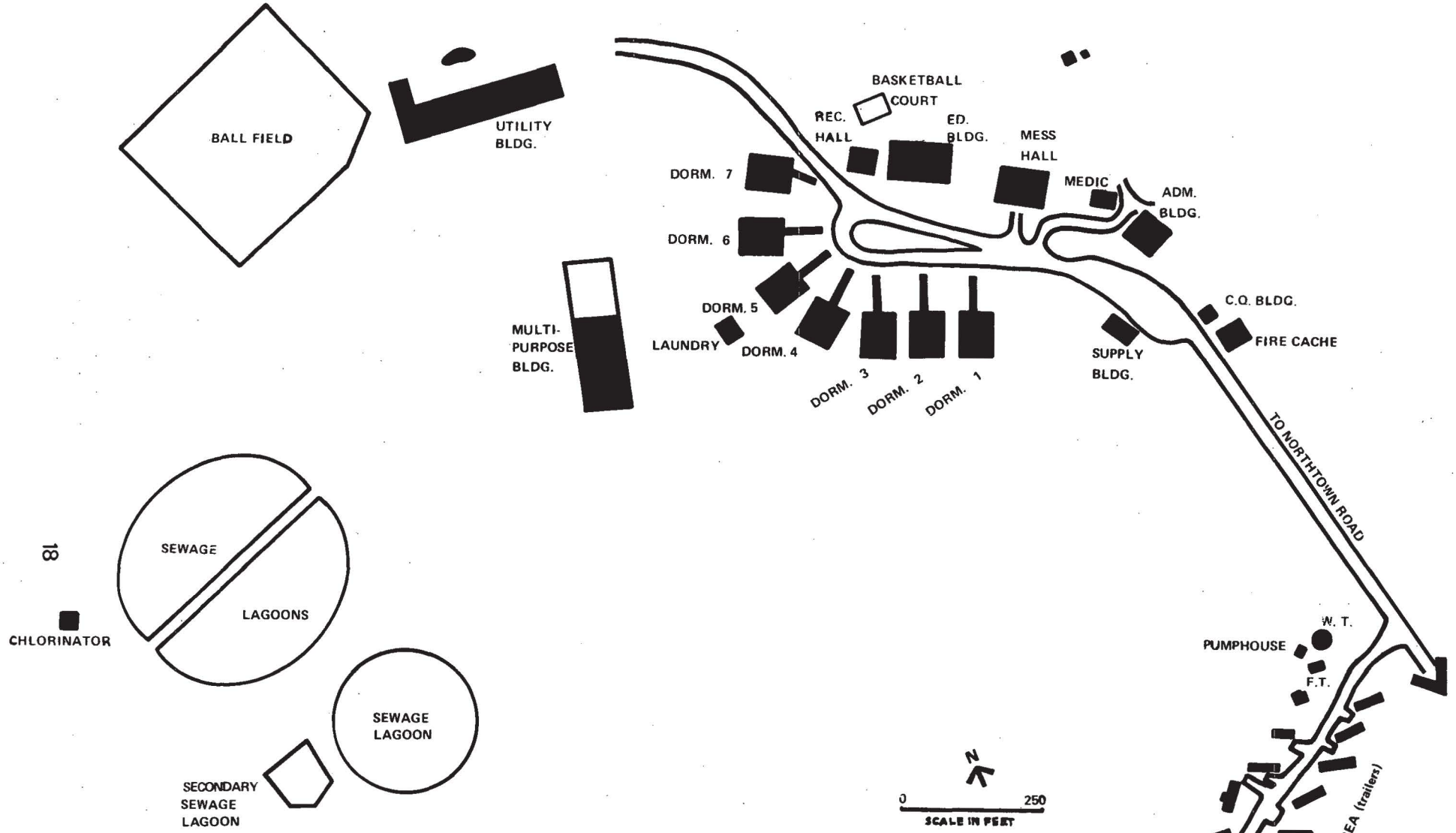


(C) – CONCESSIONER

(NPS) – NATIONAL PARK SERVICE

0 250 500 1000
FEET

ON MICROFILM
135 | 40010
DSC | APR 76



18

GREAT ONYX CIVILIAN CONSERVATION CENTER

MAMMOTH CAVE NATIONAL PARK

UNITED STATES DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

ON MICROFILM

135 | 40011
DSC | APR 76

(1) Government: 20 employee quarters, community building, four warehouse and shop buildings, gasoline service station, three equipment storage sheds, unused incinerator, with associated paved roadways and paved parking lots. Of these structures 11 were built by the Civilian Conservation Corps, 12 were MISSION 66 projects, and seven have been part of the training program of the Great Onyx Civilian Conservation Center. These structures were built at a cost of about $320,000.

(2) Concessioner: three warehouses and paved parking lot. Two of these structures were built during the Civilian Conservation Corps period and one was a recent Great Onyx Civilian Conservation Center project.

b. Ultimate Action – The master plan calls for eventually restoring the Historic Entrance to its natural appearance (c. 1800) to the greatest extent possible. This will be accomplished gradually. As concessioner and government structures reach their economically useful life, or as the functions they house terminate, the structures' disposition will be governed by the public interest. For those that are listed on the National Register of Historic Places or are eligible for nomination, this determination will be guided by the procedures of the Advisory Council on Historic Preservation (36 CFR, part 800), and other criteria. Disposition may include preservation, alteration for adaptive use, or removal with restoration of the site.

However, certain roadway clearings may remain for the transit system, and a transit station will be located at Historic Entrance to provide shelter for visitors waiting for transportation after returning from a cave trip or from hiking the existing trails along the Green River bluff. An estimated 47,586 hikers used this 5-mile trail system in 1967. The station is envisioned now as a modest, unobtrusive structure for about 50 people to get out of the weather. Summertime thundershowers are often severe and sudden, and wintry blasts require some shelter. The structure will be cooled and heated according to season, and will contain rest rooms, perhaps a food and beverage vending machine if warranted, and a lounge area for cave guides. The paved and lighted trail will remain to Historic Entrance.

About a half mile away, in the present campground and out of sight of Historic Entrance, there will be a transit stop adjoining the elevator house that will serve Star Chamber.

c. Interim Action – Neither government nor concessioner will expand at Historic Entrance, but will continue maintenance and may

make improvements to facilitate interim operations like remodeling the visitor center or the dining room. For instance, when cave tour and sightseeing boat trip tickets are sold at the peripheral staging area, that space in the visitor center will become the Historic Entrance Transit Station along with the adjoining public rest rooms. Upon completion of the transit terminal building at Union City, the museum and auditorium functions will be transferred to it and the space they occupy in the visitor center will be converted to offices for members of the superintendent's staff.

It is the policy of the Congress that concessioners provide only those services in the national parks that are essential to the needs of the visitor. Thus there will be periodic review of the concessioner's operations at Mammoth Cave National Park in light of the continuing expansion of tourist-oriented business in the environs of the park. The contract held by National Park Concessions, Inc., expires December 31, 1981.

5. **Utilize New Source of Domestic Water**

a. **Present Condition** — The springs emerging from the perched aquifer in the Haney limestone on Flint Ridge are now the major sources of domestic water used in the park. The water from the springs is of high quality because almost all of Flint Ridge is in the park and pollution sources are virtually nonexistent. This same high quality water is essential to the perpetuation of the cave fauna and continued geologic development of the cave system. Spring water is supplemented by water from wells, which is high in sulfates. Both sources are barely adequate to meet present requirements for water in the park. Moreover, during periods of low flow nearly all of the spring water is diverted from the caves to the park's domestic needs. This could be disastrous to certain cave animals that depend on a continuous flow of water and the nutrients the water contains.

Water use by the Great Onyx Civilian Conservation Center is about 11,500,000 gallons annually; by the concessioner 5,000,000 gallons annually; and all other uses (campground, visitor center, public comfort stations, park residences, and utility area) 15,000,000 gallons annually; or a total of 31,500,000 gallons.

b. **Ultimate Action** — Eventual restoration of full water flow into the caves from the springs on Flint Ridge and abandonment of the wells is anticipated in the master plan so that natural conditions will be re-established. Major water use will shift to the peripheral staging area

where, by August 2000, 13,265 daily average cave visits are expected. If staging area visitors used 10 gallons per day, water demand there during August 2000 would be somewhat more than 4 million gallons.

During August 1973, park water use was recorded as follows: 1,247,990 gallons Job Corps; 1,111,820 gallons concessioner; 2,218,650 gallons all other; or a total of 4,578,460 gallons for the park. Even though Great Onyx Civilian Conservation Center functions terminate before August 2000, total park water use will then be more than 1½ times greater than in August 1970 assuming that facilities at Historic Entrance are still operating at present levels.

c. **Interim Action** – The National Park Service has concluded that it will obtain the water it needs for use in the park from Green River, the source recommended by the Geological Survey in 1965 (see Water-Supply Paper 1475-Q). A recent study (1974) commissioned by the Barren River Area Development District (BRADD) confirms that the river water at most times is basically quite good for a surface supply. Therefore, treatment will consist of chemical coagulation, sedimentation, filtration, and chlorination. Maximum park water usage is estimated at 650,000 gallons per day so the treatment plant capacity will be on the order of 500 gallons per minute.

Raw water will be taken from Green River near the mouth of Floating Mill Creek. An intake structure will be built on the riverbank from which the water will be pumped through a heavy duty, 8-inch pipe to the treatment plant atop Flint Ridge 1¾ miles from the river and 430 feet higher. The plant will be located in the vicinity of the present water storage tanks. The raw water pipe will be placed in a ditch alongside existing roads. (See drawing on p. 23.)

Various sludges and wastewater will be discharged from the treatment plant into an 8-inch gravity sewer line, to be constructed, that will transport it to the existing sewage-treatment plant at Green River near Historic Entrance, a distance of 2½ miles. This plant will have to be modified and/or enlarged to meet current effluent standards. Again, the sewer line will be laid adjacent to roads except for the last mile, which will be cross-country through mature woodland.

Existing water mains and storage tanks will be utilized for distributing and holding potable water, but the water main will have to be extended about 1½ miles from Mt. McKinley tank across Doyel Valley to the Union City staging area. It is possible that the water line could be laid

in the clearing now occupied by the overhead telephone line. Because of the high elevation at Union City, an elevated storage tank there will be needed and the water will have to be pumped from Mt. McKinley.

B. RIVER VALLEYS

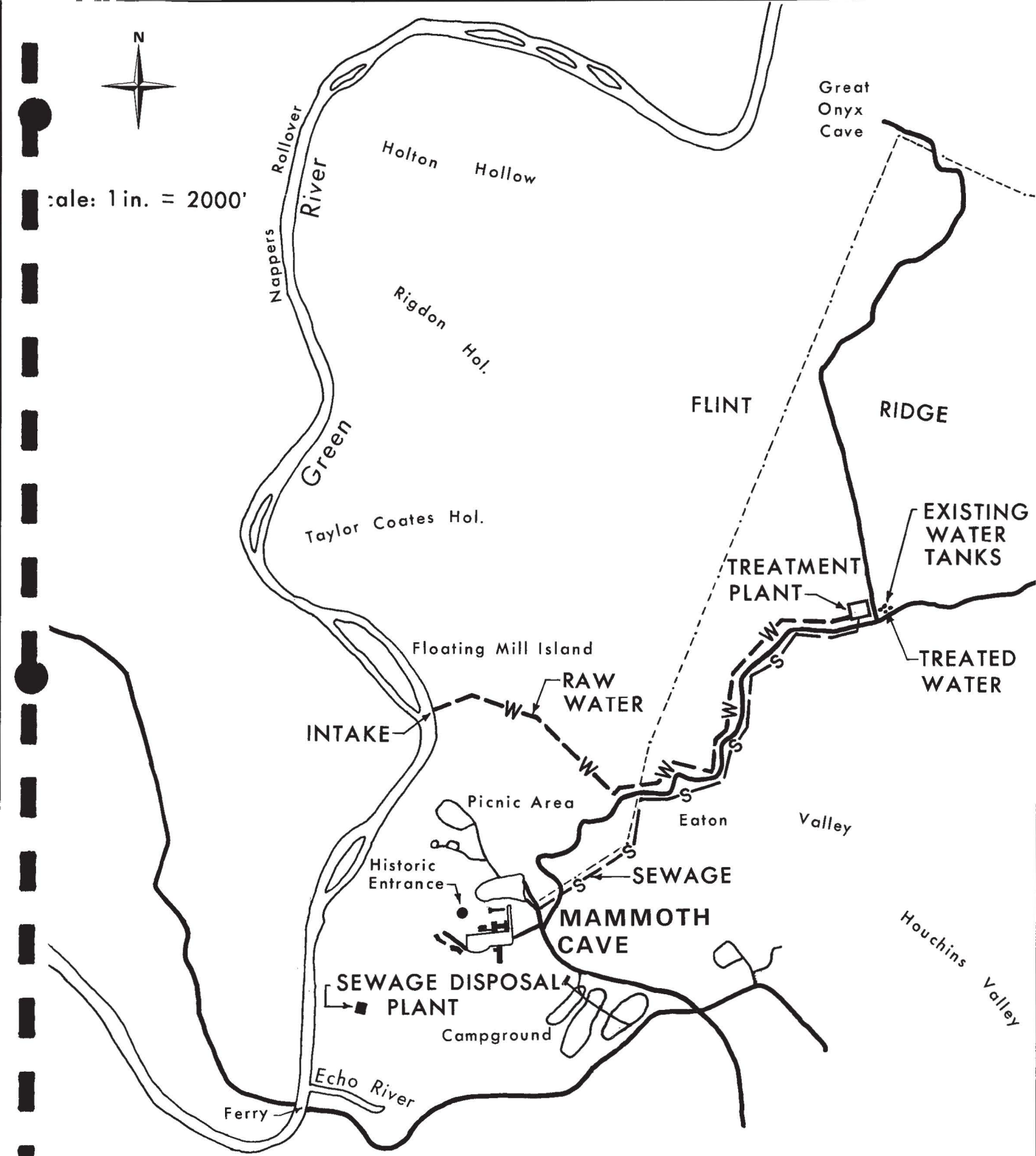
The Green and Nolin River Valleys comprise the second of the three zones of the park. A 26-mile segment of the Green bisects the park from east to west and a 6-mile segment of the Nolin flows into the Green from the north and is generally parallel to the park's west boundary. The rivers meander in deep valleys and some bluffs rise 100 to 300 feet above the water.

Nature enjoyment is one of the highest park uses. Those attracted to the River Valleys look forward to this type of experience coupled with the charm that comes from remoteness and isolation. Because of heat, humidity, and noxious insects in the River Valleys during summer, many visitors may prefer to do their boating in late spring and autumn.

Boating on the Green and Nolin is an entirely different experience than on Corps of Engineers' reservoirs nearby. There, shoreline developments, water skiing, speed-boating, and houseboating establish an atmosphere foreign to either a "wild river" or "scenic river" experience that the master plan seeks to perpetuate at Mammoth Cave. The Green and Nolin provide much opportunity for solitude and enjoyment of nature's handiwork and creatures. Sightseeing and fishing by boat are compatible recreational uses that will continue.

It is estimated that as many as 2,000 boats are brought on trailers each year and launched at the ferry ramps for sightseeing or fishing. Small motorboats, up to 10 horsepower, may be used on the slackwaters, but only hand-propelled boats may be used on the 9-mile, free-flowing section of the Green at the east end of the park. The sole exception to these boating standards is the specially-designed sightseeing boat, *Miss Green River,* which carries 122 passengers (fee). Trips originate from a dock just downstream from Mammoth Cave Ferry. This boat, operated by a concessioner, carried 85,000 patrons in 1970, and 84,725 in 1974.

The Green River, being subject to 50-foot flood crests, has steep banks of alluvium, which are very muddy and slippery most of the time. A narrow bench forms the floodplain at the three ferry sites. Floods are most likely to occur January through April, but may come anytime. Permanent structures constructed on the floodplain will be designed to withstand high water, and portable chemical toilets will be removed in December and replaced in May. During those months, the worst floods are most likely to occur according to data provided by the Louisville office of the Corps of Engineers.



PROPOSED DOMESTIC WATER SUPPLY SYSTEM

MAMMOTH CAVE NATIONAL PARK

ON MICROFILM

135 | 40,004
SEPT 75 | DSC

Green River forms a natural barrier to north/south travel. Two roads cross the park in this direction, however, and each has a ferry operated by the National Park Service without fee. Both the Houchins Ferry Road and the Mammoth Cave Ferry Road are to remain open for the "usual use by the public" in accordance with the 1945 road deed. The ferries are used by local people commuting to work, for shopping, and for access to churches and cemeteries in the park; by park employees traveling on business; and by park visitors. Over the years, the wood-hulled ferries have been replaced with steel hulls, and the vessels are driven by a paddle wheel powered with a gasoline engine. These ferries are picturesque and they represent an antiquated method of crossing rivers. Perimeter roads outside the park have been improved significantly over the years and many local people now find that they can reach their destination quicker, safer, and with less wear and tear on car and driver without using park roads and ferries.

As public use increases, the master plan recognizes that it will be necessary to add certain simple facilities in the River Valleys.

1. **Provide Additional Sites for Picnicking and Primitive Camping**

a. **Present Condition** – Houchins Ferry is situated on a 6.5-mile transpark road extending from near Brownsville on the south to Ollie at the north park boundary. It is a gravel road one to two lanes in width. In addition to the ferry and its ramps, there is a small development on the south bank consisting of a picnic area with six to eight tables, drinking fountain, two pit toilets, and roadside parking for a dozen vehicles. In 1971, 12 primitive, walk-in campsites were provided. The ferry operator has a warming shack with electric light and heat. A picnic shelter was built in 1974 and is a popular place for family picnics. Campfire programs are conducted here three times a week in midsummer by park ranger/naturalists.

Mammoth Cave Ferry is on another transpark road 5.7 miles long between Mammoth Cave Ridge on the south to near Stockholm on the north park boundary. The 1.2-mile section of the transpark road from the ridge to the south bank is paved and two lanes wide; and the 4.5-mile section north of the river is gravel and mostly one-lane wide. Again, in addition to the ferry and its ramps, there is development only on the south side consisting of a parking lot holding 60 vehicles and the sightseeing boat dock. The lot cannot be expanded because it is hemmed in by steep slopes, the ferry road, and the Green and Echo River channels.

Dennison Ferry, near the east park boundary, is reached over a 1.6-mile, single-lane gravel road, impassable in wet weather. The park road leads off of a single-lane, gravel county road along the park boundary. A mile or two of the county road east of the park towards Northtown was rebuilt, widened, and paved in 1969 to 1970 and a similar standard exists all the way to Horse Cave on I-65 about 4 miles farther. Nothing remains of the old ferry operation. The road ends in a cul-de-sac on the floodplain where fishermen who have recreation vehicles stay overnight occasionally. The site is very muddy when wet. The Park Service placed two portable, chemical toilets near the riverbank in June 1973, and Dennison Ferry Road is being maintained regularly. There is no potable water at the site.

Under a backcountry-use permit, visitors may camp at random in the River Valleys. Ample driftwood for cooking fires is available on the islands. About 300 persons camped there during 1972, and about 850 in 1974.

b. Ultimate Action – At Houchins Ferry, the ferry operator's warming shack will be replaced in 1975 by a concrete block and brick building, which will also contain comfort stations that will drain into a vault that will be pumped out periodically. When the new facility is completed, the two pit privies will be removed. Simple interpretive devices are to be installed and are to be designed for removal at flood times. On both banks, enough space is available to expand picnicking and parking by clearing away undergrowth. Grass covers the ground in the present area, and would be planted in the expanded area to form a stable footing because the alluvium is very slippery when wet. On the north side, water is available from a small spring nearby to serve a picnic area of eight to ten sites. Sanitary facilities suitable for use on the floodplain will be provided. The concrete ferry ramps will continue to serve for boat launchings. After the bridge is built across Green River (see I.C.2.b.), the existing, 12-foot gravel Houchins Ferry Road will remain as spurs off the new road to serve the picnic areas and boat-launching ramps on the north and south banks, respectively. Houchins Ferry may continue to operate seasonally only, as a "living-history" exhibit, according to the master plan.

At Mammoth Cave Ferry, the parking lot will become a transit stop for *Miss Green River* passengers who will be transported there from the peripheral staging area. Boat launching from the south bank will be discontinued at that time as will the ferry (see I.A.5.b.). The paved portion of Mammoth Cave Ferry Road south of the river will be retained as a transit roadbed. The gravel-surface portion of the road, 4½

miles long, north of Green River, will remain open to public travel to serve the boat-launching ramp (existing ferry ramp). Parking space is available for tow vehicles and boat trailers, and it can be enlarged if warranted. A portable, chemical toilet has been installed.

At Dennison Ferry, space on the floodplain for primitive camping is to be expanded and more sanitary facilities provided. Water from a small spring upstream, draining from a bluff along the river, might be piped to supply drinking water if tests are satisfactory. Planks with cleats or a set of wood steps will be laid on the muddy riverbank to facilitate launching of hand-propelled boats and embarking and disembarking from them. No motorized boats are to be used in the 9-mile section of Green River, which is free flowing and adjacent to Dennison Ferry.

As the outstanding riverscapes along the Green and Nolin become better known, float trips with overnight stays en route will become more popular. Then a primitive campsite will be provided on the north bank at Mammoth Cave Ferry, and on the south bank opposite the mouth of Buffalo Creek. Both sites are high enough above the river to be out of reach of most floods and each is accessible to park maintenance vehicles for cleanup and for providing sanitary facilities. No potable water is available at either place.

Random, backcountry camping will continue in the Nolin River Valley under permits issued by park rangers. Campsites will be designated, when needed, if approved sanitary facilities can be provided; otherwise, use will be restricted so as not to endanger the health of visitors.

c. **Interim Action** – Expand facilities at Houchins Ferry on the north bank when needed. Space available will constrict size of ultimate development on the south bank. There is a swamp at the mouth of Dry Branch just upstream that will not allow expansion of the picnic area eastward.

No further development will take place on the south bank at Mammoth Cave Ferry, but a parking area will continue in use on the north bank for the convenience of those using the boat ramp.

At Dennison Ferry, upgraded maintenance will correct the drainage problem in the camp area on the floodplain.

Camping at random on river islands and on the floodplain will continue, upon issuance of a backcountry-use permit by a park ranger.

C. HILLY COUNTRY

This is the third zone of Mammoth Cave National Park and comprises about 40 percent of the park's total acreage. It is the seldom visited backcountry north of the Green and west of Turnhole Bend south of the Green. Most of the land is forested, though extensive areas that had been cultivated are still old fields, not yet reverted. Those willing to explore it will find scenic geologic formations, small limestone caves, waterfalls, and abundant wildlife. The best seasons, because of pleasant temperatures and lower humidity, are spring, when the forest is carpeted with wildflowers, and autumn, when the forest is ablaze with colorful foliage. Hikers need to be aware of the presence of copperheads and rattlesnakes in summer, though these are not considered to be abundant, but ticks and flies are pests.

The Hilly Country has been virtually inaccessible to visitors because the Green River is a natural barrier to transpark traffic. The ferries and dust-choked roads are, in a sense, built-in controls that limit travel across the river. Trails have not been laid out and built in the Hilly Country, for the National Park Service has felt that use would be too limited to warrant the cost of providing them. A few hikers and horseback riders, however, have used old farm roads, which have been maintained as management roads or brushed out for trails, but these do not serve points of scenic interest. Because of dense undergrowth, cross-country travel is most difficult.

The park's forests and rugged topography were recognized by the Southern Appalachian National Park Commission as being assets of national significance, hence the master plan recommends that this area be made more accessible. The master plan, however, contains provisions for protecting the natural values of the area. Nothing in this plan for the Hilly Country cuts off access to Good Spring Church or the cemeteries now reached by public roads.

The master plan proposes the following actions:

- Build bridge and improve transpark Houchins Ferry Road (see I.C.1. p. 28).
- Establish trail system (see I.C.2. p. 30).
- Develop primitive campsites (see I.C.3. p. 32).

1. Build Bridge and Improve Houchins Ferry Road

a. **Present Condition** – Two outdated ferries, Mammoth Cave and Houchins, carry up to three vehicles (passenger cars or light trucks) per trip across the Green. Capacity is 15-18 vehicles per hour in each direction. Service is available daily from 6 a.m. to 11 p.m. (April to November 15) and 6 a.m. to 10 p.m. the balance of the year except in

times of flood, which occur usually in April but may occur sporadically from April through September. The ferries close during periods of high water, because of danger from floating objects such as tree trunks and large limbs.

At Mammoth Cave Ferry, traffic backups occur frequently during the busy part of the day in summer. Congestion results from the low capacity of the ferry, traffic in and out of the parking lot by sightseeing boat patrons, and competition with the ferry by boat launching at the ramp. Cars with boat trailers must park along the edge of the pavement, so their maneuvering adds to the congestion. Cars with trailers attached can seldom board the ferry because the angle of the approach road is too steep for the flexibility of the hitch. No data is available to quantify the foregoing situations.

Congestion also occurs daily, except Sundays, all year at Mammoth Cave Ferry during the morning and evening commuting periods (6:30 to 8 a.m. and 4:45 to 6 p.m.). Frequently as many as five cars are waiting to cross. The ferry's capacity is three vehicles and about 8 minutes are required for a round trip. The waiting period is often from 12 to 15 minutes.

b. Ultimate Action – Build a bridge across Green River at Houchins Ferry, and improve the present, transpark Houchins Ferry Road. The new road will link the compatible, yet diverse, recreational resources of the Corps of Engineers' Nolin River Lake to Mammoth Cave National Park, and the Hilly Country will become more accessible to motorists and hikers.

The rebuilt Houchins Ferry Road will be classed as a park road with a pavement width of 22 feet and 3-foot shoulders, 35 m.p.h. design speed, and will carry passenger cars, buses, and light, local traffic. The road is to lay lightly on the land, hence a ridge top location wherever possible, but there could be some heavy cuts and fills at the river crossing.

The Green River, at the bridge site, is over an impoundment with a normal pool elevation of 421 feet. From the Geological Survey map, the river appears to be about 200 feet in width. The Corps of Engineers can advise as to maximum flood dimensions at this point, and that is likely to be less than the 50-foot crest predicted for sections of the river and valley that are narrower. This data will help to determine the length of the bridge span, which could be as long as 1,000 feet at this site.

Until borings are taken, foundation problems cannot be determined and that will dictate the type of structure to be built. In 1969, the bridge was estimated to cost about $1.25 million with a span of 1,000 feet and the road about $150,000 per mile.

Segments of the existing Houchins Ferry Road will remain as spurs from the improved road at each end of the bridge to the riverbank picnic areas and boat-launching ramps. The spur roads will retain their present gravel surface, alignment, 12-foot width, and 2-foot shoulders. The ferry ramps will continue to serve for boat launchings.

Once the new bridge is built and the Houchins Ferry Road is improved, the ferry can be discontinued, though it might be operated seasonally as a "living-history" exhibit.

Along this transpark road, near the north park boundary, a small picnic area will be established. Sufficient water could be obtained from the springs at the headwaters of the Wet Prong of Buffalo Creek.

c. **Interim Action** – Carry on the necessary studies and prepare the plans for building the bridge across Green River, improving Houchins Ferry Road, and establishing the two picnic areas – one on the north bank of the river, and the other near the north park boundary.

2. **Establish Trail System**

a. **Present Condition** – No recreation trails had been built in the Hilly Country prior to 1974. A fisherman's foot trail had developed through repeated use between the Houchins Ferry Road at Temple Hill Cemetery and First Creek Lake. This trail is about a mile in length and is steep and narrow. This trail was rerouted somewhat in 1972 to provide a better grade, and it has been used occasionally for conducted nature walks.

A 4½-mile loop trail for hikers and equestrians from Maple Springs to Collie Ridge was brushed out in 1971 following, for the most part, old wagon road traces. About 500 horsemen used it that year. Horses were trucked in, some from as far away as Tennessee.

By 1974, 15 miles of old wagon roads had been brushed out north of the Green. Most were linear, that is out and back over the same route, and they varied in length from 0.6 mile to 7 miles round trip. Youth Conservation Corps enrollees cleared out a 4½-mile trail between Jaggers Cemetery and Collie Ridge during 1974. That year more than

2,900 visitors hiked the trails and management roads, and about 850 persons rode horseback.

b. Ultimate Action – Establish a primitive trail system, about 20 miles long, from parking areas along the transpark Houchins Ferry Road into the valleys of the Nolin River and the Wet Prong of Buffalo Creek, and to Maple Springs. This is an area of 12,000 to 15,000 acres. If the trail bed was cleared to a width of 6 feet, about 15 acres would be devoted to hiking.

Trails will not penetrate "basin ecosystems" selected as research study areas. These are watersheds, 150 feet or more in depth, and self-contained within the park.

Park specialists knowledgeable in natural science, landscaping, and engineering will plan and lay out the trails. Wherever practical, old farm roads will be incorporated into the trail system. Care will be taken to preserve habitats and species, both plant and animal, that may be rare or infrequent in occurrence, and to avoid sites of pre-Columbian Indian occupation or activity. The trails will be routed to include representative plant communities, geologic formations, streamsides, waterfalls, and scenic vistas. A loop system from trailheads along the transpark road will be designed to enable users to start and return to the same point without backtracking.

Because of the north-to-south drainage of the Green River tributaries there was little east/west travel in the park across the hollows. Instead, this was done along the ridge top north of the park where the state highway system is located today. Necessarily then, east/west travel will require much entirely new construction of the trail bed, and fords or bridges will be needed across streams. A crossing of Buffalo Creek will be avoided within a half mile of its mouth as it would be flooded out every spring. Similar circumstances exist at and near the mouths of the other tributary creeks. Cliffs, rimming many of the hollows, are another constriction on trail routing. Breaks in the continuity of the cliffs do exist; however, a trail could be constructed there, though tight switchbacks might be required. Otherwise, no unusual problems are anticipated in trail building.

Two or three parking areas for hikers' vehicles will be provided north of the Green where trails intersect the transpark Houchins Ferry Road. These lots need to be large enough to accommodate about six private cars and a couple of school buses. It is anticipated that use of these

trails could easily build up in 5 to 10 years to the point where widening and surfacing with gravel or crushed rock would be necessary. The latter is because of highly erodible soil.

c. **Interim Action** – Laying out and constructing a trail system requires considerable investment. However, use of the interim 15 miles of old wagon roads that have been brushed out will provide data valuable for planning the ultimate trail system. If use of the trails continues to increase, despite the present ferry crossings and low-standard roads, the need for bridging Green River and improving Houchins Ferry Road will be hastened.

3. **Develop Primitive Campsites**

a. **Present Condition** – Random camping is permitted after issuance of a backcountry-use permit by a park ranger.

b. **Ultimate Action** – Designate primitive campsites for backpackers as warranted by use. Such sites would probably include a fireplace and sanitary facilities. Use could reach the point that public health requirements could only be met by providing chemical toilets that can be pumped out periodically.

At Maple Springs, space is adequate to establish several primitive campsites when warranted. Water is available there and the area can be serviced by park maintenance vehicles. The gravel road serving this area is to remain open to public use because of the deed reservation, but the campsite is for hikers only. Maple Springs is about 4 miles by trail from the proposed trailhead parking area along the improved Houchins Ferry (transpark) Road.

Space is also available at Maple Springs for an environmental study area to be used by local school groups. This is an excellent place to study the interaction of man and his environment. Nearby are old homesites, overgrown fields, wagon road traces, Good Spring Church, cemeteries, and a ranger station. Several half-day and all-day hikes may be taken from here, also, when the proposed trails are built. School groups spending the night will need shelter. These could be of the Adirondack type built of yellow-poplar logs cut on site and treated to resist decay. Inside, bunks lined with hardware cloth could be provided.

c. **Interim Action** – Park rangers will continue to monitor trail use and will make recommendations to the park superintendent as to where and when primitive campsites are needed. The site at Maple Springs will, most likely, be established first.

D. LAND AND CAVE PASSAGE CLASSIFICATIONS

When the park was established, Congress charged the National Park Service with administering it in accordance with the act of August 25, 1916 (39 Stat. 535), from which the following is excerpted:

> "The National Park Service thus established shall promote and regulate the use of the Federal areas . . . by such means and measures as conform to the fundamental purpose of the said parks, . . . which purpose is to conserve the scenery and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." (U.S.C., Title 16, Sec. 1)

In 1941, the National Park Service inherited at Mammoth Cave a pattern of public use that had begun early in the 19th century. By the mid-20th century, because most of the facilities were antiquated, the National Park Service and concessioners responded by improving roads, trails, accommodations, and services under the MISSION 66 program for the benefit of cave visitors. Before that decade (1956 to 1966) had ended, phenomenal increases in travel and new discoveries underground prompted the National Park Service to re-examine its management of the park. It inaugurated master plan studies that revealed that some drastic changes in public use and management were required if the Park Service was to meet its obligations to the public under the congressional mandate cited above.

One of the first steps in planning is to analyze the park's resources and to classify them. Such classification may be represented graphically to show readily the degree of preservation and the allowable intensity of use that these park resources will accept without jeopardizing their perpetuation for future generations.

1. Land Classification

a. Present Condition – The National Park Service now uses a modification of the land classification system developed by the Outdoor Recreation Resources Review Commission described in its report to the President and to the Congress titled *Outdoor Recreation for America,* January 1962, pp. 96-120 inclusive. Its application to park planning is contained on pp. 32-35 of a booklet titled *Compilation of the Administrative Policies for the National Parks and National Monuments of Scientific Significance (Natural Area Category),* Revised 1970.

Public lands, including park lands, are classified under six categories:

Class	Definition
I	High-density recreation area
II	General outdoor recreation area
III	Natural environment area
IV	Outstanding natural area
V	Primitive area
VI	Historic and cultural area

Classes I and II identify the lands reserved for visitor accommodations, for administrative facilities, formal campgrounds, two-way roads, etc., of varying intensities, *both existing and proposed.*

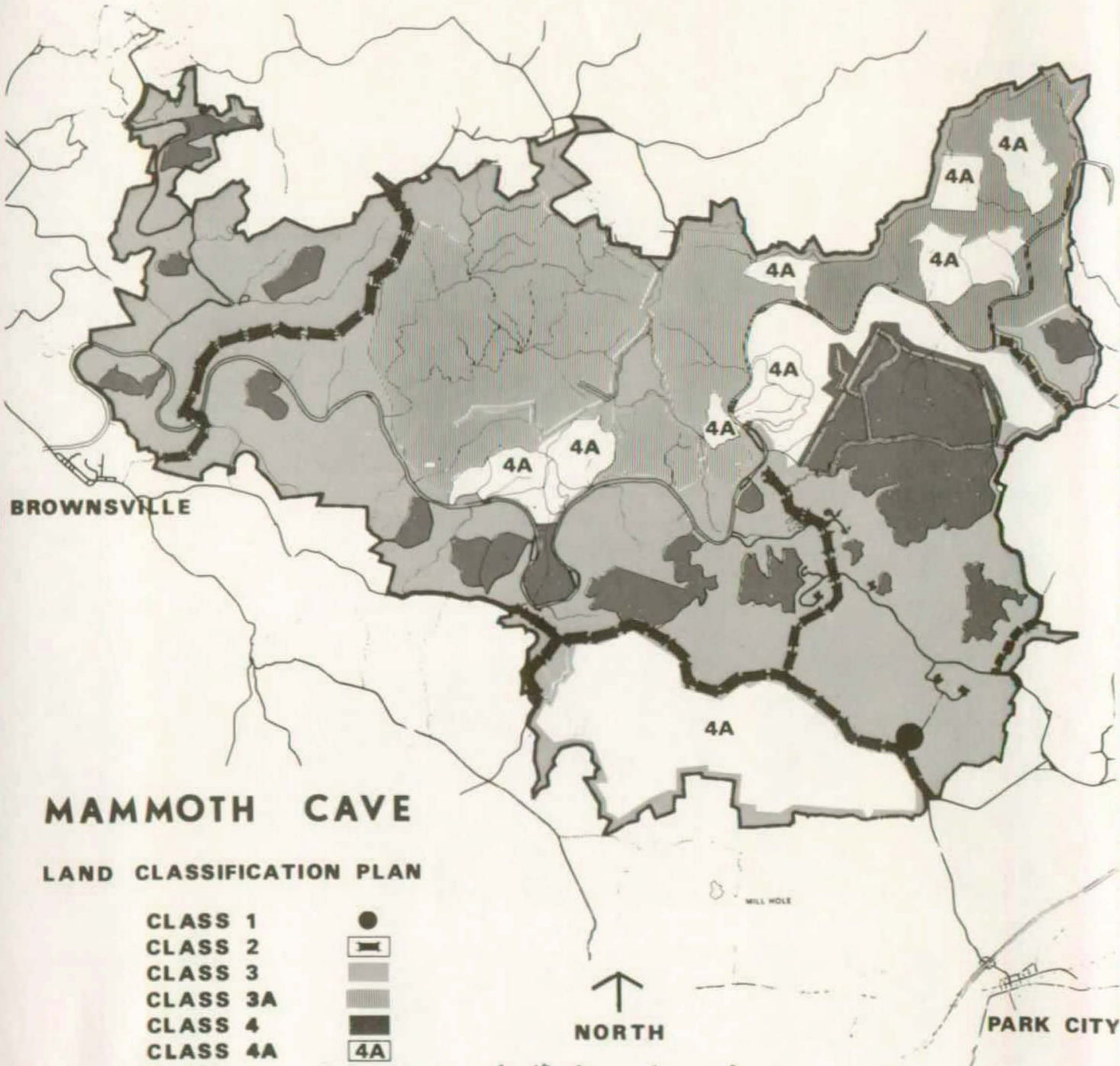
Class III lands represent significant natural values that distinguish areas of the National Park System from other public lands providing outdoor recreation. Only those minimum facilities required for public enjoyment, safety, health, and preservation and protection of the features are provided, such as one-way motor nature trails, small visitor overlooks, informal picnic sites, short nature walks, and wilderness-type uses. Such limited facilities must be in complete harmony with the natural environment.

Class IV lands are those with unique natural features. These lands usually represent the most fragile and most precious values of a natural area. Class IV identifies the terrain and objects of scenic splendor, natural wonder, or scientific importance that are the heart of the park. These are the lands that must have the highest order of protection so they will remain "unimpaired for the enjoyment of future generations." Nothing in the way of human use should be permitted that intrudes upon or may in any way damage or alter the scene. The sites and features are irreplaceable.

Class V are the primitive lands that have remained pristine and undisturbed as a part of our natural inheritance. They include in some instances lands that, through National Park Service management, have been restored by the healing processes of nature to a primeval state. There are no water impoundments or other intrusions of man to mar their character and detract from the solitude and quiet of the natural scene.

Class VI are the lands, including historic structures or objects, of historical or cultural significance.

b. Ultimate Action – The process of classifying park land is rather complicated and it requires a multidisciplinary input. The first step is to



MAMMOTH CAVE

LAND CLASSIFICATION PLAN

CLASS 1
CLASS 2
CLASS 3
CLASS 3A
CLASS 4
CLASS 4A
CLASS 6

4A

For list of Class 6 sites and objects see page 34

PARK BOUNDARY

NORTH

1 ½ 0 1 2

SCALE IN MILES

135	20002B
DSC	APR 76

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

ON MICROFILM

identify and evaluate the resources of the park (see subsequent paragraphs and Section II, Description of the Environment). Those resources requiring special protection are delineated on a map and classified IV, V, or VI. Then the needs of the visitor and of park management are listed and analyzed as to their areal requirements and location. These are drawn on the map with needed ancillary facilities like utility lines and classified I, II, or III depending on the type and intensity of use they will receive. Uses compatible with Class IV, V, and VI lands are shown also. The graphic representation of this data is then studied carefully and the boundaries manipulated to be contiguous with one another.

In the tabulation that follows, the various types of development and uses that are compatible with the resources of Mammoth Cave National Park are listed and keyed to the eight categories of land classification.

Class	Compatible Developments and Uses
I	Peripheral staging area
II	Paved, two-way, public-use roads and minor developed areas including cave entrances, campgrounds, picnic, residence, and utility areas
III	Minor public roads, transit vehicle tour routes, foot and horse trails, primitive campsites, boating routes and facilities, and environmental and nature study areas
IIIA	Foot and horse trails, primitive campsites, boating routes and facilities, and environmental and nature study areas
IV	Foot and horse trails where resource is not too fragile; research projects: lands of special scientific value
IVA	Ibid
V	No lands so classified presently. Class IIIA and Class IVA lands may qualify someday for Class V
VI	Type of development, hence use, depends upon preservation of the site, structure, or object of historical/cultural significance

Land-use planning at Mammoth Cave is strongly influenced by 160 years of man's influences, so some compromises have to be made and the consequences accepted. For example, it has never been possible, economically or sociologically, to extend the boundaries of the park to include all the land within 7½ miles of Chaumont, or to locate the staging area north of Green River. These actions, if feasible, would embrace the watersheds of the underground streams and permit removal of all developments immediately above the cave systems.

Some of the features and planning considerations regarding Class IV, V, and VI lands are noted in subsequent paragraphs.

Lands of special scientific value in Class IV include Big Woods, "basin ecosystems," Bylew Creek Valley, a tract of virgin forest in the vicinity of Historic Entrance, Goblin Knob, Turnhole Bend, Woolsey Valley, Strawberry Valley, Double Cellars and Hunt Sinks, Deer Park Hollow, and portions of the ridge tops on Mammoth Cave Plateau. These Class IV areas are to remain free of any new development; some will be surrounded with Class III zones where there will be only harmonizing development.

All of Flint Ridge is designated Class IV except for the roads serving cave entrances and the powerlines, which provide electricity for illuminating Mammoth Cave and for pumping water. Because these must remain, at least for the time being, they are placed in Class III corridors 50 feet wide. Nevertheless, by Class IV designation, the National Park Service recognizes the great worth of the underlying cave system for research. Once the Great Onyx Civilian Conservation Center is discontinued and its buildings removed, that area will revert to a more natural condition.

No lands in the park were designated Class V, primitive, because evidences of past uses by man and his abandoned works, such as farmsteads, sunken wagon roads, fence lines, chimneys, building foundations, gullies, and the like, are still evident to knowledgeable observers on the ground and apparent from the air. As time passes, these things will disappear, but this will probably require several more decades.

Meanwhile, the National Park Service has identified certain lands and waters and shown them as Class IIIA and Class IVA on the land classification plan drawing. By this action, the National Park Service declares that it will so manage these lands that they may become of

Class V caliber in the future. The bulk of Class IIIA lands are north of the Green River and they will continue to be administered very much as they have been for the past 30 years, though primitive trails will be marked for those seeking a backcountry experience on foot, and some abandoned roads will be available for use by horseback riders.

Woolsey Valley is a typical Class IVA area with its high scenic and scientific values. It is an outstanding example of solution valley physiography. Long Cave is at the east end of Woolsey Valley and contains the largest and most important bat hibernaculum in the park. It shelters a colony of Indiana bats (*Myotis sodalis*) that are listed as an endangered species by the Secretary of the Interior. No development of Class IVA land is contemplated.

Lands, structures, and objects in the park are being evaluated to determine which belong in the Class VI category – historic and cultural – in compliance with Section 2(b) of Executive Order 11593, dated May 13, 1971. Nomination forms are being submitted for inclusion of the following on the National Register of Historic Places: Mammoth Cave Railroad train consisting of the dummy-type locomotive "Hercules" and one coach designed as a combination baggage/passenger car, saltpeter vats and the two tubercular huts within Mammoth Cave, Salts Cave, the "old" Mammoth Cave Hotel, Floyd Collins' home, and Crystal Cave ticket office. Over time, other historic, cultural, and archeological sites and objects may become eligible for nomination to the National Register. These will be studied, professionally evaluated, and nominated if they meet the criteria.

Those appearing in the National Register, and those eligible for nomination, will be identified on the land classification plan as Class VI areas. Similarly, those in cave passages will be designated in Zone F on the cave zoning plan (see discussion under I.D.2.). The acreage covered by each of the historic and archeologic sites and objects mentioned in the preceding paragraph is too small to be shown on the drawing on page 35 of this report. Nevertheless, these sites and objects will be managed by the park staff as Class VI. With respect to archeological sites, the Park Service deems it unwise to publicize their location lest irreplaceable evidence is disturbed or objects removed by unauthorized persons. Few pre-Columbian sites are known in the Green River Valley outside the park.

The accompanying land classification plan drawing (see p. 35) resulted from the foregoing analysis. It represents graphically the categories of

use and preservation accorded the surface lands and waters of Mammoth Cave National Park as described in the master plan.

c. **Interim Action** – As actions affecting land and water use are carried out, upon adoption of the master plan, present uses will change to the categories called for on the land classification plan drawing.

2. **Cave Passage Classification**

a. **Present Condition** – Prior to 1970, neither the National Park Service nor anyone else had ever attempted to devise a system of cave passage classification for designating an acceptable level of use based on the ability of the resource to absorb it. This would be a desirable guide for park management. The master plan contains an innovative system of zones labeled "A" through "E" in descending order of intensity of use and development, and Zone F, which recognizes outstanding natural and historical features and passages, as follows:

CAVE ZONING SYSTEM

ZONE	DEFINITION	EXAMPLES
A	Intensive use area	Snowball Dining Room; rest areas
B	Fully developed passage; electrically lighted	Cleaveland Avenue, Broadway, etc.
C	Partially developed passage; no electric lighting	Nickerson Avenue, Fox Avenue, old commercial routes in Colossal, Crystal, Great Onyx, and Proctor Caves, back part of Salts Cave
D	Natural passage	Blue Spring Branch, Marion Avenue, Columbian Avenue, Pohl Avenue, front part of Salts Cave
E	Scientific study or pristine passage	Paradise passage in New Discovery, parts (or perhaps all) of Upper Turner Avenue, White Cave, Long Cave in winter
F	Outstanding natural or historical feature or passage	Saltpeter vats and pipes, unique column in Upper Turner Avenue, Attic Room

b. **Ultimate Action** – As with the land classification plan, the cave zoning system will guide management in its development of the cave passages and identify the uses that are compatible with the resource. This will range from intensive use such as in the Rotunda of Mammoth Cave to rare visits to passages where formations or archeological remains are so delicate that they may be destroyed inadvertently. Most places of greatest scientific value may be reached only by those possessing uncommon physical stamina and courage, and who are familiar with caving techniques.

c. **Interim Action** – The master plan recommends the following criteria to guide preparation of the resources management plan following adoption of the master plan:

No passages in Flint Ridge or Joppa Ridge are to be zoned "A" or "B," and spelunker traffic is to be limited to zones "C" and "D." All passages not now discovered are zoned "E" automatically.

Cave Zone A is limited to those areas where people assemble, such as Snowball Dining Room, Grand Central Station, Mt. McKinley comfort station, and elevator portals. Such places, essential to the comfort and convenience of the visitor, are situated in sections of cave passages that have low aesthetic and/or scientific value.

Cave Zone B includes those cave passages provided with electric lighting aesthetically arranged and developed with trails, bridges, steps, stairways, and handrails. Guides accompany all parties and a fee is charged. Parties not exceeding 120 persons with two guides may be conducted over the trails in passages so developed. Depending on the width of the passages and fragility of formations, up to 650 persons per hour may be admitted to Zone B on semi-guided tours. Party size mentioned above is maximum; visitors will generally have a higher quality experience when numbers are smaller.

Those passages that are partially developed or were once developed and are now abandoned are in Zone C. Trails range from good to somewhat primitive; other development is limited to the essentials for visitor safety. There is no electric lighting. Such passages provide a "wild-cave" experience for visitors without training in caving techniques. Lighting is by hand-carried lanterns. Tour size, with at least one guide, is limited to from 25 to 40 persons, depending on the passages traversed, and there is a fee for the services of the guide.

Natural passages are classified in Zone D. Only those who are properly equipped and experienced in caving techniques may traverse these passages, which have not been improved in any way except for possibly remedying dangerous situations. Parties must be small and a special fee is charged for guided tours.

Zone E includes those portions of the cave systems reserved for scientific study and approved for exploration, or pristine passages that would be irreparably damaged by heavy use. Temporary "E" zoning may also be obtained for non "E" passages by scientists conducting approved projects.

Cave passages containing unique natural and historic features are in Zone F. They may be located within Zones B through E. Both the saltpeter vats and tubercular huts are in Zone B passages. Special measures may be taken to ensure their protection and preservation, as warranted. This may include highly restricted visitation to places such as a bat colony during certain seasons of the year.

It is impractical to compress into the pages of this report drawings to represent the lengthy honeycomb pattern of passages in the cave systems, hence there are none to illustrate this cave zoning system. Such a drawing will be prepared, at a later date, as part of the resources management plan. Knowledgeable people outside the National Park Service will be consulted and asked to assist in drafting it.

The zoning system will not reduce the authority of the superintendent to regulate entry into, and to regulate use of the cave passages; it is a guide that identifies for him the maximum degree of use permissible for the preservation of the underground features. Park regulations concerning cave entry may be modified by the cave zoning system, upon its completion. The regulations now read:

> **Cave entry.** Except for those portions of the caves open to the general public, no person shall enter any cave within the boundaries of the park without first obtaining a permit from the Superintendent. Permits will be issued to persons who are qualified and experienced in cave exploration, who possess the needed equipment for safe entry and travel, and who are engaged in scientific research projects which in the opinion of the Superintendent are compatible with the purpose for which the park was established. (44 Stat. 635, 16 U.S.C. 404).

3. Wilderness Study

The *National Wilderness Preservation Act* (PL 88-577) required the National Park Service to study the lands within Mammoth Cave National Park and to report to the President and to the Congress, by September 3, 1974, as to their suitability or nonsuitability for wilderness designation. The following was considered by the Park Service in finding park lands nonsuitable at this time.

a. **Background Data** – The land was exploited beginning with its settlement during the last decade of the 18th century. Mammoth Cave, itself, was mined for saltpeter used in the War of 1812; public tours began in 1816.

Park lands are rugged; soils are acid and have been moderately to severely eroded. Soil fertility, where farmed, was further depleted by raising corn and tobacco. Similarly, ruthless cutting of trees on the steeper land and forest fires lowered soil fertility, and the species composition changed. American chestnut has been lost to blight; wood bison and passenger pigeon are extinct, and black bear has been extirpated.

In 1936, 5 years before the park was established, 56 percent of the 47,348 acres studied by Park Service foresters supported a recognizable forest cover type. The balance of the land (44 percent) was open. Of this, 14 percent was former fields that were beginning to regenerate to forest, while 30 percent was not regenerating because it was still being tilled or had been abandoned too recently for tree growth to reappear.

About 600 families lived within the area designated for the park. There were 4 churches, 11 one-room schoolhouses, over 250 miles of wagon and motor roads, 9 ferries and one ford to cross rivers, several country stores, a post office, and 4 hotels for cave patrons. Families abandoned their farmsteads after the land was purchased for the park.

The Civilian Conservation Corps (CCC), during the late 1930s and early 1940s, carried on a number of land improvement projects through their work programs. Corpsmen razed structures, removed fences, checked erosion, and reforested fields to assist natural processes in reclaiming the land. However, a 1966 map of the park's vegetative cover reveals that broomsedge was still dominant in old fields, and pine plantations had not yet been invaded by the climax hardwoods. The slow rate of recovery in 30 years indicates that the soil is still infertile following nearly 150 years of exploitation.

b. **Field Study** – Under the Wilderness Act, a procedure for study has been established that starts with identification of roadless areas 5,000 acres in extent, or larger. Like the farmsteads, most roads were abandoned when the people moved out. Hence it was possible to delineate 4 areas labelled "A" through "D" on the drawing on p. 47. These roadless areas total 39,185 acres or 76 percent of park lands.

Each of these roadless areas was studied by the Park Service and its report was released in April 1972. The finding was that none of the land in the park met the criteria for wilderness designation in the act. This decision was reached on the basis of the history of land use described above, consultation with others, and an analysis of resources and uses of the 4 roadless areas. A summary of the consultations and analysis follows:

(1) Symposium – This was conducted by the Park Service at Mammoth Cave National Park, May 22 to 26, 1967, inclusive. Its purpose was to consider the "application of the Wilderness Act as the means for preserving the surface and underground features of the park." Symposiasts included representatives of the National Park Service, Geological Survey, both of the park's concessioners, the Office of the Secretary of the Interior, Cave Research Foundation (CRF), and the National Speleological Society (NSS). Before the meeting, each representative was supplied with a copy of the Wilderness Act, a briefing statement prepared by the Park Service, and a copy of *A Wilderness Proposal for Mammoth Cave National Park, Kentucky* published by NSS a few weeks earlier (see Section VIII, Alternatives, in this statement). During the symposium there were discussions and a series of field trips, both on the surface and underground. The discussions were supplemented by written statements of observations and conclusions prepared by several of the participants.

In general, both the NSS and CRF advocated "underground wilderness" designation of the Flint Ridge Cave System, then the longest explored cave in the world. CRF saw such designation as a means of preserving the caves for their scientific values, and NSS saw it also as a means of opening them to the sport of "recreational caving." To the NSS this is a valid "wilderness use."

Both groups recognized that there was inseparable affinity between the surface and underground – hydrologically, climatologically, mineralogically, geologically, and biologically – and that the surface of Flint Ridge does not now qualify for wilderness. This is because of the

roads, powerlines, Great Onyx Civilian Conservation Center, a church, CRF field office and bunkhouse, fire lookout tower, water collection and storage system for the park, and immediate past land uses: Great Onyx Cave and Crystal Cave properties were shown commercially and the properties were not added to the park until April 7, 1961. Some of these disqualifying surface uses will continue long into the future.

As for other surface areas of the park, which are roadless, many symposiasts had the philosophical attitude that these may be included in the National Wilderness Preservation System "if we so desire," since "wilderness is in the eye of the beholder." Moreover, whatever area is designated will be but a "small portion of an already highly developed geographic region."

(2) Master plan public meeting – An informal meeting was held by the master plan team at the park on May 25, 1968, to learn what others thought the plan for the park should be.

Several months preceding this meeting, the National Parks Association (NPA) had prepared and distributed their proposal entitled *A Wilderness Plan for Mammoth Cave National Park and the Surrounding Region* (see Section VIII). NPA's proposal included designation of practically all of the park as wilderness (the major exception was Mammoth Cave Ridge); recommended no expansion of lodgings; picnicking and camping were to be phased out; and major roads were to be closed including the two ferries across Green River.

The master plan team's public meeting was attended by about 100 people of whom about 50 spoke for themselves, or represented public bodies and organized groups.

Spokesmen for conservation organizations strongly endorsed the wilderness proposals, surface and underground, of NSS and NPA. On the other hand, most local people said they were opposed to any wilderness in the park because the National Park Service now had all the authority it needed to preserve and conserve it, wilderness would deter development of south-central Kentucky, and all facilities in the park should be fully developed as a means of enhancing it for public use. Moreover, some asserted that the park had "ruined" Edmonson County and its citizens had been denied use of some roads in the park.

(3) Comparative study of roadless areas – The following tabulation by the Park Service was derived from an analysis of old maps:

PRELIMINARY – SUBJECT TO CHANGE

WILDERNESS STUDY

(NO WILDERNESS PROPOSED)

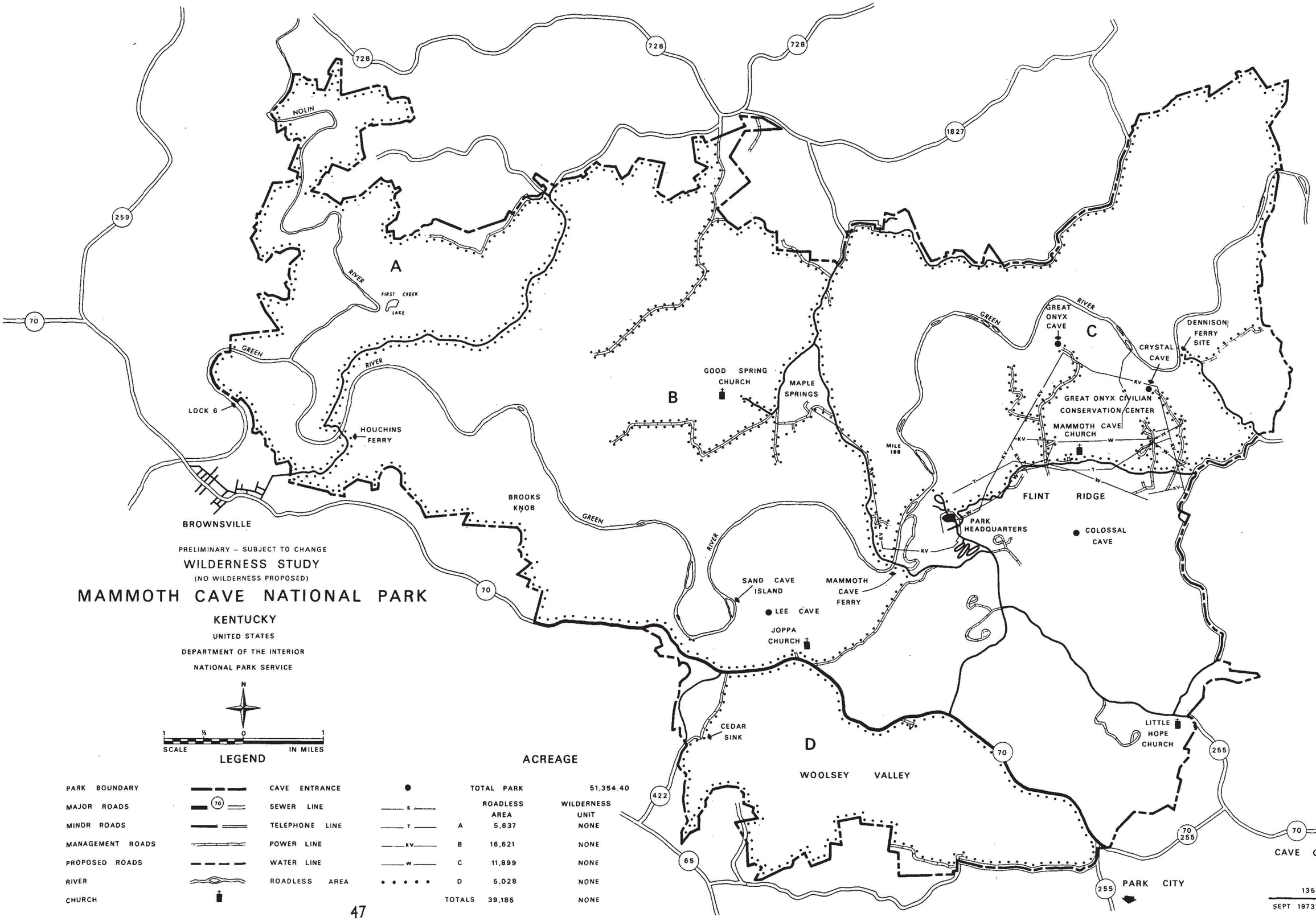
MAMMOTH CAVE NATIONAL PARK

KENTUCKY

UNITED STATES

DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE



SCALE 1 ½ 0 1 IN MILES

LEGEND

PARK BOUNDARY	CAVE ENTRANCE		
MAJOR ROADS	SEWER LINE	S	
MINOR ROADS	TELEPHONE LINE	T	
MANAGEMENT ROADS	POWER LINE	KV	
PROPOSED ROADS	WATER LINE	W	
RIVER	ROADLESS AREA		
CHURCH			

ACREAGE

	ROADLESS AREA	WILDERNESS UNIT
TOTAL PARK	51,354.40	
A	5,837	NONE
B	16,621	NONE
C	11,899	NONE
D	5,028	NONE
TOTALS	39,185	NONE

135 | 40,001-C

SEPT 1973 | DSC

ON MICROFILM

Man's Works Affecting the Land — 1936 and Earlier

Roadless Area Studied	Gross Acreage	Acres Not Forested	Percent of Gross Acreage	Number of Tracts Purchased	Number of Farmsteads (1)	Miles of Road	Number of Cemeteries (2)
A	5,637	1,563	28	43	42	15	7
B	16,621	3,662	22	226	182	89	17
C	11,899	3,272	28	138	131	50	15
D	5,028	1,810	36	70	55	15	8
Totals	**39,185 (3)**	**10,307**	**26**	**477**	**410**	**169**	**47**

(1) A farmstead usually consisted of a one-story log or a 2-story frame house with stone or brick chimney, smokehouse, woodpile, garden, and orchard. Corn and tobacco were the principal cash crops. Soil erosion was rampant. Most tracts were fenced with barbed or woven wire.

(2) Most cemeteries are family plots containing a dozen or fewer burials, often identified by unmarked stones.

(3) Total park acreage is 51,354.

From the tabulation above, it appears that each of the four roadless areas was affected about equally by man's works. However, each of the areas has been untrammelled by man for the past 30 to 45 years, except for the two cave properties on Flint Ridge, totalling 672.68 acres, purchased in 1961. During the CCC period, structures were razed, fences removed, erosion checked, and trees were planted. Despite this, old fields covered with broomsedge and briar patches, fence rows, exotic plants at homesites, occasional chimneys and building foundations, burial plots, sunken wagon roads, and erosion gullies are clearly visible. Knowledgeable observers will see more subtle things like plant indicators of early stages of forest succession, reforestation projects, check dams, pits where trees had been wind-thrown years ago and the bole removed for lumber, and other pits where walnut stumps were removed to salvage the valuable wood. Several decades will pass before the plant cover again resembles the original hardwood forest.

Two major streams cross the park: 26 miles of Green River and 6 miles of Nolin River. Both are impounded by Dam and Lock 6 completed on

the Green in 1907 by the Corps of Engineers. The lock was deactivated in 1951. Both streams are further regulated by flood control dams upstream. Sightseers and fishermen use motorboats on the slackwaters and the *Miss Green River,* a sightseeing boat carrying 125 passengers, is powered by an inboard diesel engine. She is operated by a park concessioner on a 3¼-mile segment of the Green. These rivers cross roadless areas "A," "B," and "C" (see map, p. 47). The impoundments are permanent works of man, and motorboat use on the slackwaters will continue as provided in the master plan. Some of the finest riverscapes in Kentucky are found in the park.

A summary of some of the natural characteristics and uses of each roadless area follows:

Roadless Area A: approximately 5,637 acres measuring about 4 miles long by 3 miles wide. Excellent overviews of this area can be obtained from Whistle Mountain and Indian Hill, respectively. Some fine cliffs may be viewed when traveling on the rivers. First Creek Lake is located on the floodplain of Nolin River, the only one so situated in the park. There are several outstanding examples of plant associations, an acre or two in size, at the mouth of Bylew Creek, in Flea Cave and Cubby Cove Hollows, and on the north flank of Indian Hill. Hemlock trees grow at some of these localities disjunct from their nearest counterparts 100 miles east in the Cumberland Mountains. Motorboats carrying fishermen and sightseers put in at Houchins Ferry and ply the rivers. Hikers and horseback riders will use the proposed trails.

Roadless Area B: approximately 16,621 acres and of irregular shape about 5½ miles across in each direction. There are no prominent viewpoints in this area except of Turnhole Bend from Ky-70, and of the general area from Brooks Knob fire tower. Turnhole Bend is the area's outstanding scenic surface feature, a classic example of an incised meander. Turnhole Spring is the largest resurgence on the Green River. Here steamboats turned around in bygone days. Lee Cave beneath Joppa Ridge, rediscovered by a CRF team in 1938, contains major passages. There are a few shallow caves in limestone north of the Green. Wet Prong of Buffalo Creek has some attractive segments and numerous springs along its course. Wet Prong and Dry Prong are sinking streams at certain times of the year when their waters go underground. *Miss Green River* passengers frequently observe deer, raccoons, turtles, kingfishers, and ducks on their trip. Private

motorboats are launched at both Houchins and Mammoth Cave ferries, primitive campsites are to be established, and new trails for hiking and horseback riding are proposed. A primitive campsite and environmental education area are to be located at Maple Springs between roadless areas "A" and "B."

Roadless Area C: about 11,899 acres in extent and measuring about 3 by 5 miles. In the northeasterly part is Big Woods, a 300-acre tract of hardwood forest, which has probably not been cut, and the adjoining Wilson Cave Hollow. In addition to shallow Wilson Cave, the hollow contains a small waterfall, some pretty scenery, and an attractive beech/maple forest. A 9-mile segment of the Green River is free flowing and is to be treated generally as a "wild" river with no motorboat use. Nappers Rollover and Goblin Knob are interesting geologic features. Overviews may be obtained only from the Flint Ridge and Hickory Cabin fire lookout towers. The northern half of the Flint Ridge Cave System underlies that portion of this area south of the Green.

Roadless Area D: about 5,028 acres in size and roughly 5 miles long by 2 miles wide. It contains Woolsey Valley, one of the finest examples of a solution valley in the park. At the west end of the area is Cedar Sink through which passes an underground stream. Some cave passages in the phreatic zone have been entered from Cedar Sink. At the east end is Long Cave, the most important hibernaculum in the park for it shelters a colony of the Indiana bat, an endangered species. Vegetatively this roadless area is interesting, also. There is a strong visual contrast between the cedar karren and the hardwood stands as viewed from the valley rim at the old quarry along Ky-70. There are probably some small areas of savanna vegetation, which is a relict of that which formerly grew on The Barrens. No developments have been planned for this area in the future.

c. **Conclusions** – Application of the definition of wilderness in the act to the roadless areas at Mammoth Cave leads to the following conclusions: they are no longer "trammeled by man," and "man himself is a visitor who does not remain." The areas generally offer "outstanding opportunities for solitude" and "a primitive and unconfined type of recreation." Each area appears to be large enough to "make practicable its preservation and use in an unimpaired condition," and they "also contain ecological, geological, and other features of scientific, educational, scenic, or historical value."

However, the Wilderness Act also specifies that the land shall "generally appear to have been affected primarily by the forces of nature, with the imprint of man's works substantially unnoticeable." This condition is not met at Mammoth Cave. The Park Service maintains that many more decades will elapse before the plant cover will again resemble the original hardwood forest. The impoundments of the rivers and regulation of their flow are "permanent improvements," but under current Departmental guidelines they are not disqualified from wilderness designation.

Motorboat use will continue on the rivers, trails will be built through the woods and abandoned fields of the Hilly Country, and primitive campsites established. As explained previously, the magnitude of these uses is expected to be the antithesis of wilderness.

For these reasons, the Park Service finds no lands suitable at this time for wilderness designation in Mammoth Cave National Park.

In time, most of man's past works will disappear, but when this condition will prevail is unknown at this time. Several decades may pass before the land returns to its pristine condition. When park lands meet wilderness criteria, at a later date, the President may so recommend to Congress. (See I.D.1.b., p. 34.)

Much of the discussion about "underground wilderness*" has focused on the Flint Ridge Cave System, which has been studied and mapped by scientists since 1947. The proponents of underground wilderness feel that the language of the Wilderness Act is broad enough to cover this concept except for the "semantic problem of subsurface acreage." Surely, caves are places where "man himself is a visitor who does not remain," and they provide truly "outstanding opportunities for solitude."

As discussed previously, the Park Service has carefully studied and considered the application of the Wilderness Act to underground features in Mammoth Cave National Park. As a practical matter, where the surface qualifies, any subterranean features would be administered as wilderness also. Because the surface of the park does not qualify, the

---

* The genesis of the idea of wilderness caves may have first appeared in print in a booklet titled *Speleological Research in the Mammoth Cave Region, Kentucky: Elements of an Integrated Program* published by the Cave Research Foundation, June 1960, pp. 16-18.

proponents of underground wilderness suggest that the undeveloped cave passages be so designated. These could be described by using both horizontal and vertical boundaries, or by naming specific passages that possess wilderness "quality."

Only about 10 percent of the 150 miles of cave passages in the park, known to date, have ever been developed for public tours. The balance could be considered for wilderness designation. Scientists familiar with the caves are convinced that future exploration will reveal perhaps double the miles of cave passages already explored. Exploration is slow and tedious and it requires great physical stamina and uncommon courage. Many hours are now consumed traversing mapped passages before unexplored passages are reached. Exploring parties now consist of many people and much advance preparation. The significance of the passages already explored is not fully understood let alone those that are yet to be discovered. New knowledge could dictate essential changes in the management and use of the caves. Hence the Park Service considers it prudent to defer further consideration of the application of the Wilderness Act to the underground features in Mammoth Cave National Park.

Meanwhile, the Park Service will continue to manage the cave systems under existing statutory controls, and will prepare a resources management plan that will contain, among other things, a cave passage classification system. In developing the classification system, the Park Service will utilize all available knowledge about the cave passages including their physical appearance and the animate and inanimate resources they contain. Use will vary from "intense," as in those portions of Mammoth Cave developed with electric lights for public tours, to "highly restricted" where resources are fragile, such as some gypsum crystals that are so delicate they may be shattered by a current of air.

E. INTERRELATIONSHIP WITH OTHER PROJECTS

In its role as the foremost tourist attraction in Kentucky, there are strong economic ties between the park and the surrounding "Cave Country." Visitors find a variety of scenic and commercial attractions, lodgings, restaurants, and picnicking and camping facilities, both in the park and in the region. Outside the park, private business continues to expand.

On a 150-acre tract bordering park land ¼ mile east of Chaumont along Ky-70, an amusement (theme) park opened in July 1973. A franchised unit of a national campground chain, coupled with a small theme park, opened in 1974 along Ky-70

½ mile west of Cave City. Thus two more tourist-oriented businesses have been added near the park to about a dozen others established since the park's master plan study was completed in December 1970.

Now that Green River Parkway, between Owensboro and Bowling Green, is open to traffic, travel to the park through Brownsville should increase. This parkway eases travel from the vicinity of Chicago and St. Louis. Brownsville and Edmonson County generally should benefit economically, especially if travel over this route is promoted.

Commercial development along the park approach roads is beginning to cause traffic congestion that will worsen unless the roads are widened. These developments must maintain a uniformly high standard of appearance and of service to the public, else travel to the region will suffer eventually. Additionally, the rural countryside is disappearing that made the approach to the park so pleasant in years past. The advantages of cluster development over strip development should be considered.

Lack of municipal water and sewer service has constrained this development somewhat. Now that the adjacent counties are served by water districts, it will be only a matter of time until the approach roads are paralleled by pipelines. No plans have been made, however, for collecting wastewater from these developments and treating it in a regional facility.

As commercial enterprises come closer to the park, the danger becomes greater of polluting the underground streams that are in the caves beneath Mammoth Cave Plateau. Sources of pollution include sewage-disposal systems, spillage of petroleum products, agricultural pesticides and fertilizers, disposal of waste in sinkholes, and the like. Pollutants could kill the aquatic life in the underground streams and could make conditions unhealthful in the cave passages to the point where public tours would have to be cancelled. Either would be a tragedy. In fact, it would be desirable to establish a sewer district at the same time water became available.

No water quality standards have been established for underground streams. Their watersheds include both the Sinkhole Plain and Mammoth Cave Plateau. Disposal of both liquid and solid wastes in these watersheds has to be monitored and controlled, as necessary, to preserve the cave environment.

Pursuant to its obligations under Federal Water Pollution Control Amendments of 1972 (P.L. 92-500), Kentucky expects to complete by July 1975, the Green River Basin Water Quality Management Plans. Among other things, the plans will contain measurements of existing stream water quality, will specify water quality

standards, and will identify and analyze all pollutant sources. In the future, the plans will be updated as additional information and knowledge is obtained.

The underground streams are tributaries of Green River so discharges into sinkholes are covered by "point source" permits that require secondary treatment of wastewater by 1977, and a higher level of treatment by 1983. Pollutants in effluent are both biological and chemical, and either or both can adversely affect cave fauna, geological processes, aesthetics, and the health of cave visitors. Water quality standards for underground streams will be difficult to establish. They are based on assimilative capacity and the principal of nondegradation, i.e., not lowering the present water quality by effluent discharge. In addition to point sources, underground streams may be polluted in other ways, as mentioned previously. Little is known about the restorative ability of underground streams once a pollution source is removed. However, if a species of cave animals unique to the central Kentucky karst is lost to pollution, it could never be restored. Locating the source of pollution of an underground stream might be impossible. For these reasons, it is important that wastewater be treated at the tertiary level, wherever practical, and that all pollution sources be monitored very carefully within the watershed of the underground streams to prevent damage to the irreplaceable resources of Mammoth Cave National Park, which contains the longest cave system in the world.

Kentucky has no land-use laws though they have been and are being considered by the legislature. The Barren River Area Development District (BRADD), one of 15 multi-county districts in the Commonwealth, is charged with formulating and coordinating regional plans. Its plans are advisory and, if adopted, are carried out by the agency having jurisdiction. The superintendent of Mammoth Cave National Park has been working closely with Commonwealth and BRADD officials, with the county judges of adjoining counties, and with the city councils of nearby towns concerning the foregoing and other matters of mutual interest and concern. There is full local planning and zoning authority, but in the present political climate, this authority is not being exercised.

Further insight into the region's economy and problems is contained in the forepart of Section II, Description of the Environment.

II. DESCRIPTION OF THE ENVIRONMENT

The Region

Mammoth Cave National Park is partially situated in Barren, Edmonson, and Hart Counties, south-central Kentucky, within a vacation region known as "Cave Country." The master plan for the park was developed in the context of the region's natural and recreational resources and with respect for the social and economic effects of the proposals.

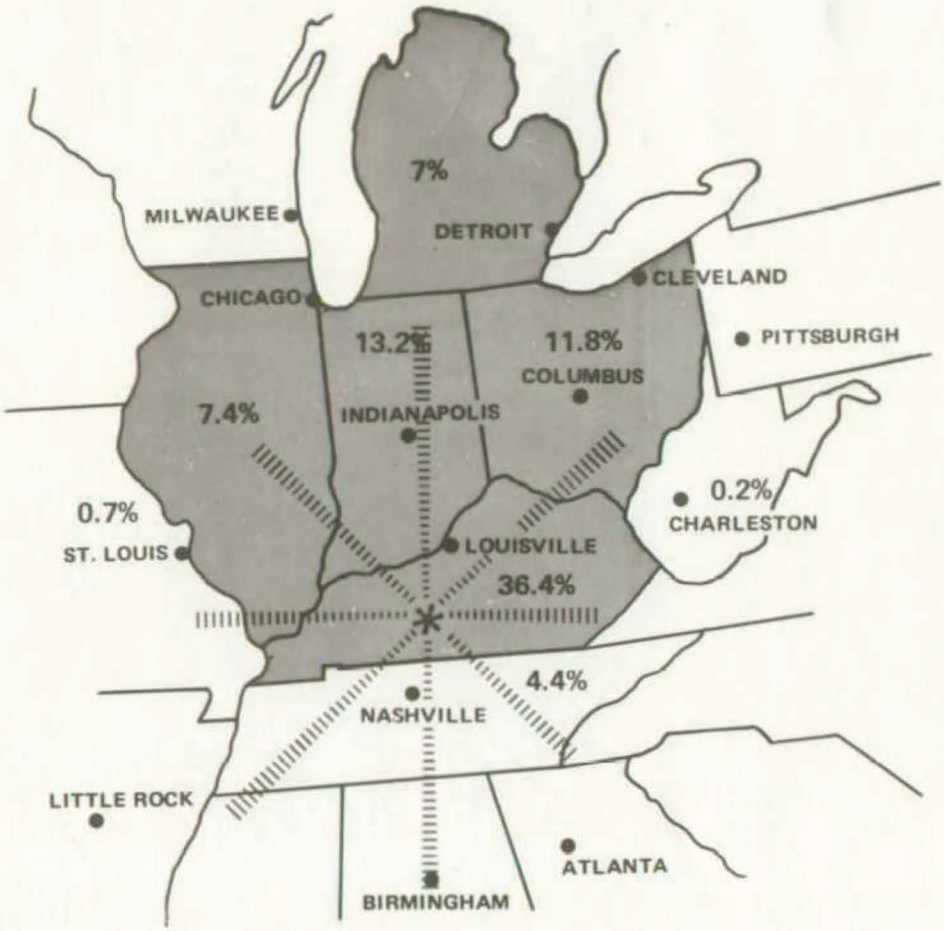
During the past 20 to 25 years, Cave Country has been turning from agriculture to manufacturing and tourism as its major sources of income, but this transition has not provided jobs for everyone. The rural population of Cave Country has been declining resulting from an out-migration to urban centers in Kentucky, Indiana, Ohio, and Michigan. For many, ties to the homeland are strong and they return to visit relatives and friends. Frequently, they visit Mammoth Cave to share with their children an experience of their youth.

Surrounding Mammoth Cave National Park is a rural area of small farms, few of which are self-sustaining. Strip mining for coal started recently near the park's northwestern border. About a mile north of the park is Nolin Dam constructed by the Corps of Engineers for flood control. Along the shores of Nolin River Lake are marinas, picnic areas, campgrounds, and summer homesites, and there is recreational boating and fishing on the lake. South of the park, about 25 miles distant, is Barren River Lake, another Corps' project, and a state resort park has been developed on its shores. Within 10 miles of the southeast corner of the national park, are a half dozen privately owned caves that have been developed and are being shown to the public.

In and near Cave City are a frontier village, outdoor theater, chair lifts, wax museum, wildlife museum, curio shops, service stations, motels, and restaurants. On the south side of the city, a 165-acre tract is being considered for a theme park of the Disneyland-type. Development would cost over $28 million if the project is activated. Adjacent to it, the promoters are considering a motel, convention center, and other establishments. A theme park opened on July 4, 1973, ¼ mile east of the main entrance to Mammoth Cave National Park along Ky-70 and -255. It is situated on a 150-acre tract of rugged land adjoining the national park.

In 1974, within an hour's travel time of Mammoth Cave, there were 35 motels providing 2,077 units and 29 campgrounds providing 2,454 campsites. More units are being added to keep up with the demand, among which are two campgrounds within 2½ miles of the park's main entrance at Chaumont, which have a total of 250 sites.

Two large population centers and many smaller cities and towns in a predominantly rural setting are within 2 hour's travel time. Louisville, Kentucky (361,500 people in



POPULATION OF STANDARD METROPOLITAN STATISTICAL AREAS (1970)

Akron, Ohio	679,239	Greenville, S. C.	299,502
Atlanta, Ga.	1,390,164	Indianapolis, Ind.	1,109,882
Birmingham, Ala.	739,274	Knoxville, Tenn.	400,337
Charlotte, N. C.	409,370	Little Rock, Ark.	323,296
Chattanooga, Tenn.	304,927	Louisville, Ky.	826,553
Chicago, Ill.	6,978,947	Madison, Wis.	290,272
Cincinnati, Ohio	1,384,851	Memphis, Tenn.	770,120
Cleveland, Ohio	2,064,194	Milwaukee, Wis.	1,403,688
Columbus, Ohio	916,228	Nashville, Tenn.	541,108
Davenport, Ia.	362,638	Peoria, Ill.	341,979
Dayton, Ohio	850,266	Pittsburgh, Pa.	2,401,245
Detroit, Mich.	4,199,931	St. Louis, Mo.	2,363,017
Grand Rapids, Mich.	539,225	Toledo, Ohio	692,571

TRAVEL INFLUENCE AREA

DISTANCE FOR 8-HOUR TRAVEL

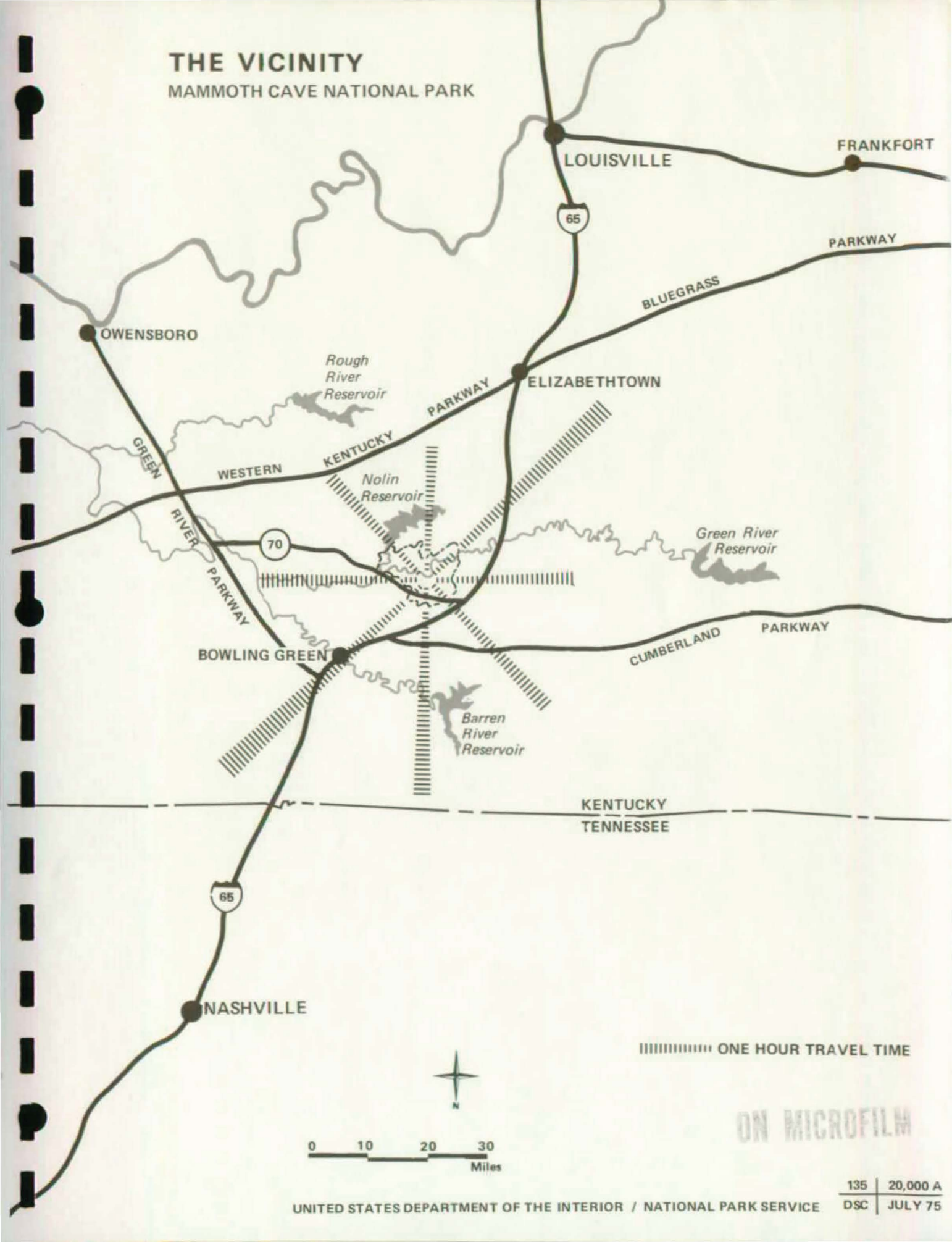
% VISITATION FROM STATE

MAMMOTH CAVE
NATIONAL PARK

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

135	20,027
DSC	JULY 75

ON MICROFILM

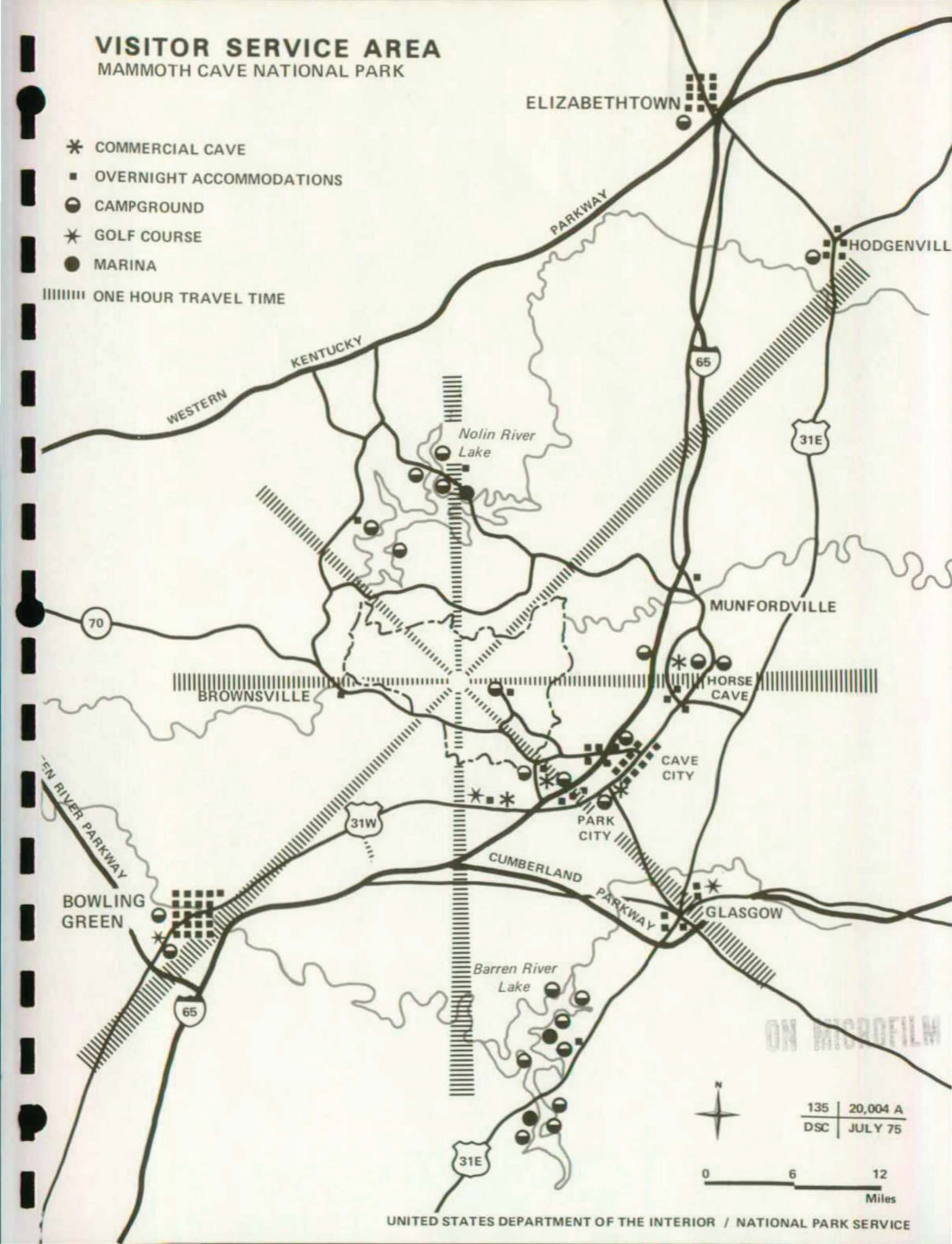


ON MICROFILM

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

135 | 20,000 A
DSC | JULY 75

VISITOR SERVICE AREA
MAMMOTH CAVE NATIONAL PARK



ON MICROFILM

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

1970), and Nashville, Tennessee (448,000 people in 1970), are connected by a new interstate highway (I-65). This road, and others feeding it, make it relatively easy for Kentuckians as well as residents of adjoining states to reach Mammoth Cave. This transportation corridor passes within 2.3 miles of the main park entrance at Chaumont. The Dixie Highway (US 31W) dating from the early 19th century and the mainline of the Louisville and Nashville (L&N) Railroad built before the Civil War occupy this corridor also. A Kentucky Department of Highways Survey made August 23, 1970, gives the following breakdown of visitors to Mammoth Cave:

Kentucky	36.4%	Michigan	7.0%
Indiana	13.2%	Tennessee	4.4%
Ohio	11.8%	Missouri	0.7%
Illinois	7.4%	West Virginia	0.2%
	All Others 18.9%		

Two new highways, completed in 1974, are bringing more people into Cave Country, viz. Green River Parkway from Owensboro in northwestern Kentucky and Cumberland Parkway from Somerset in eastern Kentucky. These highways are projected to carry a total of 16,300 cars per day by 1990.

Average daily traffic in 1974, at Cave City interchange on I-65, 9 miles east of the park via Ky-70, was 13,116 cars; by 1990, 22,300 cars are expected. Mammoth Cave is within a day's drive of 80 million people. It is the foremost tourist attraction in Kentucky according to the Department of Public Information at Frankfort.

Copeland's *1971 Survey of Travel in Kentucky* reports that, since 1954, all retail business rose at an average annual rate of 5.2 percent, but travel spending increased 6.3 percent. Tourists from other states spent 426 million dollars in Kentucky and 159 million dollars was spent by Kentuckians traveling within their own state or a total of 585 million dollars. This represents 10 percent of Kentucky's retail business.

The cities of Glasgow and Bowling Green, about 15 and 25 miles distant from the park, respectively, are growing as new industries are established in their area.

Planning for Cave Country is centered in the Barren River Area Development District (BRADD), which comprises 10 counties. The superintendent of Mammoth Cave National Park is a member of its council. A report titled *The Year 2000: A Long Range Plan,* printed in 1970, gives an overview of planning problems in the region. Several of the recommendations fortify the park's master plan:

- consolidation of farms and forest lands into larger units for more economical operation
- establishment of vacation farms, hunting preserves, and fishing ponds

- construction of six scenic highways for passenger cars, including one across the park to connect Nolin River Lake and Barren River Lake, thereby combining the three areas into a more cohesive recreation unit

For the park itself, the BRADD report suggests:

- that its scientific and natural integrity be maintained
- that day-use predominate
- that primitive walk-in and boat-in campsites be provided
- that a greater variety of cave trips be offered with smaller parties to increase quality
- that the park area be expanded to the north and to the south

No recommendation for land acquisition is included in the park's master plan, however.

Other studies have been commissioned by BRADD. One released in April 1971 concluded that Cave Country had:

- an inadequate visitor holding capacity
- a present tourist pattern that is dispersed
- an absence of major commercial attractions

Among the constraints on such development, recognized in the report, was the lack of water and sewer facilities. In addition to these studies, *An Appraisal of Potentials for Outdoor Recreation Development in Barren County, Kentucky* was released in 1972. Two studies relating to the feasibility of establishing the major vacation complex at Cave City, noted previously, were completed in 1973.

A *Comprehensive Water and Sewer Plan* report of 280 pages with numerous tables and drawings, commissioned by BRADD, was completed in July 1973. It includes data on the many separate systems that provide service in the 10-county area. Mammoth Cave National Park has its own water and sewer systems; others serve parts of the adjoining counties. The extent of and plans for future expansion of these utilities is of direct concern to the National Park Service especially in a circular zone of 7½-mile radius centered at Chaumont. A fourth of this circular zone is the cavernous southeast part of the park; the remaining three-fourths includes parts of Barren, Edmonson, Hart, and Warren Counties, also underlain by cavernous limestone. This 15-mile diameter zone is in a karstic region where there are few surface streams and thousands of sinkholes and fissures. Through them precipitation and surface water disappears rapidly underground. Much of the groundwater collects in subsurface streams that flow northward through natural conduits in the limestone and discharge into Green River. It is common practice to dump waste and wastewater into sinkholes, but continuing and extending this method of disposal is likely to damage the cave systems.

Agriculture is the predominant land use in the circular zone, but the area is also influenced by the cluster of tourist-oriented development at Cave City (1,818

population in 1970), by Park City with its 567 people in 1970, by several commercial caves, and Park Mammoth Resort. Two major highways (I-65 and US 31W), many secondary roads, and the L&N Railroad all cross the zone.

According to the aforementioned report, there are no plans for water or sewer service in the sections of Hart and Warren Counties included in the circular zone. The data in the following paragraphs concerning water and sewer systems in Barren and Edmonson Counties comes also from the report and from information supplied by the Water Resources Division, Geological Survey, Louisville.

Barren County – A municipal water system, drawn from wells, was established by Cave City in 1949 and by Park City in 1956. The former abandoned its wells and connected to Green River Valley Water District in 1963, and the latter took similar action in 1974 by connecting to Edmonson County Water District.

Green River Valley Water District was organized in 1959 and began operating in 1963. Its principal water source is Rio-Verde Spring with an estimated minimum flow of 2.9 mgd (million gallons per day) and a treatment-plant capacity of 1.0 mgd. An alternate intake on nearby Green River can provide an emergency supply of 2.16 mgd. Green River Valley Water District served 1,871 customers or about 6,500 people during the period December 1971 to November 1972 in the communities of Horse Cave, Cave City, and Hiseville. The average daily consumption was 577,100 gallons. The district's 5-year plan calls for expanding treatment-plant capacity to 1.5 mgd and 400 additional customers will be served.

Barren River Lake is another major water source for Barren County. The lake is an impoundment operated by the Corps of Engineers. The minimum 7-day mean discharge for the climatic years (year beginning April 1) 1939-1962 was 22.4 cfs (cubic feet per second) for the gaging station on Barren River near Pageville. This gaging station is now in Barren River Lake, but the flow record would represent part of the flow into the lake. The drainage area above the gaging station is 531 square miles as compared to the drainage area above the dam of 940 square miles.

On the north shore of the lake, Glasgow Water Company has a 6.0 mgd treatment facility. This company also has a 2.5 mgd plant north of the city of Glasgow along US 31E. Barren River Water District was reactivated in 1972 to service the rural areas of Barren County not included in other districts. It is reported that 500 customers have signed up for water. The district has contractual arrangements with Glasgow Water Company for supplying water at bulk rates, maintenance, and billing services. Barren River Water District had prepared plans to supply water to the area along Ky-70 between Cave City and Chaumont.

Only municipal sewerage systems have been established in Barren County. Elsewhere individual septic tanks or pit privies are being used. Cave City's system was constructed

in 1964. Secondary treatment is provided by a high rate trickling filter with a design capacity of 320,000 gd (gallons per day) of wastewater. Other treatment processes include grit removal, comminution, primary and secondary clarification, and chlorination. BOD removal efficiency averaged 84 percent for 8 months in 1971, which is below the current state standard of 85 percent BOD removal for secondary treatment. An average of 204,000 gd of wastewater was treated in 1972. Peak flows occur during summer months coincident with the travel season to Mammoth Cave National Park, when the influent to the treatment plants averaged 266,900 gd. This peak flow is equivalent to 150 gd per person served by the system. The effluent is discharged to groundwater through a sinkhole. The clustering of tourist-oriented business around Cave City was mentioned previously. This has come about partly because of a plentiful water supply and adequate municipal sewerage disposal.

BRADD's report (p. 189) made the following observation and recommendation:

> "The existing wastewater disposal plants at Horse Cave and Cave City discharge their effluent to the groundwater through sinkholes. The total average flow treated and released into underground streams by these treatment plants during 1972 was over 500,000 gd. The long-term impact on the quality of the subsurface water as a result of large volumes of wastewater effluent being discharged over an extended period at one point is unknown. Continuation of this practice may preclude the use of groundwater in this area for water supply or for any other purpose. Another potential consequence is the contamination of underground streams that flow in the caves of Mammoth Cave National Park. It is therefore recommended that a treatment plant to serve Cave City and Horse Cave be constructed near Green River, the nearest stream large enough to dilute the effluent effectively. The proposed location also will enable the facility to serve the city of Munfordville. Thus, any danger of pollution of the groundwater by these municipalities can be eliminated."

At the present time, Park City residents use individual septic tanks, but plans are underway to establish a sewerage collection system and construct a secondary treatment facility. The effect on groundwater would be lessened by upgrading to tertiary treatment. In either case, the treated effluent would be discharged in a sinkhole for there are no surface streams. An alternative would be to pipe the wastewater to Cave City for treatment and disposal, but that would be more costly in dollars.

On the basis of the known hydrology, it is highly important that Park City's future sewerage treatment facility be adequate in every respect. The effluent is more likely to be deleterious to groundwater quality in the park, because of the proximity of the city and the park. Park City's growth has been constrained by lack of sufficient water and no municipal sewerage system. When both constraints are lifted, the city's population

could grow much faster than predicted along with more business establishments, so the potential of altering the ecology of the cave systems will be greater. This would take many years to correct, if indeed it could be corrected at all.

The 500-site KOA Campground at Diamond Caverns, about ½ mile south of Chaumont along Mammoth Cave Parkway draws its water from wells, and has a package sewerage treatment plant that discharges into a sinkhole. The plant was authorized in 1970. Sewerage from Wondering Woods, a theme park ¼ mile east of Chaumont along Ky-70 and -255, enters a septic tank and drain field adjoining the park boundary at Doyel Valley. This system was constructed in 1973 upon approval of the Kentucky Division of Sanitary Engineering.

Cave Country has had some experience with polluted groundwater. For example, Hidden River Cave in the town of Horse Cave has been closed to public tours for many years. Effluent from a cheese factory was discharged into a sinkhole; moreover, the present municipal treatment plant also discharges into a sinkhole. At Bowling Green in Warren County, there have been instances of gasoline leaking into underground streams. This has caused great concern lest an explosion occur.

Edmonson County – This county is supplied by the Edmonson County Water District, which has been operating since 1969. Its intake and treatment facility are situated on Green River between Brownsville and Dam 6. The district supplies Brownsville, and its pipelines extend eastward across the county to serve Park Mammoth Resort, Park City, and many customers in between. The system has been expanding rapidly. The 7-day minimum discharge of the Green at Brownsville, prior to construction of the Nolin and Green River dams, was 137 cfs for the climatic years 1925-1930 and 1939-1961. Regulated flows, since construction of the dams, can be expected to be equal to or greater than this amount. The treatment-plant capacity is 0.576 mgd and it is now operating at about 50 percent of its capability. Rural customers now total about 700. Connections in Brownsville and Park City combined are an additional 400.

Brownsville, 1970 population 542, has the only municipal sewerage treatment plant in the county. It does not serve any of the adjacent rural area. Again most people in the county use individual septic tanks or pit privies. Park Mammoth Resort has its own lagoon.

Untreated or improperly treated wastewater is not the only source of contamination of groundwater. It can be polluted by spillage or leakage of petroleum products, application of agricultural herbicides, pesticides, and fertilizers, and drainage from a landfill. Unless properly treated, surface runoff and wastewater from the proposed industrial park at Stovall along the L&N Railroad in Barren County, could be harmful. Depending on the kind of pollutant, the physical appearance of caves could be altered, the wild creatures living in them could sicken and die, explosive conditions could

occur, or foul odors could be produced that would be unpleasant or unhealthful to visitors and force the closing of cave passages to public tours.

Now that plentiful water is, or will become available within the 15-mile circular zone, cited previously, development is likely to increase more rapidly than in the past. This will generate more liquid and solid waste. Wastewater treatment facilities are not keeping pace with development. Supplying potable water without providing for wastewater treatment in approved central plants of adequate capacity could prove disastrous to groundwater quality and to the cave systems in the long term.

Moreover, uncontrolled development along the highways approaching the park could detract from the quality of a visit to Cave Country. The present rural countryside is pleasant and adds to the anticipation of a national park visit. This type of scenery prevails along I-65 and continues along Ky-70 and Ky-255 to the park boundary. However, Ky-70 from Cave City to Chaumont is becoming lined with a conglomeration of businesses. Some of it is unsightly and traffic congestion is beginning to develop. As congestion worsens, the only solution is to widen the road, but the cost will be prohibitive later on. Possibly 60 percent of park visitors turn off I-65 at Cave City and follow Ky-70 to the park. Business expansion and congestion is likely to occur in the future along Ky-70 between Brownsville and the park now that Green River Parkway is open, and travel time and distance to the park is shorter for people living in the Chicago and St. Louis areas. The remaining approach from I-65, at the Park City interchange, may remain free of commercial development except for what has been established already. Mammoth Cave Parkway (Ky-255) was designated a limited-access roadway by the Kentucky Department of Highways when it was rebuilt in 1968. This policy will continue provided it receives strong public support.

If and when the aforementioned developments are carried out in the region, park visitation is likely to rise faster than the master plan forecasts because more people will be attracted to Cave Country and they will be staying longer.

It was mentioned previously that BRADD is commissioned to prepare plans to guide development in Cave Country. However, these plans are unenforceable without the concurrence and action of the county or city involved. The Commonwealth has delegated full authority for planning and zoning to local jurisdictions. At this time, imposing any control on land use is unpopular and elected officials are reluctant to advocate it. Maintaining the quality of the environment in the 15-mile circular zone is essential to perpetuation of tourism. The quality can be degraded or destroyed without forthright action to provide for adequate and proper liquid and solid waste disposal, and without guiding the appearance and density of development along the approach roads to the park.

The Park

Establishment of Mammoth Cave National Park was authorized by Congress (act of May 25, 1926, 44 Stat. 635), following a study made by the Southern Appalachian National Park Commission. It was to comprise 70,618 acres of land, all of which was in private ownership. Through donations of land and money by citizens, supplemented with funds appropriated by the Kentucky legislature and Federal monies, sufficient land was acquired, 34 years ago, to establish the park on July 1, 1941. It now covers 51,354.40 acres of land. This land had been farmed, grazed, and logged for over a century and a half. Since the park's establishment, annual deposition of tons of silt in surface and underground streams, because of old-fashioned farming practices, has been checked, soil fertility has been improving as the forest cover develops, and the scenic beauty of the area has been enhanced. The three zones in Mammoth Cave National Park, each of national significance – Mammoth Cave Plateau, River Valleys, and Hilly Country – will be described in sequence.

A. MAMMOTH CAVE PLATEAU

1. Natural Resources

Of the three prime park features, the plateau, which comprises the southeast section, is best known to the public. Beneath its ridges and valleys are exceptional lineal cave systems, of which Mammoth has 75.9 miles mapped to date. Mammoth Cave Ridge is about ½ mile wide and more than 3 miles long. Flint Ridge is about 2 miles wide and more than 3 miles long. Under it, some 91.19 miles have been surveyed. On December 1, 1972, the National Park Service announced that Cave Research Foundation explorers had discovered a connection, beneath Houchins Valley, between Mammoth Cave and the Flint Ridge Cave System. This confirms a belief long held by those familiar with the cave passages in the park, and it required uncommon courage, great stamina, and years of exploration to achieve this discovery. Water in an underground stream, Echo River, was barely low enough when the connection was made for the explorers to wade through. The combined length of passages in the Mammoth-Flint Ridge Cave System surveyed through 1974 is 167.1 miles and many more miles will be added as exploration continues. This is the longest cave in the world. The next longest cave is Holloch Höhle in Switzerland, 71.8 miles, less than half the length of the Mammoth-Flint Ridge Cave. Joppa Ridge contains caverns of unknown extent beneath a surface area as much as 2 miles wide and about 3 miles long. By 1975, 13.14 miles of one of these caverns, Lee Cave, discovered in 1968, has been mapped.

Nearly every type of cave formation is displayed in the park. There are also a number of underground streams of which Echo and Roaring Rivers in Mammoth Cave are best known to the public. A stream in Flint Ridge discharges at Pike Spring at the edge of the Green River. Groundwater has

been traced a distance of 7 miles from several of the sinking streams on the Sinkhole Plain, beneath the plain to Mill Hole, thence to Cedar Sink, and then to the springs in the Green River at Turnhole Bend.

The three northwest-trending, cave-bearing ridges are bordered by three major solution valleys – Woolsey, Doyel, and Houchins – which are up to 300 feet deep and are rimmed by discontinuous cliffs 100 to 150 feet high in places. The solution valleys are underlain also by cave passages of unknown extent. Many cannot be explored because they are wholly or partly in the phreatic zone. Elevations vary from about 425 feet in Cedar Sink to 902 feet at Little Hope Church near the park's eastern boundary. In all, Mammoth Cave Plateau is about 23,000 acres in extent or 45 percent of the total park.

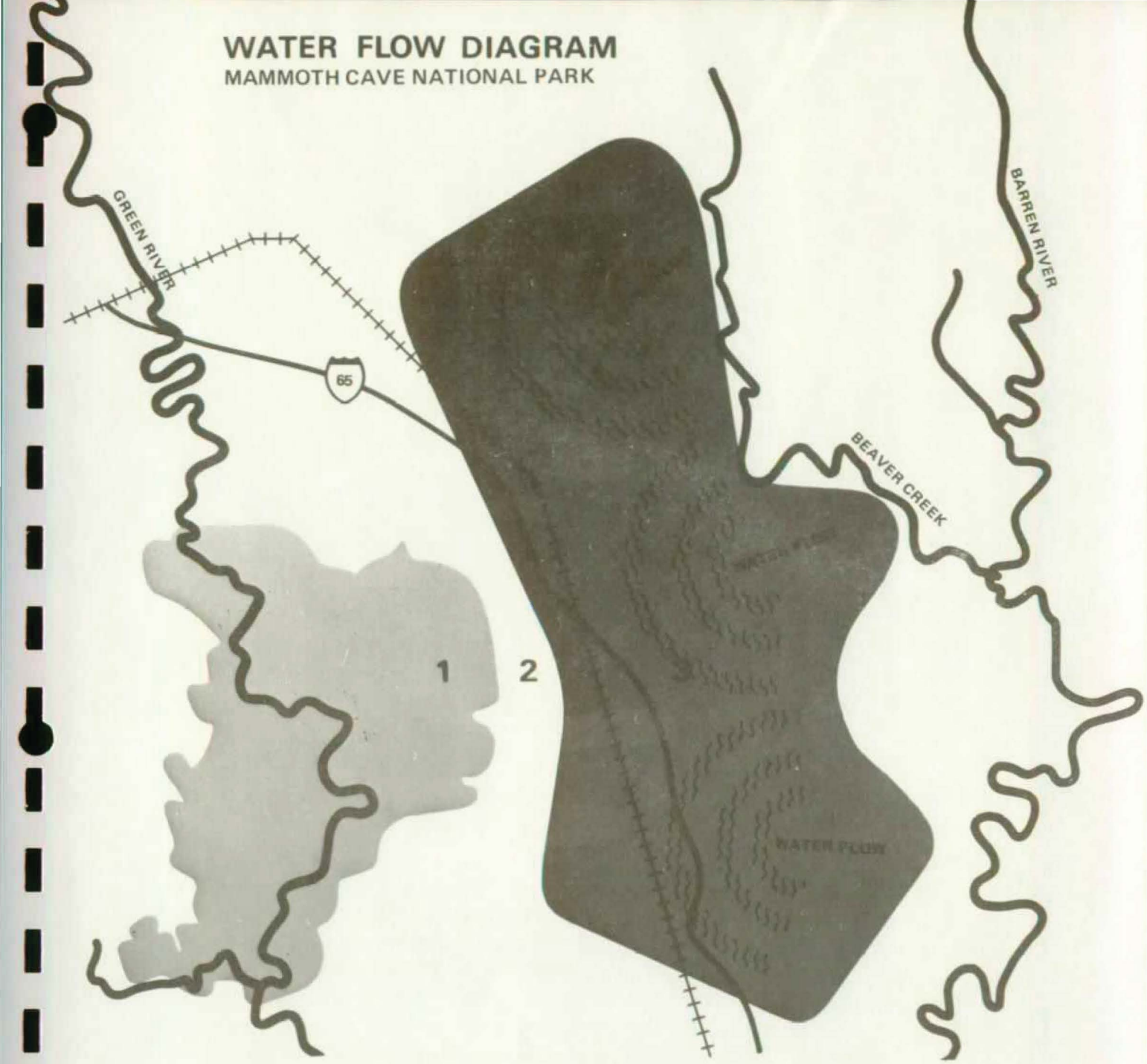
Once the Green River and its tributaries flowed across the Mammoth Cave Plateau on top of the Big Clifty sandstone. The tributaries entering the Green River from the south drained a large area called the Pennyroyal Plateau. In time the erosion-resistant sandstone was breached and the water table dropped as the Green River lowered its bed. Concurrently, water from the Pennyroyal found its way underground and flowed through the solution passages it formed in the limestone. These are the dry cave passages tourists visit today. The valleys, which separate the ridges of the Mammoth Cave Plateau, are the result of solution and subsidence.

Beneath the surface of the park are several trunk conduits that carry drainage to the Green River from the Sinkhole Plain, the northern part of the ancient Pennyroyal Plateau. Much of the Sinkhole Plain is in agriculture. Pesticides, herbicides, fertilizers, and wastewater may contaminate the several trunk drains flowing through the cave systems in the park. These underground streams discharge into the Green River at seven or more big springs along its banks or in its bed. The Sinkhole Plain is a 100,000-acre area to the south of the park where agriculture is the predominant land use, at present, and it is crossed by highways, the main line of the L&N Railroad, natural gas pipelines, and water mains. There are also several towns on the Sinkhole Plain.

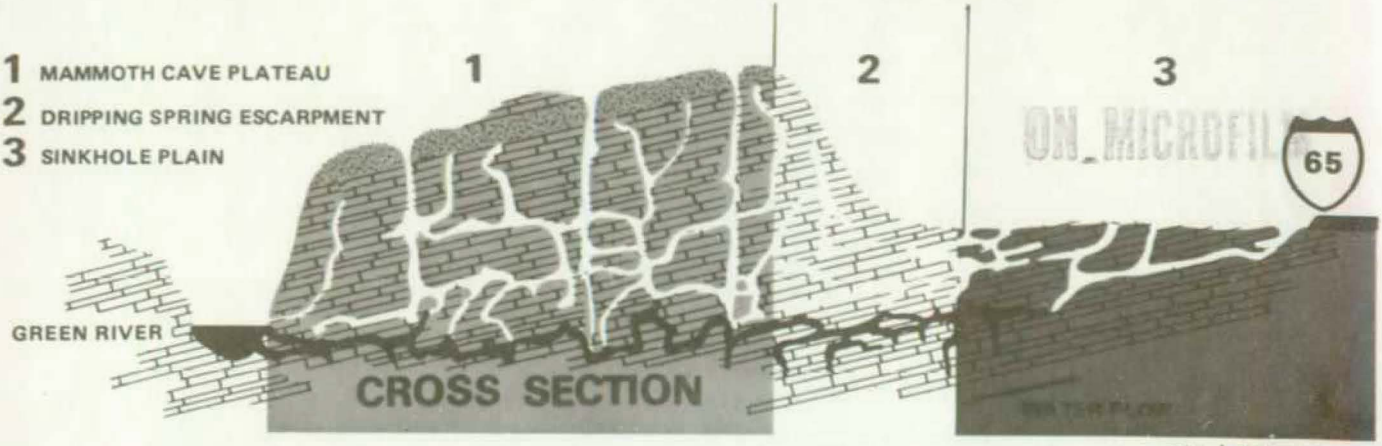
Capping the ridges for the most part, is the Big Clifty sandstone, 50 to 120 feet thick. Below it is the limestone of the Girkin formation, 95 to 190 feet thick. Beneath that is the Ste. Genevieve limestone, 180 feet or more in thickness. This last contains the cave passages that were formed at different levels as the Green River lowered its bed. This process is continuing.

Not only is the Big Clifty erosion resistant, it is also impermeable to water. Hence, rainfall moves outward to the perimeter of the ridges where it drops

WATER FLOW DIAGRAM
MAMMOTH CAVE NATIONAL PARK



1 MAMMOTH CAVE PLATEAU
2 DRIPPING SPRING ESCARPMENT
3 SINKHOLE PLAIN



CROSS SECTION

ON MICROFILM

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

135	20,007 A
DSC	JULY 75

into vertical shafts or flows a short distance into sinkholes in the solution valleys. The perched water table on Flint Ridge owes its existence to porous rocks and soils overlying the Big Clifty. The water emerges as springs. These have been tapped to provide the major sources of domestic water for the park.

The cap rock also protects the caves from physical damage. The ridge tops are good locations for roads and buildings, except that oils and tars from vehicles deposited on road surfaces and washed off by rainfall may eventually enter the caves.

It has been observed at Historic Entrance that the dry outside air is drawn inward in winter; the opposite occurs in summer. The circulation of air through the cave passages is a natural phenomenon that is thought to be triggered by differences in barometric pressure above and below ground. When air is inhaled at Historic Entrance, it is simultaneously exhaled through cracks, fissures, and shafts. The reverse occurs also. Thus, atmospheric contamination from combustion (emissions from vehicles and heating plants) may enter the caves.

The water table was raised when the Corps of Engineers completed, in 1907, the uppermost of a series of six locks and dams on the Green River to improve navigation. Lock 6 had a 9-foot rise at the time it was built. This caused some cave passages upstream to be flooded. Those just above the water table are flooded periodically, when the Green River rises. These passages and those near the perimeters of the ridges may contain dripstone or flowstone formations. The dry passages under the cap rock have carbonate and sulfate minerals deposited on the ceilings and walls.

The very long horizontal passages, elliptical or canyon-like in cross section, are best known to visitors. A spectacular example is Cleaveland Avenue in Mammoth Cave, which is 1½ miles long, averaging 40 feet wide and 15 feet high. Throughout the caves, passages join and diverge on at least five different levels. Among the distinctive features of the caverns are the vertical shafts, called domes or pits, which resemble the interior of a silo. They are of all sizes, up to 40 feet or more in diameter and 130 feet in height. Mammoth Dome and Bottomless Pit are typical of these shafts.

In all, some 200 kinds of animals are known in the cave passages of the park, including two species of "blindfish." Some live in total darkness, high humidity, and 54 degrees constant temperature; others may leave the cave for varying lengths of time and return to it. For many animals, the only source of nutrients is washed into the cave by water. Any change in the

environment, especially in the quality and quantity of water, could destroy whole communities of cave life. About a third of the animals have been isolated from other cave systems for over a million years. A shrimp, a beetle, a pseudoscorpion, and perhaps a book louse and a millipede are found only in the central Kentucky karst. Once extirpated, they could never be replaced. The Indiana bat, an endangered species, utilizes certain caves in the park.

The Kentucky cave shrimp (*Palaemonias ganteri*) is a freshwater species that is colorless and eyeless. It depends on annual flooding of relatively quiet pools in autumn when water levels are lowest, microorganisms are present, and the majority of the young hatch. According to the Office of Endangered Species and International Activities of the Fish and Wildlife Service (FWS), it is known in only two pool systems, both in Mammoth Cave National Park: Roaring River in Mammoth Cave and near Golden Triangle in Crystal Cave, where there are only small populations though it was once abundant along tourist trails in the Echo River passage. The FWS also observes that there has been a considerable reduction in population during the past 40 years because of periodic sewage pollution. In 1967, many shrimp were lost through premature opening of the flood gates in Nolin River Dam. This remains a danger along with similar releases from Green River Dam. Because of its uncertain status, the FWS "considers this species a candidate for the official list of endangered species" (1974). The Kentucky cave shrimp may have become extinct according to one authority who has not seen any of them since 1967.

Water of the proper quality and quantity is basic to perpetuation of the animal and plant life in the caves and to the geologic development of the cave passages. In this region of 50 inches annual rainfall, there are few surface streams, for water disappears quickly underground through sinkholes, swallow holes, cracks, and fissures.

In karst areas, besides the hydrologic cycle, the surface of the earth and the cavernous limestone beneath are complexly and vitally interrelated biologically, climatologically, geologically, and mineralogically. Uses of the surface that affect the quality of air and water directly affects the subterranean environment. Moreover, on the time scale of man, caves are not a renewable resource. Each visitor to a wild cave progressively deteriorates it, for the marks of his passing and the trash he leaves behind are not erased as they are when exposed to sunlight and weather. In sum, caves are fragile. Special management techniques need to be applied to the surface and the underground to protect the unique aesthetic, recreational, and scientific values of the caves.

The ease with which visitors view Mammoth Cave belies the stamina and uncommon courage required of those who enter wild cave passages. Those who do so face great danger; they often suffer physical discomfort and experience sheer exhaustion while crawling over sharp rocks and through mud, while wriggling through crevices, while climbing precipices, or descending into deep pits. The constant 54-degree temperature and high humidity sap one's strength, and combine with the stygian blackness to form an environment inhospitable to man.

In addition to the cave passages, visitors find the land surface fascinating with its many sinkholes, lack of surface streams, rock-capped ridges, forests, overgrown fields, and varied wildlife. Living on the surface of the Mammoth Cave Plateau are communities of plants and animals that include 84 kinds of trees, 28 varieties of shrubs and vines, 29 types of ferns, and 209 wildflowers. The cedar karren and savannas of the solution valleys are picturesque and of special interest to scientists. Some species of plants and animals have been introduced by man. Of the 41 kinds of mammals, Virginia white-tailed deer, raccoons, opossums, grey and red foxes, grey squirrels, rabbits, woodchucks, chipmunks, skunks, and bats are observed frequently. Deer are live-trapped and released elsewhere in the state in an effort to keep the herd within the limits of its food supply. There are 203 species of birds, 18 kinds of reptiles, and 15 amphibians. Invertebrates are numerous; chiggers, ticks, and flies are pests to man and beast.

Fossils are generally distributed throughout the rocks of Mississippian Age in the park. The fossils include brachiopods, crinoids, and corals. There are no places where fossils are concentrated and no unique forms have been found, according to the U.S. and Kentucky Geological Survey staff geologists.

2. Cultural Resources

Pre-Columbian Indians of four cultural periods occupied the park and its environs: Mississippian, Woodland, Archaic, and Paleo-Indian. These peoples hunted in the area that is now the park and lived in cave entrances, beneath rock shelters, and near riverbanks. No sites have been identified in solution valleys or on ridge tops. Evidence of Indian activity, if indeed it had occurred there, has probably been erased by post-Columbian agriculture and erosion. Woodland peoples practiced primitive agriculture on river floodplains. They also penetrated as far as 2 miles into cave passages where they chipped gypsum and mirabilite from the walls. Two mummies have been found, and numerous human feces have been analyzed to determine the diet of these people. Sandals, bags made of twine, reed torches, remains of campfires, smoke smudges on walls and ceilings, and prints of bare feet preserved in the mud, are among the evidences of Indian use and activity

underground. Much evidence of Woodland Indian activity has been observed in Salts Cave. T. G. Sloan and Douglas W. Schwartz of the University of Kentucky did considerable field work in the park, surface and underground, during the summers of the late 1950s. Their manuscript (1960) titled *Archeological Survey of Mammoth Cave National Park, Kentucky* is in the park's files. Much more recent archeological work has been done by Patty Jo Watson and she has published extensively.

Mammoth Cave was discovered by modern man about 1798. Tradition credits a hunter who stumbled upon the cave's only natural entrance while chasing a wounded bear. This opening is known today as the Historic Entrance.

Subsequently, someone noted that the dirt on the floor of the cave was rich in saltpeter used in the manufacture of gunpowder. With the advent of the War of 1812, exploitation of Mammoth Cave began. The rich "peter dirt" was mined and the saltpeter was leached from it. Cave visitors today see some of the relics of this period including leaching vats and wood pipes made by drilling holes lengthwise through straight yellow-poplar logs up to 30 feet in length and 6-8 inches in diameter. This industry began in 1809 and flourished for nearly a decade, ending after the close of the war.

Visitors hearing of the immensity of the cave began to come, and public tours guided by Negro slaves started in 1816. The guides explored deep into the passages and found many wondrous things. In time, Mammoth Cave was extolled as the seventh natural wonder of the world. Trails, bridges, ramps, and stairways were built to improve the footing for visitors. This construction often required blasting.

People arrived after many days' journey on foot or horseback over dusty or muddy roads and had to have lodging and food. Hence, the saltpeter miners' log cabins became the nucleus of a hotel and such accommodations have been provided ever since. Fire destroyed the hotel in 1916. The present "Old" Hotel at Historic Entrance dates from 1925 and it was remodelled in 1930, 1936, and 1940. The building was acquired by the National Park Service in 1941. It is a two-story frame structure with basement and a one-story addition all resting on a concrete foundation measuring approximately 33 feet x 283 feet. A one-story screened porch with hipped roof extends partially across the front. The building has clapboard siding and an asphalt shingle roof. It appears to be well maintained, but there is some unevenness of the first and second floors that could indicate deterioration of the structural members. Architecturally, it is fairly typical of rural hotels constructed during the same period.

Today, the basement level contains the national corporate offices of National Park Concessions, Inc. This firm is the principal concessioner in Mammoth Cave National Park. It operates the Old Hotel and other lodgings, food services, curio sales, automobile service station, camper's store, and a transit system in the park. The Old Hotel contains 46 guest rooms on the first and second floors, a craft shop, and a snack bar.

Dr. John Croghan, seeking a cure for tuberculosis, established a hospital in Mammoth Cave in 1843. Two of the patients' roofless stone huts, erected in the cave, remain today. The experiment was not successful.

Searches for entries into Mammoth Cave at the east end of the ridge began in 1915. These culminated in 1921 with the formation of the Mammoth Cave Development Company that opened New Entrance that same year. This entry is about 3 miles east of Historic Entrance. It descended the side of King Solomon's Dome by ramps and stairways, and a series of tunnels blasted in the limestone. From Grand Central Station, at the bottom of the descent, trails were constructed into passages nearby and visitors were conducted on tours. On March 12, 1923, the spectacular area named Frozen Niagara was discovered and trails were extended to it. The following year, the Frozen Niagara portal was opened enabling visitors to descend King Solomon's Dome and exit through the Frozen Niagara section without retracing their steps. For the benefit of its cave patrons, the Mammoth Cave Development Company built New Entrance Hotel in 1923 containing 25 rooms. Its name was changed to Frozen Niagara Hotel in 1936. The building was razed in 1945. New Entrance was closed in 1967 because of unstable rock, but Frozen Niagara portal has been open and in use continuously since 1924.

On Flint Ridge, Colossal Cave was owned and exhibited to the public by the L&N Railroad. Great Onyx Cave and Crystal Cave were developed and shown commercially by their owners. Similarly, on Joppa Ridge, Proctor Cave was opened to visitors. The proprietors of Great Onyx and Proctor Caves built hotels for their patrons. There was great rivalry among cave owners, but Mammoth Cave had received the most publicity and enjoyed the most patronage.

A casket in Crystal Cave contains the remains of Floyd Collins, an intrepid cave explorer, who became entrapped in Sand Cave while seeking a connection between it and Mammoth Cave. He died on February 16, 1925, before he could be rescued. Floyd is credited with discovering and exploring Crystal Cave on his father's farm. The house near the entrance to the cave, according to tradition, was the Collins' farmstead. Presently this three-room,

one-story frame house partially covered with clapboards and vertical boards and battens, and a corrugated metal roof, is in very poor condition. It rests on a foundation of field stone piers laid up without mortar. The wood floors are badly worn, and the sills, wall framing, boards, and battens have rotted.

Near the farmhouse is a ticket office building, which was constructed many years after Collins' death by a subsequent owner and operator of Crystal Cave. This building is similar architecturally to the "dog-trot" cabin of the southern mountain region having two units separated by a center hall or passage. One unit consists of only one room. The other contains a shower room, dressing room, and toilet rooms. Both units are encircled by a porch and there were benches between supporting log posts. Structurally it is frame covered with clapboards. The hipped roof has a corrugated metal cover, and the foundation is of field stone, walls and piers, some of which have been replaced by concrete block. The porch floor framing and floor boards have deteriorated to a dangerous condition, rot was observed in the clapboards and wall framing, and the roof appears to be in poor condition.

Mammoth Cave has witnessed more than a century and a half of visitation. Persons have come on foot, on horseback, in stagecoaches, by railroad, packet boat, bus, and automobile. From 1886 until 1931, the Mammoth Cave Railroad Company operated an 8-mile spur off the main line of the L&N Railroad from Glasgow Junction (now Park City) to Mammoth Cave. On exhibit, near Historic Entrance, is the dummy-type locomotive "Hercules" and a baggage/passenger car that were used on this spur line. This train is protected from the elements by a roof and from vandalism by a high wire fence. The alignment of the old railroad grade is now the corridor of the major access road to Historic Entrance.

In years past, the hallmark of Mammoth Cave was its restful atmosphere, following a tedious and rugged journey. Louisville and Nashville, the nearest large cities, were more than a hundred miles away, though they were connected by highway and railroad. Trips in the cool cave, swims in the river, elegant dining, and relaxation on the hotel's veranda made this a vacation destination.

In 1905, a movement got underway, spearheaded by the Kentucky Congressional delegation, for Federal ownership and operation of Mammoth Cave. At the behest of Congress the Southern Appalachian National Park Commission studied the area and made a report to the Secretary of the Interior. The result was an act of Congress approved May 25, 1926 (44 Stat. 635), which authorized establishment of Mammoth Cave National Park after a minimum area of 20,000 acres was acquired and title vested in the United States in fee simple.

Land acquisition with donated funds was begun by the Mammoth Cave National Park Association, but monies were insufficient and progress slow. Funds were appropriated later by the Kentucky legislature and by the Congress, and negotiations with landowners were undertaken by the National Park Service. On May 22, 1936, 27,402 acres had been acquired and accepted by the Secretary of the Interior, and the area was declared a national park on July 1, 1941. Later the Great Onyx and Crystal Cave properties were purchased for the park.

With lands added after 1936, the park now comprises 51,354.40 acres of the 70,618 acres authorized. The park includes the cave-bearing ridges, segments of the Green and Nolin River Valleys, and the Hilly Country north of the Green, and that portion south of the Green west of Turnhole Bend.

All land in the park was privately owned. In some cases cave rights were purchased separately from surface rights. On the Mammoth Cave Plateau, as elsewhere in the park, people lived on the land. About 600 families resided in the area acquired. The flat ridge tops, valley floors, and river floodplains were in crops like corn and tobacco that depleted the fertility of the soil. Erosion went unchecked. Some lands were grazed. Slopes too steep to cultivate remained forested and these had been logged several times. Mine timbers cut from the forests were shipped by barge down the Green River. There was a network of wagon roads connecting farms to one another and to markets in towns nearby.

At Historic Entrance, there was a hotel and associated buildings, parking areas, a post office, and private residences.

Following land purchase, farming and logging ended, families moved away, buildings and fences were demolished, the forest cover began to return, and erosion was controlled with the aid of Civilian Conservation Corps' projects. During the period from May 1933 to July 1942, four CCC camps were operating in the park.

Reminiscent today of the years of private cave ownership and operation are the "old" Mammoth Cave Hotel; "Hercules" (locomotive) and coach of the Mammoth Cave Railroad; Floyd Collins' farmhouse and the Crystal Cave ticket office nearby; three one-room frame churches where services are held on Decoration Day each year, and Little Hope Church, on the edge of the park, which holds services weekly; occasional fences, chimneys, wagon road traces, and cemeteries; and Chaumont, Union City, and Sloans Crossing, which are the names of road junctions. In Mammoth Cave are the remains of the saltpeter manufacturing process and a tuberculosis hospital; walls and

ceilings darkened by smoke from workers' and visitors' torches; abandoned trails with their flights of wooden stairways; countless names, initials, and dates inscribed on the walls of the passages from early times; and archeological remains.

Union City was the name given to a "T" intersection along Joppa Ridge Road where an unimproved dirt road headed north across Doyel Valley to New Entrance Hotel. The Geological Survey quadrangle sheet printed in 1922 shows a cluster of four structures at the intersection and 14 others within a ½-mile radius including a church. All have disappeared, but Locust Grove Cemetery reminds one today of the location of the church. In the memory of a prominent local citizen, who was born and raised at Union City, all the structures were farmhouses and dependencies. Union City was probably also a "whistle stop" on the Mammoth Cave Railroad. Its single track paralleled Joppa Ridge Road between Chaumont and Sloans Crossing. Joppa Ridge Road was rebuilt by the National Park Service about 1960 and became a segment of Ky-70.

There are no cultural sites within Mammoth Cave National Park listed presently on the National Register of Historic Places, but in compliance with Section 2(a) of E.O. 11593 of May 13, 1971, seven sites are being nominated in 1975 for possible inclusion on the register. Other sites are being studied.

3. Recreational Resources

Virtually all public use of Mammoth Cave National Park is confined to Mammoth Cave Plateau. There are motor roads, trails, scenic vistas, forests and wildlife, a picnic area, campground, comfort stations, lodgings, food services, curio sales, amphitheater, visitor center, parking lots – all above ground; trails, a dining area, and comfort stations are below ground in Mammoth Cave.

The public roads on Mammoth Cave Plateau predate the park's establishment. They were deeded to the National Park Service (Deed No. 262, recorded in Edmonson County Deed Book 45, pp. 604-607) with the stipulation that some of them remain open to the public. In 1945, this was considered necessary to assure access to inholdings, to churches, and to cemeteries. All inholdings have been purchased. Most church services are now held annually on Decoration Day, but Little Hope Church holds weekly services. Burials are less frequent each year. Some of the roads were rebuilt to modern standards between 1959 and 1961; most have bituminous pavement; all but two are two lanes wide. In the inventory that follows, those which are subject to this deed reservation – to remain open for public use – are marked with an asterisk.

Inventory of the Public Road System on Mammoth Cave Plateau:

a. **Ky-70 on Joppa Ridge** – A modern transpark road, 7.7 miles long, connects with state highway system at east and west park boundaries; carries commercial, local, and intrapark traffic; built, maintained, and patrolled by the National Park Service; pavement 21 feet wide; designed for a 50-mile speed limit. The wide shoulders are grassy and are mowed regularly.

From Ky-70, motorists get fine views of Woolsey Valley and of Turnhole Bend, which contribute to a pleasant windshield experience for truckers, local commuters, and others who drive through without stopping. Should this traffic cause congestion on Ky-70 within the park in the future, it should be rerouted on other roads outside the park to avoid irretrievable damage to park resources.

Mammoth Cave Parkway, a segment of Ky-255, intersects Ky-70 at Chaumont on the east park boundary. This 2.3-mile roadway, completed in 1968 by the Kentucky Department of Highways, is a limited-access scenic approach to the park from Park City and its I-65 interchange. Diamond Caverns, one KOA campground, and two private campgrounds are all reached from the parkway.

From Chaumont, most visitors proceed westward along Ky-70 to Sloans Crossing Pond, thence northward on Sloans Crossing Road to "Old 70" on Mammoth Cave Ridge, and then northwesterly to Historic Entrance – a total distance of 6.0 miles. Motorists may reach Chaumont also via Ky-70 from Cave City and its I-65 interchange 5.4 miles east. Between Cave City, Chaumont, and the main park entrance, private enterprise operates several souvenir stands, chair lifts, wax museum, pioneer village, cave-information kiosks, motels, service stations, and other tourist-oriented businesses.

At Sloans Crossing Pond, along Ky-70, there is a parking turnout and roadside table, and fishing is permitted. Another parking area is situated near the intersection of Ky-70 and Ky-422 for visitors walking 0.4 mile to the Turnhole Bend Overlook. There are gravel spur roads leading to cemeteries and to Joppa Church off Ky-70.

b. **Ky-422 on Joppa Ridge** – Modern road near Cedar Sink; 1.2 miles in park; connects Ky-70 with state highway system at south park boundary; uses same as Ky-70. On this road is a parking area for those who walk the trail 0.75 mile to Cedar Sink.

c. **Joppa Ridge Motor Nature Trail** – This gravel road is one-way only between Mammoth Cave Ferry Road (see below) and Ky-70 near Joppa Church. It is 2 miles long and has 13 interpretive stations keyed to a guide folder dispensed from a box at the start of the motor nature trail off Mammoth Cave Ferry Road. The motor trail was established in 1970. As mentioned previously, once the transit system is fully operational, access to this trail by private vehicle will be cut off. It will then be replaced with the Cedar Sink Motor Nature Trail, which will follow the old road abandoned when Ky-422 was built.

d. **Sloans Crossing Road** – Modern intrapark road across Doyel Valley; connects Ky-70 at Sloans Crossing Pond with "Old 70" at Carmichael Junction; 1.6 miles long. Along Sloans Crossing Road is a parking area with an interpretive marker describing Doyel Valley, which is seen well from here. This paved road is 20 feet wide and is designed for a speed of 45 m.p.h.

*e. **"Old 70" on Mammoth Cave Ridge** – Segment "A" extends 3.1 miles from east park boundary to Carmichael Junction; narrow (18-foot pavement) and tortuous to drive because of sharp curves. It has not been rebuilt to modern standards because Chaumont was designated the main park entrance during MISSION 66 planning for the park. Segment "B," 1.6 miles, connects Carmichael Junction with Historic Entrance; modern road. "Old 70" carries mostly intrapark traffic and some commuters.

From the park boundary at "Old 70," motorists may travel eastward over Ky-255 to Turleys Corner (this is not the Mammoth Cave Parkway mentioned above) and then via Ky-70 to the Cave City Interchange with I-65, 4.7 miles farther.

Like Ky-70, "Old 70" has many intersecting roads including accesses to Little Hope Church and cemetery; management roads to the Snowball Dining Room elevator, Mt. McKinley well and storage tank, National Park Service employee residence and utility areas; bus transit system spurs to cave entrances; spurs to the campground, picnic area, camper's store and service station, and to the hotel; and the following public roads: Cox Store, Sloans Crossing, Mammoth Cave Ferry, and Northtown. "Old 70" terminates in the visitor center parking lot at Historic Entrance.

*f. **Mammoth Cave Ferry Road on Mammoth Cave Ridge** – Modern intrapark road between "Old 70" and the Green River, a distance of 1.2

miles, serves intrapark traffic, consisting mostly of sightseeing boat passengers who drive to a parking lot on the riverbank. North of the river, after crossing by ferry, a gravel road continues 4½ miles to the park boundary near Stockholm where it connects with the state highway system. This intrapark road also carries commutation traffic.

*g. **Northtown Road on Flint Ridge** – This road, 3.6 miles long, connects "Old 70" on Mammoth Cave Ridge with Cox Store Road along the east park boundary. This 18-foot-wide gravel road was surface-treated as far as the Conservation Center to control dust. Spurs lead to Great Onyx Cave, 1.8 miles; to Mammoth Cave Church and cemetery, 0.1 mile; Great Onyx Civilian Conservation Center, 0.75 mile; and to Crystal Cave, 1.2 miles. Several spurs lead off these roads to cemeteries and to springs and wells. Few tourists travel the Northtown Road because the caves are not open to the public; there is little scenic interest; and the east boundary road is a one-lane gravel road (see j. below).

*h. **Great Onyx Cave Road** – A gravel spur off Northtown Road leads 1.8 miles to the cave entrance. First 1.4 miles, to the old property line, is covered by deed reservation; intrapark use only.

*i. **Crystal Cave Road** – This gravel spur from the Northtown Road is 1.2 miles long, but only the first 0.7 mile is to remain open according to the deed; intrapark use only.

*j. **Cox Store Road** – Connects "Old 70" with a state highway along east park boundary; 1.0 mile; gravel surface; narrow; used mostly by local people to reach their homes, and by school buses.

All the roads described under a. to j. above, inclusive, total 24 miles, of which 12.6 miles are covered by deed reservation. Of these 12.6 miles, 10 miles will be occupied by the transit system roadbed when that system becomes operational from the new peripheral staging area discussed in the master plan. At that time, the National Park Service will petition the court to amend the road deed so that these roads may be converted to transit use. Even then, provision will be made for public access by private vehicles to churches and cemeteries as required.

It will be necessary to close the Joppa Ridge Motor Nature Trail, also, because the Mammoth Cave Ferry Road leading to its eastern entry, will not be open to use by the public in personal cars.

Where heavy concentration of traffic requires, such as the 3/4-mile segment of Ky-70 between Chaumont and Union City, the road will be widened to four lanes with a median and an overpass will be provided (see III.A.2.).

Some of the road system in the park crosses limestone. Such terrain is unstable because water dissolves the limestone and may cause it to collapse beneath the road. This happened the last weekend of May 1974 when about 75 feet of Sloans Crossing Road settled a foot or two about 100 yards north of its intersection with Ky-70. Collapses of this type have been of rare occurrence in the park and region. A similar condition developed in mid-January 1968, outside the park about a mile west of Cave City, when a section of Ky-70 settled. I-65 crosses similar terrain south of the park. Unless roads are built where there are deep, open sinkholes, close together, little trouble should be encountered, according to the Geological Survey.

Park Travel Figures

Two sets of travel figures are maintained by the park: estimated gross travel and actual cave entries. The count of actual cave entries has been kept since 1942. Figures for cave and parking lot capacities in the master plan are based on actual cave entries.

Gross park travel in 1973 reached an all-time high of 1.9 million of whom 675,000 (36 percent) entered Mammoth Cave. Gross travel is figured by multiplying the vehicle count (from the automatic counters on park roads) by 3.5 persons per vehicle. Vehicle count is adjusted by subtracting an estimated number to compensate for park employees and their families, and official vehicles that pass the automatic counters, thus arriving at an estimation of actual visitors. This includes about 700,000 visitors (37 percent) who travel across the park on Ky-70. Much of this is local, commuter, and business traffic, including commercial trucks, but a park facility (roadway) is being used and this transpark drive has high scenic quality. The remaining 525,000 visitors in 1973 (27 percent) picnicked, camped, hiked, photographed, fished, went on boat rides, or motored over park roads other than Ky-70.

Observations by the park staff show that 20 percent of the occupants of cars parked by visitors at Historic Entrance parking lots are not on cave trips. They may be waiting for others to return, may be hiking trails on the Green River bluffs, may be dining or buying curios, may be hotel patrons, may be babysitting, or may be "people watching." Facilities and services for supporting these and related activities are provided by the National Park Service and the concessioners.

All persons entering the cave pay a guide fee, as follows:

Cave Tour	Guide Fees	
	Adults	Children Under 16
Frozen Niagara	$1.50	$1.00
Historic	1.50	.75
Scenic	2.50	1.50
Lantern	2.00	2.00
Physically Handicapped*	1.00	.50
Wild Cave**	3.50	---
Photography**	2.00	---

* restricted to wheelchair patients and their assistants
**restricted to those persons 16 years of age or older

Visitors walk to and from Historic Entrance, but all other tours require bus transportation for which a fee of $.50 (included in guide fee) per person is charged except small children. Guides are provided by the National Park Service, and National Park Concessions, Inc., owns and operates the buses. In 1973, 51 percent of the cave visitors used bus transportation.

The accompanying schedule of cave tours and the list of features seen on each shows the choices each visitor has to make before purchasing his ticket. The number and variety of tours varies with the season. Of the three most popular tours – Frozen Niagara, Historic, and Scenic – the first is least strenuous and the last named is most strenuous; the first takes the least time and the last takes the most time. Choice of a tour then is a function of time of day when the visitor arrives, length of time available for the trip, the physical condition of the visitor, and the kinds of things he wants to see.

The following analysis suggests the extent of the impact of the present visitor load upon facilities and services, and upon park resources both surface and underground.

Of the 675,167 visitor entries to Mammoth Cave in 1973 (by contrast, there were 388,015 in 1965), 7 percent used the campground and 3 percent stayed overnight in the lodging units. Of the overnight visitors, about 80 percent stay only one night. Nearly 70 percent of the cave visitors come during June (15 percent), July (20 percent), and August (28 percent). Weekends, Tuesdays, and holidays attract the most visitors. Of today's visitors, 70 percent spend 4 hours or less in the park – long enough to take a cave trip, sightseeing boat ride, a hike, or eat a meal in the dining room or picnic area, and then be on their way elsewhere.

Grassed areas adjacent to the visitor center and the "Hercules" exhibit are used regularly for overflow parking.



Ruts in the sod adjacent to the visitor center at Historic Entrance caused by overflow parking when the ground is wet.



TYPICAL SCHEDULES OF CAVE TOURS

Tour	Frequency	Spring	Summer	Autumn	Winter
Frozen Niagara Tour Walking Distance ½ mile Duration 1-1½ hours	Daily	9:00, 10:00, 12:30, 2:30, 4:00	8:30, 9:30, 11:00, 12:15, 1:30, 2:45, 4:00, 5:15, 6:30	9:00, 10:00, 12:00, 2:00, 4:00	9:00, 10:00, 1:30, 3:30
Historic Tour Walking Distance 2 miles Duration 2 hours	Daily	9:30, 10:30, 12:00, 1:00, 3:00	8:30 – 4:30 (semi-self-guided)	9:00, 11:00, 1:00, 3:00	10:30, 12:00, 2:45
Scenic Tour Walking Distance 4 miles Duration 4½ hours	Daily	11:45 10:30, 11:45*	8:00, 9:15, 10:30, 11:45, 1:00, 2:15	11:45 9:45, 11:45*	11:30
Lantern Tour Walking Distance 3 miles Duration 3 hours	-----	10:00, 2:00*	8:00, 10:00, 12:00, 2:00 daily	10:00 daily 10:00, 2:00*	-----
Wild Cave Tour Walking Distance 5 miles Duration 6 hours	-----	8:30, 9:30*	8:15, 10:15 daily	8:15, 10:15*	9:30*
Physically Handicapped Tour Distance ½ mile Duration 1-1½ hours	Daily	1:00	11:30	11:30	12:30
Photography Tour Walking Distance ½ mile Duration 1½-2 hours	Tu, Th, Sat	-----	10:00	-----	-----

*Weekend tour schedule

FEATURES OBSERVED ON TOURS

Frozen Niagara: Stalactites, stalagmites, flowstone, draperies, Crystal Lake; limit 120 persons per tour

Historic: Natural cave entrance, War of 1812 mining operation, Indian mummy and artifact, Fat Man's Misery, Mammoth Dome, blindfish from Echo River, and torch-throwing demonstrations; limit 160 persons per tour

Scenic: Gypsum flowers, narrow winding passages, dome-pits, break-downs; exits through Frozen Niagara section that features travertine formations; limit 200 persons per tour

Lantern: Natural cave entrance, War of 1812 mining operation, Mummy Ledge, tubercular huts, largest cave rooms, Indian mummy and artifacts, a few travertine deposits, torch-throwing demonstration; limit 40 persons per tour

Wild Cave: A rugged, strenuous trip over unimproved trails and through crawlways — a spelunking adventure — participants must be in excellent physical condition, wear old clothes, sturdy shoes, and gloves; limit 15 persons per tour

The majority are in the park between 10 a.m. and mid-afternoon. The largest number of cars is in the parking lot about 2 p.m. These loadings have held constant for several years. On peak days there are in excess of 6,000 cave visitors and such days are becoming more frequent all during the year. The peak day to date was July 2, 1972, Sunday, with 8,013 cave visitors. Overcrowding of the parking lot and visitor center, and excessive numbers on cave trips first became noticeable in 1967 with the situation worsening ever since.

The paved parking spaces at Historic Entrance are filled when there are 3,414 visitors in the cave. The visitor center is overcrowded with 4,000 cave visits per day. Between June 1 and September 1, 1974, the average daily cave visitation was 4,259. The capacity of the parking area was exceeded on 6 days in June, 31 days in July, and 26 days in August. Maximum use occurred July 6 when 6,672 visits were recorded in the cave.

If travel continues to increase during the next 30 years as it has during the past 10, a reasonable projection is about 13,265 average daily cave visits in August 2000, or more than two and a half times greater than in August 1974 when there were 5,080.

When the paved parking spaces are filled, cars overflow into the picnic area, onto the road shoulders, median strips, and the grassed areas between the visitor center and the Hercules exhibit near the automotive service station. Such parking is congested and destructive to the environment. Cars become mired frequently when thunderstorms occur. Towing them out ruts the grass; oil drippings kill it; and contaminants are washed into the cave or the Green River. Such conditions will become worse unless corrected.

In the following tabulation is a comparison of the percentage of participation on the major cave tours in 1970 and 1974:

	Percentage of Participation	
Name of Tour	**1970**	**1974**
Frozen Niagara	24	30
Historic	54	48
Scenic	21	19
Lantern	1	2
Wild Cave	—	1
Total cave entries	**610,964**	**590,265**

Actually more people see the Frozen Niagara portion of the cave than the foregoing figures show because the Scenic Tour exits from that portal. Thus, 45 percent of the cave visitors saw Frozen Niagara in 1970, and 49 percent in 1974.

The foregoing figures also include an evening Frozen Niagara Tour (6:30 p.m.) offered for the first time during July and August 1974. A total of 5,350 visitors took this tour or an average of 92 per trip. Likewise, the Wild Cave Tour was new in 1974.

On a summer afternoon, 200 to 400 persons on a guided cave tour is of common occurrence. People are rushed through with few stops for explanation by guides. Party size is a function of visitor volume at a given time, numbers of trips available then, and size of guide staff. More guides, more cave trips, and more lighted passages would accomplish nothing towards solving the problem of automobile storage on the surface. The master plan identifies solving this problem as the first order of priority.

Utilities

From early times, Mammoth Cave Hotel had used spring water. It was readily available and of high quality. As park use of domestic water increased, it was logical to develop more of the springs on Flint Ridge that drain the perched aquifer in the Haney limestone. A water shortage in August 1962 required hauling water by tank truck to supplement the collections from five springs and one well, then in use. Water from springs flows normally a short distance on the surface and then disappears into the cave system through cracks. During periods of low flow virtually the entire flow of some springs is diverted from the caves to the park's domestic supply. Presently, the system collects water from eight springs and two wells; a third well was drilled on Mammoth Cave Ridge. Wells tap the basal water table. The spring and well water is chlorinated in the respective storage facilities before use. Storage tanks on Flint Ridge have a capacity of 1,200,000 gallons and the tanks on Mammoth Cave Ridge hold 550,000 gallons.

Use of park water, in gallons, was as follows:

Function	Aug. 1970	Aug. 1973	C.Y. 1970	C.Y. 1973
Grt. Onyx Civ. Cons. Ctr.	1,308,930	1,247,990	7,200,000	11,441,401
Nat'l. Park Conces., Inc.*	1,187,560	1,111,820	6,750,000	5,180,440
National Park Service**	2,796,690	2,218,650	13,230,000	14,740,122
Totals	**5,293,180**	**4,578,460**	**27,180,000**	**31,361,963**

*This includes the hotel, restaurants, camper's store, etc.
**This includes the visitor center, picnic area, campground, employee residences, etc.

The bulk of the water comes from springs because the yield from wells is low, the water quality is poor and is high in sulfate. The amount of water available from these sources is lowest in late summer and early fall. At times, during this period of the year, practically all the available surface flow of spring water is collected and pumped to storage tanks on Flint Ridge. The major springs have all been diverted so only very limited expansion of yield is possible by tapping groundwater. However, additional storage could provide a further cushion for periods of low flow.

Following the water crisis of 1962, mentioned previously, the Geological Survey investigated all existing and potential sources in the park. Its findings were documented in Water-Supply Paper 1475-Q (1965) with the conclusion that Green River was adequate to meet all future park requirements.

The master plan recognizes the problem of increasing the supply of water to meet the increasing visitor load, and the damage to the Flint Ridge Cave System by perpetuating the present collection system. The plan suggested two alternates, viz. purchasing from a water district, or tapping the Green River in the park. The former would probably be much less expensive than the latter because extensive treatment of Green River water would be required. The intake structure, treatment plant, and associated works would consume considerable acreage, electrical energy, and be a visual intrusion.

National Park Service engineers concluded that purchasing water would be less expensive in dollars than to pump and treat river water. Accordingly, the Park Service sent a "letter of intent" to Barren River Water District on March 13, 1973, expressing its plan to purchase water subject to necessary funding by the Congress of the United States. Subsequently, the district applied for a Federal loan to extend its system. In June 1974, following the public meeting on the draft master plan for the park and its environmental statement, the Park Service withdrew its commitment. The district's pipeline would have paralleled Ky-70 from Cave City to Chaumont.

The decision to withdraw was based upon a more thorough analysis of the environmental consequences of the action. Lack of water and a sanitation district have constrained development somewhat in the past along the Ky-70 corridor. This is the most popular approach to the park. It is already becoming congested and some of the development is unsightly, thus detracting from the pleasant rural atmosphere that has prevailed in the past. The effect of the waterline would be to stimulate development, increase congestion, and screen out the fields and forests, thus detracting from the anticipation of a national park visit. In addition, development increases volumes of liquid and solid wastes. If these are not disposed of properly in

this karstic area, the result would be degradation of groundwater and the probability of polluting the underground streams that flow through the caves in the park. Contamination could become so great as to force closing of some cave passages to public tours and result in destruction of some cave animals found nowhere else.

Thus the Park Service found itself in the position of aiding and abetting an action that would cause environmental damage to the park and its visitors. This could be mitigated by establishing a sanitation district and by formulating and enforcing zoning standards. Constraints on land use are not acceptable in south-central Kentucky and are beyond the control of the Secretary of the Interior.

In-park sewage collected from the Historic Entrance area, the comfort station in Great Relief Hall of Mammoth Cave, and park residence and utility area is treated at an Imhoff tank, coupled with trickling filter, final clarifier, recirculation, chlorination, and sludge drying beds, near the Green River. This plant's capacity is 120,000 gallons per day. There are two comfort stations in Mammoth Cave – at Snowball and Mount McKinley – from which the effluent is pumped to the surface and disposed of by spray field and by septic tank, respectively. Three lagoons plus an overflow line to the Green River handle the sewage from the Great Onyx Civilian Conservation Center. A septic system serves the Cave Research Foundation's dormitory on Flint Ridge. All these systems are approved by Federal and Commonwealth water pollution control officials, though there have been some operational problems that have been corrected.

The presence of underground gasoline, fuel oil, and diesel oil storage tanks, and sewer tanks and sewer lines on Mammoth Cave Ridge and Flint Ridge poses some physical threat to the caves and to life in the caves if leakages should occur. Gasoline tanks holding several thousand gallons each are buried at two locations on Mammoth Cave Ridge and at one location on Flint Ridge.

In April 1966, near Trenton, Georgia, leakage of 160 gallons of gasoline from a filling station storage tank was carried by an underground stream to a pit in Howard's Cave. The gasoline was ignited by the flame from a carbide lamp worn by one of a party of cave explorers. The resultant explosion and generation of carbon monoxide gas caused three persons to lose their lives. A lethal concentration of gas was still present in the cave 10 days later.

Fuel and diesel oils, while not as volatile as gasoline, would leave stains that could never be removed and would be harmful to cave life if leakage

occurred. Fuel oil is used for heating government and concession buildings on Mammoth Cave Ridge and trailers occupied by the staff at the Conservation Center on Flint Ridge. A 4,000-gallon underground diesel oil storage tank is situated at the Conservation Center.

Sewage effluent overflowing from the first lagoon built at the Conservation Center is known to have entered the cave system beneath. The effluent killed vegetation in a narrow strip along its path and went underground into a fissure after flowing about 100 yards on the surface of the ground. This was corrected by the addition of two more lagoons and piping the chlorinated effluent to the Green River. Chlorine treated effluent also overflowed from a cleanout valve on the surface overflow line when a stoppage occurred. This effluent was not toxic to humans when it went underground, but it could be toxic to other forms of life.

The threat of sewage pollution in the caves is not confined to park sources, but might occur from a point outside. Odorous industrial sewage dumped several years ago into a sinkhole on the Sinkhole Plain near the town of Horse Cave, Kentucky, polluted Hidden River flowing through Hidden River Cave and forced its closing to public tours. Subsequently, the treated effluent from Horse Cave's municipal sewerage treatment plant was discharged into a sinkhole that also connects with Hidden River. The cave cannot be reopened because the odor persists. Recent dye tests show that Hidden River discharges into Green River at a spring upstream from the east boundary of Mammoth Cave National Park.

4. Great Onyx Civilian Conservation Center (Job Corps)

Situated on Flint Ridge, about 3.7 miles northeast of Historic Entrance via Northtown Road, this center is operated by the National Park Service for 214 disadvantaged young men recruited mostly outside Kentucky by the Office of Economic Opportunity, now under the U.S. Department of Labor.

Although the site of the center had been occupied by one of the Civilian Conservation Corps Camps in the late 1930s and early 1940s, none of the structures remained. The functions of the Job Corps center are housed mostly in buildings of temporary mobile construction, though there is an internal paved road system and sidewalks. The center has its own utility systems – water, sewer, electricity, and telephone. The total government investment in the center's structures and utilities is about $1.5 million.

The Great Onyx Civilian Conservation Center was activated on June 15, 1965, after approval of the site by the Governor of Kentucky in accordance with Section 109 of the Economic Opportunity Act of 1964, Public Law

88-452, and after agreement between the Director, Office of Economic Opportunity and the Secretary of the Interior on January 15, 1965, under authority of Subsection 103 (a) of the act.

An educational staff provides instruction in the "three R's," and there is on-job work training in several of the manual skills. This program is designed to give the corpsmen learning opportunities so they may qualify themselves for the labor market and become self-sustaining.

Work projects are conducted in the center itself, in nearby communities, and for the National Park Service. Among the latter were the construction of a new ferry boat, deer traps, trailwork in Mammoth Cave, spring development, boundary survey and marking, water and sewer lines, road improvements, landscape plantings, vista clearing, frame and masonry building construction, and fighting forest fires. In general, about 6 percent of the center's work program has been for communities nearby, 35 percent has been devoted to rehabilitation and improvement of the center itself, and 59 percent has been conservation projects within the park.

The following is indicative of the center's economic influence:

Fiscal Year	Supplies, Salaries, Etc.	Projects Cost	Appraised Value
1969	$1.6 million	$137,270	$304,687
1974	$1.2 million	$ 61,800	$123,000

Unquestionably, the presence of the center has a strong influence on the local economy, but suitable work projects for the corpsmen are becoming fewer. The backlog of park conservation projects is almost exhausted and community projects have been sought in order to maintain the staff and program. In FY 1972, the level of community work was higher than any year since FY's 1966 to 1967. It is doubtful that the combined load of work projects – community, in-center, and park – can sustain the center much longer. Aside from other considerations, this may force the center's relocation.

Corpsmen also engage in recreational activities in the center's gymnasium and on its playing fields, arts and crafts, offsite trips to nearby communities, and may receive weekend passes and home leave.

When the center was established, additional springs on Flint Ridge were tapped to provide water for domestic use. Of the 31.5 million gallons used in

the park annually, about 11.5 million gallons are delivered to the center, or about 125 gallons per day per person.

All the buildings at the center are heated electrically, but the staff and their families who live in trailers heat them with fuel oil stored in 800-gallon tanks. Most of these tanks are buried beneath the ground as are both of the 4,000-gallon gasoline and diesel oil storage tanks in the center proper. Petroleum products leaking or spilled accidentally could find their way into caverns or underground streams with the potential of great danger to cavers, and permanent damage to walls and ceilings because the stain could never be removed. Similarly, sewer leaks could pollute the caves.

The Great Onyx Civilian Conservation Center comprises the following buildings on a 40-acre site (see scale drawing on p. 18): dormitories (7), education, administration, dining hall, dispensary, guidance and counseling, utility, supply, PX and quiet lounge, charge-of-quarters, laundry, multi-purpose, firehouse, and chlorinator house. Housing for supervisory staff is in a trailer village with 18 to 20 units. There is a water storage tank, three sewage lagoons and effluent pipe to the Green River, a ball field, associated roadways, and sidewalks. All main buildings were completed by June 1965, and the value of the facilities is about 1.5 million dollars. Most buildings are of temporary, mobile construction. The site had been occupied previously by a Civilian Conservation Corps Camp, but all structures used in that program had been razed years before the center was established. When operations cease, the master plan calls for the complete removal of all man-made structures constituting the center on Flint Ridge, restoration of the original contours, and re-establishment of natural vegetation. The chief mitigating factor in phasing out the center is the discontinuance of water withdrawal from those springs on Flint Ridge, which serve the center. This will restore their normal flow into the cave system, thus assuring an uninterrupted supply of nutrients to the animal life and continued geologic development. Similarly, there would be no more escape of pollutants into the caves from sewage and from the area occupied by the center, and the threat of damage from accidental spillage of petroleum products would be relieved.

B. RIVER VALLEYS

1. Natural Resources

The Green and Nolin River Valleys comprise the second of the three zones in the park. The former, a major tributary of the Ohio, bisects the park from east to west for 26 miles. Six miles of the Nolin cross the park. Its waters enter the Green from the north near the park's west boundary. The Green varies in width from 50 to 300 feet and is subject to 50-foot flood crests.

Valley slopes, floodplains, and islands are densely forested with hardwoods, though pure stands of Virginia pine cover some former farmlands on the floodplains. The Green and Nolin provide a highly scenic access to some of the most primitive lands of the park, and much wildlife may be observed along the rivers.

By an act of the Kentucky Legislature, approved March 23, 1972, the Green River segment across the park was designated a "wild river." The effect of this act upon park operations is open to conjecture at this writing. Having deeded the lands in fee simple and ceded jurisdiction, the Commonwealth may not have the authority to impose controls legislatively upon a Federal function.

The River Valleys generally resemble primitive conditions more closely than any other lands in the park. Sheer cliffs of limestone along the Green, sandstone conglomerate along the Nolin, densely forested valley slopes and islands, and overhanging sycamores and elms on the banks have not changed much visually over the years. Occasionally a shadowed opening in a cliff marks the entry to a shallow limestone cave. Some of the most outstanding riverscapes in Kentucky may be seen along the Green and Nolin, respectively: where the Nolin enters the Green, Turnhole Bend, Nappers Rollover, and the vicinity of Cubby Cove Hollow and Whistle Mountain. Because of deposition of alluvium during floods, riverbanks are generally steep and muddy.

In addition to sycamore and elm, other common forest trees are river birch, boxelder, willow, cottonwood, American beech, maple, oak, hickory, hackberry, and yellow-poplar. The mature forest (some say it has never been logged) in the vicinity of Historic Entrance contains species of trees typical of the mixed mesophytic forests, which grow on such limestone bluffs along Green River.

Seen frequently are deer, beavers, muskrats, turtles, ducks (including the colorful wood duck), and songbirds. Bass, catfish, muskellunge, and carp are common fishes.

The rivers, ages ago, meandered across the Mammoth Cave Plateau. As the land rose, the meanders deepened and the riverbed is now some 300 feet below its former level. Of considerable geologic interest is the hill called Goblin Knob, formed when the Green River cut across the neck of a meander. A classic example of an incised meander is Turnhole Bend. A fine view of Turnhole Bend on the Green River may be obtained from Ky-70 about ½ mile west of its junction with Ky-422. Here the road crosses a valley

on a deep fill providing the elevation necessary for viewing this part of the River Valley.

From Turnhole Bend eastward, no surface streams tributary to the Green enter it from the south, because their valleys were pirated when the Green lowered its bed faster. Former stream channels remain as hanging valleys on the Mammoth Cave Plateau. Instead, tributaries from the south enter the Green in the form of seven large springs along its bank or in its bed. These springs are at the mouths of underground conduits that pass through the limestone and carry drainage from as far away as the Sinkhole Plain. Turnhole Spring is the largest and most spectacular of the resurgences in the park. Pike Spring, and the outlets of River Styx and Echo River, which drain Mammoth Cave, are well-known also. Former conduits, now dry, are the cave passages tourists visit today. In Mammoth Cave, the passages are on five different levels indicative of stages in the lowering of the riverbed.

A swampy area, about 25 acres in extent, is situated at the mouth of Dry Branch on the south side of the river just upstream of Houchins Ferry. This is the only habitat of this type in the park.

There are many forested islands in the Green River, all subject to annual inundation by floods. Huge piles of debris – tree trunks, old tires, and other trash – are deposited at the upstream end of these islands when the water recedes. Sometimes, narrow channels adjacent to islands are blocked when trees topple over that have been undermined by the current.

According to the records of the Louisville office of the Corps of Engineers, floodwaters crested at Lock 6 at the following depths:

10 January 1913	34.76 feet
28 March 1936	12.56 feet
11 April 1936	12.56 feet
24 January 1937	36.90 feet
02 March 1962	33.81 feet

While floods may occur on Green River during any month of the year, the worst ones come during the period from January through April. During these months the Park Service will discourage boating and camping in the River Valleys. The flood of January 24, 1937, is the worst on record.

Picturesque First Creek Lake, about 5 acres in size, is situated on the floodplain in Nolin River Valley.

At the mouth of Bylew Creek, a tributary of the Nolin, is a beautiful display of ferns at the base of a cliff. Nearby is a collection of plants that is a relict of the Ice Age or a still earlier period. The microclimate here is favorable to the perpetuation of this disjunct mesophytic community. The most conspicuous plant of this habitat is eastern hemlock, growing here 100 miles west of its nearest contemporaries in the Cumberland Mountains of eastern Kentucky. Similar habitats have been discovered recently in the Cubby Cove, First Creek, and Wet Prong watersheds, on Robbins Branch, and on the north flanks of Indian Hill. At each of these stations, the Caseyville formation, a sandstone conglomerate, is exposed. On the east side of the Nolin at Cubby Cove, the combination of brown sandstone cliffs and associated vegetation is spectacular.

2. Cultural Resources

Canebrakes along the rivers remind one of the periods of Indian use and occupancy of the land now in the park. Torches fashioned from canes illuminated trips into the caves to chip gypsum and mirabilite from the walls. Sunflower, marsh elder, chanopod, squash, and gourd plants were cultivated on the floodplains and the seeds of all, but the last named, were used for food.

Along the rims of hollows back from the river, 17 rock shelters have been found, and eight village sites have been located mostly on the floodplain. These discoveries were made in the late 1960s by University of Kentucky archeologists. Little surface archeological exploration has been undertaken in Green River Valley outside the park.

Modern man cultivated the floodplain, too. In places, dense growth of Virginia pine has covered these old fields, and they are conspicuous from the air. In general, growth on the floodplains is so dense that foot travel ranges from difficult to impossible, especially during the growing season.

To aid navigation on the Green and Nolin Rivers, the Corps of Engineers built a series of dams and locks. The sixth and uppermost was completed in 1907 near Brownsville. This impounded 17 miles of the Green, and slackwater extends from the dam to mile 199 at the upper end of Floating Mill Island, and slackwater on the Nolin extends more than 6 miles to a point above Kyrock. Pool level is at 421 feet elevation. Water backed up on Green River by the 9-foot rise of Lock 6 caused the lowermost passages of Mammoth Cave to be flooded.

Barges were loaded with rock asphalt from mines near Kyrock on the Nolin. Barges also transported mine timbers cut from the forests along the Green.

Packet boats plied the Green River bringing visitors to Mammoth Cave from as far away as Evansville, Indiana, where the Green flows into the Ohio. The names Turnhole Bend and Turnhole Spring came from packet-boat days when boats nosed into the spring to turn around. A popular excursion from Bowling Green included a 10-hour run on the river to Mammoth Cave and return by railroad. The steamboat era ended in 1917.

Shipping on the Green River had declined so much by 1951 that the Corps of Engineers deactivated Locks 5 and 6 on the first of August of that year. Dam 4, a rock-filled, timber crib structure completed in 1839, collapsed on May 24, 1965, ending commercial navigation of the Barren River and of the Green River above that point. There are no plans to rebuild Dam and Lock 4, according to the Corps of Engineers.

The Corps of Engineers has erected two flood-control dams, which affect park waters. Just north of the park is Nolin Dam, built in 1963, which formed Nolin River Lake. Upstream on the Green, 100 miles east of the park, is Green River Dam and Lake dating from 1969. Periodic releases of water from Nolin and Green River Lakes, respectively, lower water temperature, may cause turbidity, and affect cave fauna adversely if the animals are at a critical stage in their life cycle. The Corps states that the Green may still be subject to 50-foot flood crests.

Before the park's establishment, there were several ferries across the Green and Nolin Rivers connected with the network of wagon roads used by farmers and loggers. The U.S.G.S. Mammoth Cave quadrangle sheet, published in 1922, shows the location of eight ferries on the Green and one on the Nolin. The original ferry boats all had wooden hulls and carried passengers, horses, and wagons. In addition to the ferries there was one ford (Doyles) near Goblin Knob. All are closed now except for Houchins and Mammoth Cave ferries and their connecting, crosspark roads, which must remain open, by deed reservation, for the "usual use by the public." The vessels have been replaced over the years and now have a steel hull and are driven by a gasoline engine and side paddle wheel. Each may carry three vehicles, passenger cars or light trucks, per trip.

The ferries and their 1970 and 1974 traffic counts were as follows:

Date	Houchins Ferry		Mamoth Cave Ferry		Annual Operating Costs	
	Vehicles	Passengers	Vehicles	Passengers	Gross	Per Vehicle
Jan. 1970	352	674	1,912	3,588		
Aug. 1970	1,134	2,736	4,856	12,102		
C.Y. 1970	11,647	26,496	42,829	96,856	$60,000	$1.00
Jan. 1974	292	1,022	1,626	5,691		
Aug. 1974	898	3,743	4,653	16,250		
C.Y. 1974	10,262	35,917	40,447	141,564	71,000	1.40

The column headed "passengers" represents the number of people crossing in vehicles. Persons rarely traverse these roads on foot and use the ferry to cross the river. The ferries are operated by the National Park Service without fee.

Traffic in January is presumed to be almost entirely travel by local residents, many of whom are commuters, and park personnel. During the summer, about two thirds of the traffic using Mammoth Cave Ferry is by commuters and official vehicles; over Houchins Ferry, 85 percent is commuter and official use. In both cases, the balance is park visitor use. Mammoth Cave Ferry carried about 3.6 times more vehicles in 1970 than Houchins Ferry; in 1974, Mammoth Cave Ferry traffic was 3.9 times greater. Northbound traffic is from 5 to 10 percent heavier than southbound traffic, because visitors who originate at Historic Entrance choose a different route to their destination.

3. Recreational Resources

Boating is the major use of the River Valleys. Hand-propelled boats and outboard motorboats up to 10 horsepower are used by sightseers and fishermen. Murky water and submerged snags discourage swimming, and use of larger boats is hazardous. Riverbanks are steep and muddy and are subject to annual flooding, so there are no beaches. At Mammoth Cave and Houchins Ferries, boats are launched from trailers by using the ferry boat ramps. It has been estimated that about 5,300 people, about equally divided between fishing and sightseeing, use their own boats on the rivers during the course of the year. During 1974, about 860 persons camped along the river. Boaters who desire to do so are allowed to camp on the river islands at will. These islands are inundated by floodwater at least annually; all are heavily wooded.

Many more people take passage on the *Miss Green River* sightseeing boat during its season from April to November. There are a maximum of eight trips per day. More trips could be run and the season extended, when warranted. Each trip is 1 hour in length from Mammoth Cave Ferry to Sand Cave Island and return, a distance of 6.5 miles round trip. Passengers hear a recorded message or personal narration, while underway, which is descriptive of the natural features of the river valleys and the park in general.

Date	Trips	Passengers	Percent of Capacity
Aug. 1970	244	–	–
C.Y. 1970	1,065	85,641	65
July 1974	–	25,081	–
Aug. 1974	–	13,376	–
C.Y. 1974	1,158	84,725	60

Tickets for the *Miss Green River* trip are sold in the visitor center at Historic Entrance and the following fees are charged:

Time of Day	Adults	Children Under 12
Daytime	$1.25	$.60
Evening	$1.35	$.65

If either Lock or Dam 6 were breached, navigation of both the Green and Nolin Rivers would be affected because the water would not be as deep as at present, and the lowermost passages of the caves would not be flooded permanently as they have been since 1907, when the pool elevation was established at 421 feet.

On the south bank of the Green at Mammoth Cave Ferry is a 60-car parking lot for *Miss Green River* patrons. Nearby is the sightseeing boat dock and the ferry itself. A two-lane paved road, 1.2 miles in length, connects the park road on Mammoth Cave Ridge with the ferry. A foot trail, part of a 6-mile network on the river bluffs, connects the parking lot and the Historic Entrance to Mammoth Cave.

Boating and camping in the River Valleys will be discouraged during April when floods are most prone to take place. Occasionally, there is local flooding when sustained rainfall occurs in the watershed. The danger is from floating objects, from blocked channels, from swift water, and from rising water. It is greatest near Dam 6, on the Nolin, and on the uppermost stretches of the Green. Danger decreases where the river is widest, from

about the mouth of the Nolin upstream to Turnhole Bend vicinity. When floodwaters recede, great quantities of tree trunks and debris form huge piles at the upstream end of the major islands. This wood, when dry, is an excellent fuel for campfires.

At the site of Dennison Ferry, near the east park boundary, a single-lane gravel road, 1.6 miles long, extends to the south bank of the Green River from Cox Store Road. The park road becomes impassable during heavy rains. On the floodplain is a turnaround and people with small self-contained recreation vehicles sometimes spend the night here. There is no piped drinking water, but two portable, chemical toilets were placed there in 1973. Hand-propelled boats may be launched by sliding them down the steep, slippery, muddy riverbank.

Dennison Ferry is adjacent to the 9-mile free-flowing segment of the Green, which has many of the qualities of a "wild river." Here we believe many visitors will enjoy solitude, peace, and quiet, as they travel on the river in hand-propelled boats to enjoy sightseeing, nature study, and fishing. This is to be a "low key" use for relatively few people.

Tree-shaded Houchins Ferry picnic area is reached by single-lane gravel road from Ky-70 near Brownsville. There are six to eight picnic tables, a drinking fountain, pit toilets, and parking for a dozen cars. In 1971, 12 primitive, walk-in campsites were provided, and in 1974 a picnic shelter was built. This has become a popular place to hold family outings, and it is used for ranger/naturalist-conducted campfire programs three nights a week in midsummer. A concrete block and brick structure will be completed in 1975 to replace the ferry operator's warming shack and the pit toilets. This development is all on the floodplain on the south side of Green River.

There is no vehicular access to the Nolin in the park, but a secondary county road comes near it at Kyrock.

C. HILLY COUNTRY

1. Natural Resources

About 40 percent of the park's area is characterized as Hilly Country. Exploration is difficult because of lack of trails and dense undergrowth. However, on relatively steep slopes, where the hardwood forest is more mature, there is a thinner understory and walking is less inhibited. In such places, the forest floor is carpeted with wildflowers in spring. The forests are ablaze with color in the autumn. Generally, the Hilly Country is a rugged region of hills, flat-topped ridges, and deep hollows. It contains scenic viewpoints, picturesque rock outcrops, springs, streams, and waterfalls, and is well-populated with wildlife.

Soils in the park belong to the Weikert-Zanesville-Caneyville Association, according to the Soil Conservation Service, and they lack fertility. The best crops are grasses and woodlands. Zanesville soils, in particular, are steep and erosive while Weikert soils are stony and drain rapidly.

Watersheds, self-contained within the park and that are 150 feet or more in depth, have been identified in the master plan as "basin ecosystems." These are rather rare and their study would be valuable to the International Biological Program. According to the master plan, they are to be studied by competent scientists and those selected are to be untouched by any development. These will remain as scientific reserves. One of these, the north branch of Wilson Cave Hollow, adjoins Big Woods, a tract of about 300 acres, which is reported to be one of the best remaining examples of a white oak/black oak/tuliptree forest (upper slopes) and beech/maple forest (lower slopes) in eastern North America. It has probably never been logged, but windfalls have been removed.

At the head of the Wet Prong of Buffalo Creek are Big, Blue, Boiling, and other large springs. They feed this attractive perennial stream, which sinks underground for a short distance before reaching Green River.

No cave systems of any extent are known in the Hilly Country because the cave-bearing limestones dip to the north, away from the Green River. Moreover, the river intercepted drainage in the past, as it does today, from the Sinkhole Plain to the south. Thus, groundwater has not flowed horizontally to carry away dissolved carbonates and create lengthy cave passages. Through 1974, a total of 3½ miles of passages had been surveyed in several caves between Maple Springs and Green River.

Unfortunately, the Hilly Country does not possess many prominences, having been dissected from a plateau, and this coupled with the dense vegetation, makes for few distant views especially during the growing season. Much more can be seen when the trees are not in leaf. However, from the top of Whistle Mountain, reached only on foot, there is a spectacular view of the narrowest part of the Nolin River Valley. With little vista clearing, there could be a good view of First Creek Lake from a rock outcrop about 0.25 mile northwest of Temple Hill Cemetery. The strategic location of Goblin Knob suggests the possibility of a view of the Green River alongside Nappers Rollover, when the forest matures at the top of the Knob, though some vista clearing may be necessary.

From the Brooks Knob, First Creek, Hickory Cabin and Flint Ridge fire lookout towers, the Hilly Country looks deceptively smooth with a series of

Cedar karren in Woolsey Valley on the Mammoth Cave Plateau.



Flood debris deposited at upstream end of island in the Green River.



undulating ridges and shallow valleys. Such is not the case when one travels cross-country on foot. Then the rugged topography becomes apparent.

The Hilly Country harbors an over-population of Virginia white-tailed deer. In the past, browse was plentiful in the revegetating forest and in abandoned fields, but there is now much sign of overbrowsing. The deer are thought to be responsible for the presence of such large numbers of ticks that they have become pestiferous to man and beast alike, except in fall and winter. By Kentucky statute, control of the fish and wildlife is vested in the United States. Public hunting is prohibited in national parks, but a live-trapping program has been carried on since 1957 by cooperative agreement with the Commonwealth.

Year	Estimated Deer Population in Park	Deer Trapped	Deer Released*	Capture Fatalities	Buck-Doe Ratio
1970	2,400	142	124	18	1:1.3
1974	2,000	60	58	2	1:2.2

*on public hunting grounds throughout Kentucky

In 1970, the largest deer trapped weighed 225 pounds and the smallest was 27 pounds. Hunting pressure on private lands surrounding the park is heavy and poaching does occur on park lands. It has been estimated that 400 deer are lost to poachers annually.

2. Cultural Resources

Good Spring Church, several cemeteries, and evidences of old fields, homesites, and road traces may still be observed in the Hilly Country. The demarkation between old fields and more mature woodland is clearly apparent from an airplane.

It is possible that more thorough fieldwork may locate Indian sites and artifacts in the Hilly Country.

A ranger station (residence and garage) is situated at Maple Springs. These buildings were built as Civilian Conservation Corps projects. The ranger patrols the rivers and the land north of the Green. Adjoining the ranger station is the Deer Reproduction Control Laboratory, which houses a joint study of the Bureau of Sport Fisheries and Wildlife and the National Park Service. Near the laboratory are pens where deer are kept for observation. Captive animals from the wild herd are used for experimental purposes, but results are not yet conclusive. People are not encouraged to visit the

laboratory and pens because quarters are cramped and the deer become restless in the presence of strangers and may injure themselves. When the study is discontinued, the pens and related structures will be dismantled.

3. Recreational Resources

Mammoth Cave Ferry Road, 5.7 miles long, and Houchins Ferry Road, 6.7 miles long, across the park, provide access to the Hilly Country and a windshield experience for those who drive over them. These public roads are mostly one-lane wide. Their gravel surface is dusty in dry weather and roadside vegetation is heavily coated. Cars following closely move in a choking cloud of dust, which is unpleasant; visibility is reduced and driving is hazardous.

By observation, it has been determined that 25 percent of the passengers carried by the ferries are park visitors. Part of the increase in use of the Hilly Country is attributed to the availability of trails.

Year	Hilly Country	Cave Entries	Total Park Travel
1970	31,000	611,000	1.7 million
1974	44,400	590,000	1.7 million

In 1974, park rangers estimated that of the 44,400 people who visited the Hilly Country, 3,000 hiked and 850 rode horseback over some of the 15 miles of old wagon roads that had been brushed out to form the nucleus of a trail system north of the Green. Maps showing the location of these trails are available from the park superintendent. Use may increase markedly in the future as more people learn about the trails.

Both the park and Nolin River Lake can accommodate more recreation visits. This visitation could be increased materially and the capital improvements used more efficiently by the greater travel generated through improving the transpark Houchins Ferry Road. The Federal Government investment in recreational facilities on Nolin River Lake is considerable. The following public-use figures at the lake were supplied by the Corps of Engineers:

Type of Activity	1967	1974	Type of Activity	1967	1974
Camping	39,667	76,950	Hunting	3,962	–
Picnicking	17,728	31,895	Water Skiing	7,063	25,877
Boating	36,474	76,606	Swimming	4,461	29,551
Fishing	102,905	176,566	Sightseeing	128,923	214,644

Grand Total of all Activities	1967	1974
	341,183	632,089

D. PROBABLE FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

Assuming relaxation of the current energy crisis and economic recession, and the imposition of no other constraints, summer vacationing and holiday weekend travel to the park by private vehicle will resume and continue to increase. This will cause continued overflow parking at Historic Entrance, overcrowding of the visitor center, overloading of cave tours, denial to some of the privilege of taking a cave tour at the time of their choice, less diversity of cave tours; increase in visitor complaints, vandalism and littering; larger expenditures for maintenance; build-up of human waste and air pollution over Mammoth Cave; overuse of spring water resulting in probable loss of cave animals, and retardation of geologic processes; greater income to concessioner from sales and meals, but loss from lodgings; larger expenditure of energy for propulsion of private vehicles; no restoration of natural conditions through removal of developments over the Mammoth-Flint Ridge Cave; and no further development of trails and primitive campsites for greater use of surface features.

Private enterprise outside the park will probably continue to expand lodgings, camping, and tourist services to meet increasing visitation. Since Mammoth Cave is the foremost tourist attraction in Kentucky, it is important that the National Park Service welcome visitors and provide them with a high quality experience while in the park.

III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

A. MAMMOTH CAVE PLATEAU

(See Section I, Part A and Section II, Part A)

In assessing impacts of the master plan, it must be borne in mind that Mammoth Cave, Mammoth Cave Ridge, and the entire Mammoth Cave Plateau have been subject to major environmental impacts from the beginning of the 19th century. The land was cleared for farming and grazing, wildlife was slaughtered (bison and passenger pigeon), wildfire was rampant, forests were logged repeatedly and timber was used locally and exported. Hotels were built and some local farmers raised foodstuffs to supply the tables. They built wagon roads and some of these have been rebuilt and are the basis of today's circulation system in the park. Exploitation of Mammoth Cave, itself, began in 1809 with saltpeter mining and continued with exploration of passages and the building of trails, stairways, and bridges to accommodate millions of visitors on guided tours. Smoke from thousands of torches blackened walls and ceilings. While electric lighting is cleaner, its miles of wires, massive transformers, and fixtures attached to walls have had their impacts, both physical and visual. Lowermost passages were flooded in 1907 when Dam and Lock 6 were constructed on the Green River near Brownsville. New tunnel and elevator entries, paved trails, steel and aluminum stairways and bridges, comfort stations, and a dining room have all been constructed in Mammoth Cave. Much of this work has required blasting. The marks of these alterations are an irretrievable commitment of resources. Yet only about 10 miles of the 76 miles (1974) of known passages have been shown to the public and, of these, only about 6 miles are being used now. Admittedly, some passages are too constricted for tour groups.

In spite of this long history of use and manipulation by man, visitors to Mammoth Cave Ridge and to Mammoth Cave continue to be enthralled and inspired. Scientists have recently discovered "virgin" cave passages near Frozen Niagara and Echo River.

The master plan calls for five interrelated actions, over a 10 to 20 year period, to provide a higher quality park experience for more visitors while giving greater protection to the natural resources.

1. Expand Cave Trips

Expanding cave trips to accommodate the visitation expected during the next 30 years, involves a new tunnel, new elevator entry, lighting passages (now dark) and improving the trails therein, and reopening the front part of Great Onyx Cave. These measures are not expected to cause damage of a magnitude greater than what has occurred in the past. Additional guides will

be needed. More electricity will be consumed, and more visitors will see Mammoth Cave.

Preliminary reconnaissance suggests that a tunnel entry similar to those at Carmichael and New Discovery Entrances might be constructed to replace New Entrance. This tunnel (angled shaft) could be bored through strong solid rock nearby and would be about 600 feet long. It would contain a series of ramps and steps for easy walking. No damage to the cave is known to have occurred when the two tunnel entries mentioned above were bored and they have been stable since their construction.

Converting Frozen Niagara from guided to semi-self-guided requires installing illuminated signs to provide information/interpretation, leaving cave lights turned on for the entire period, blocking side passages to prevent visitors from straying off the trail, and stationing guides along the route to provide interpretive services, and assist visitors in case of accident, illness, or electric outages. First aid kits and gasoline lanterns are cached at locations known to the guides, who also protect the cave from vandalism.

Increasing numbers of visitors, lengthening the period of illumination, and opening an entry to replace New Entrance, is not expected to have unacceptable deleterious effect on this part of the cave. Nevertheless, microclimate parameters will be established and monitored. Acts of vandalism may occur.

Unlike most passages in Mammoth Cave, the Frozen Niagara section is wet. Supply of groundwater to the flowstone formations is not likely to be altered in any way by the new tunnel entry or by modification of the surface roadway, if required. It is presumed that Rural Electrification Administration (REA) will be able to supply the additional electricity for lighting this section of passageway for a longer period. Some wattage could be saved and heat reduced by substituting fluorescent for incandescent fixtures, where feasible. It will be no problem to extend electric lighting into the new tunnel entry at Frozen Niagara from existing wiring, but how much more wiring and wattage will be required is subject to further study (see I.A.1.c., Phase I). Additional fencing will be erected to protect formations and keep people from straying into side passages and becoming lost when the Frozen Niagara passage is opened for semi-self-guiding tours.

In the second phase, the Violet City tour route, now seen only by parties carrying hand lanterns, will be lighted with electricity and become semi-self-guided. Visitors will enter, as now, through the Violet City Entrance and exit by a proposed elevator from Star Chamber. Only two

guides are used now for the lantern tour, with 40 people maximum per trip. Additional guides would be needed for the new (Phase II) service. Much of the Violet City route traverses passages of large dimension, some more than 40 feet in height and width. Neither admitting more people nor adding electric lighting is expected to have adverse effect on this part of Mammoth Cave's features or values, but there will be some vandalism and people will have a different type of experience than they are now having by lantern light. Most of the trail work in this passage was done by Civilian Conservation Corps enrollees years ago. It requires some upgrading in a few places and installation of some safety devices like handrails.

The Violet City section to be lighted is about 6,800 feet long. Electric service is now within 400 feet of Star Chamber, where the elevators will be installed, and practically adjacent to the Violet City portal. No engineering studies have been made yet on these electric power requirements. Extension of lighting with its cables, transformers, and fixtures will have visual impact, as will the elevator entry, though much of this can be hidden. Again, it is anticipated that the additional electricity for lighting and elevator operation will be available through Kentucky Utilities Company, which serves this part of the cave.

To replace the Violet City lantern tour, the front part of Great Onyx, Crystal, and/or Colossal Caves will be reopened to groups of 25 to 40 per trip. Two guides would accompany each party, and hand lanterns will be carried. These are small caves that were shown to parties of this size when they were operated commercially. For visitor safety, some trail work is needed in each of these three caves before tours can begin, but it should not cause any more modification of them than had been done by their private owners a long time ago. To reach Colossal Cave, however, a surface foot trail will have to be constructed, about a mile in length, from the future transit stop along Northtown Road, to the cave entrance. The old stairway immediately inside the entrance has rotted away and will have to be replaced, and there is some breakdown at the entry that will have to be removed.

In order to expand cave trips through the year 2000, it will not be necessary to build new trails in virgin cave passages. Old trails will be rebuilt to bring them up to modern standards at considerable savings in dollar costs compared with new construction.

None of the actions required to expand cave trips is expected to adversely affect any endangered species of cave animals. During construction and after tours begin, animal life will be disturbed, but all species are common in the

park. Some invertebrate animals will die when their habitat is destroyed, but others may find the new habitat to their liking. Some may multiply from feeding on substances carried into the cave by visitors and discarded.

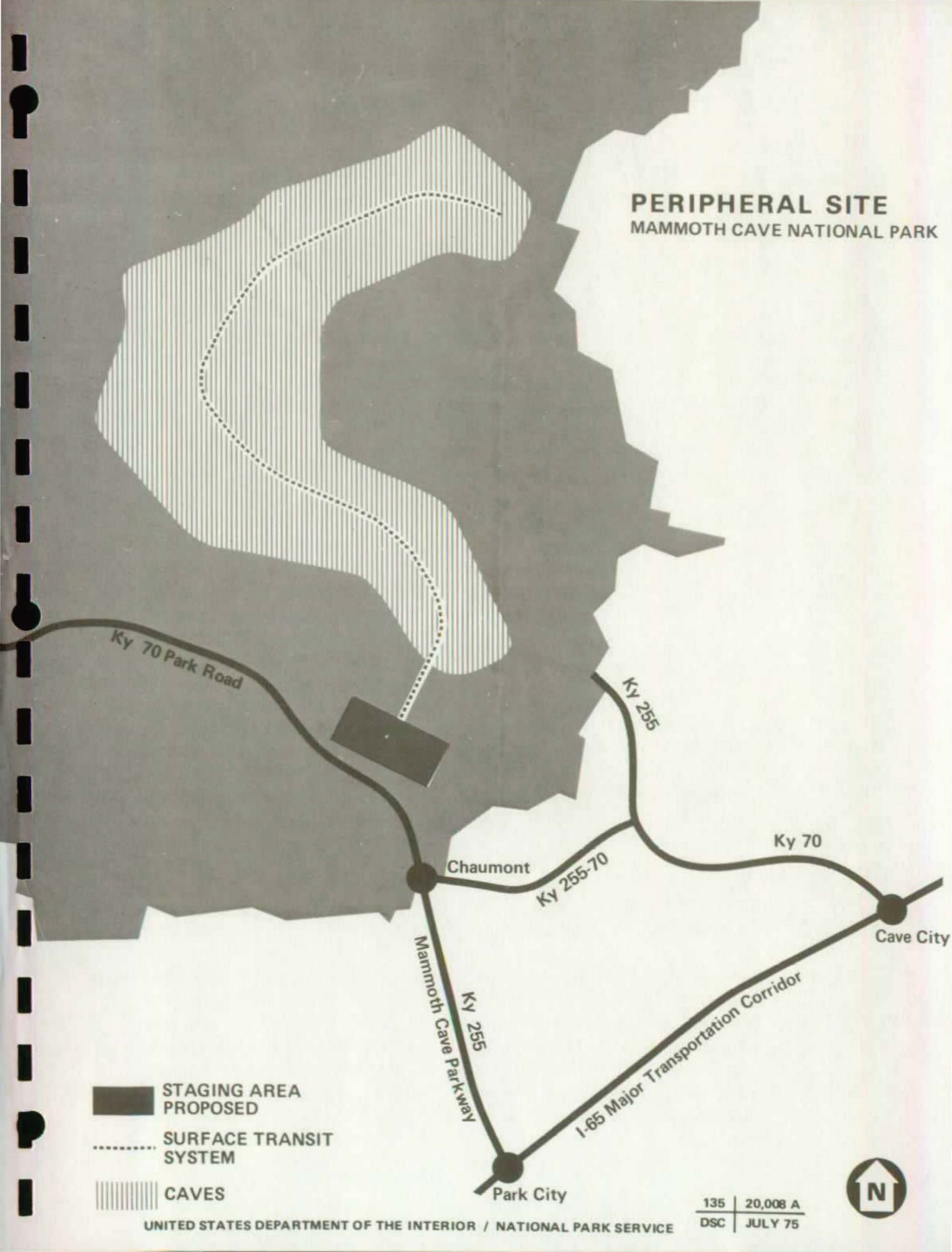
New tours over routes used previously will add variety to those presently available so that visitors will have a wider choice. More tours will help to reduce the number of participants on each, thus providing a higher quality experience, but more guides will be needed. Lighting and visitors will introduce more heat and alter air quality. These are not expected to have serious consequences, because of the immensity of the passages, the presence of plentiful groundwater, and the natural air flow. More energy and fossil fuels will be needed for lighting.

As measured on the time scale of human beings, caves are not a renewable resource. Thousands of years might be needed for a cave system to recover from some human actions. In other cases, only a catastrophic event would erase the damage. Once a cave is "developed" for tours, the action is both irreversible and irretrievable for all practical purposes. Passage of only a few people leaves signs that may never disappear.

2. Relocate Staging Area to Peripheral Site

Development of the peripheral staging area and widening of a short segment of Ky-70 will result in slight loss of habitats; destruction of vegetation; require extension of water, sewer, and electric lines; and there will be a large concentration of people and vehicles. Losses of habitats and vegetation types are minimal since both are common in the park. An artificial environment will replace the natural one when development is completed. Over a period of time, many more people will be accommodated efficiently, and in pleasing surroundings with a parking lot and transit terminal designed for the purpose.

During and following development at Union City, precautions will be taken to maintain a flow of unpolluted water into the caves. Otherwise, silt could plug the underground channels and contaminants could adversely affect the blindfish and other troglobites in the subterranean streams. Surface water enters such streams through sinkholes and fissures situated generally along the perimeter of the ridges at the edge of the sandstone cap. While development is underway, runoff from areas disturbed by construction will be diverted into sediment traps. When a detailed site plan is prepared, following approval of the master plan, environmental impact will be lessened by directing runoff into existing channels and reducing runoff by providing dry wells and tree islands throughout the paved parking lot. When the lot is completed, permanent dual lagoons will be installed in runoff channels from


PERIPHERAL SITE
MAMMOTH CAVE NATIONAL PARK
Ky 70 Park Road
Ky 255
Ky 70
Chaumont
Ky 255-70
Cave City
Mammoth Cave Parkway
Ky 255
I-65 Major Transportation Corridor
Park City
STAGING AREA PROPOSED
SURFACE TRANSIT SYSTEM
CAVES
N
UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE
135 | 20,008 A
DSC | JULY 75

which floatable solids and petroleum products can be skimmed and suspended solids settled, before the water goes underground.

Cave passages directly beneath the parking lot are dry. Parking lot construction will not affect these for they are beneath the Big Clifty sandstone cap, which is impervious, stable, and structurally sound.

The terminal building planned for this site has not been designed, so its impact cannot be assessed at this time, so far as size and materials are concerned. Suffice it to say that telephone lines now pass the site and electric service by REA is at Chaumont, about a mile away. Water supply and sewage disposal, however, require special consideration.

It is expected that up to 130,000 gallons of water per day would be required to service the site by the year 2000. The Green River will be tapped in the park and the National Park Service will establish and operate its own treatment facilities. The present water distribution system will be connected to the Union City site by a pipeline across Doyel Valley from the Mt. McKinley well and storage tanks on Mammoth Cave Ridge 1½ miles distant. If the pipeline should cross an unstable area at the bottom of Doyel Valley, special care will have to be taken in its construction (see I.A.5., III.A.5., etc).

Sanitary sewage from the staging area will be piped about 3.8 miles across Doyel Valley and along Mammoth Cave Ridge to the existing system at park headquarters and treated at the plant on the Green River near Mammoth Cave Ferry. Sewage from the comfort stations in the cave at Mt. McKinley and Snowball will be picked up en route. Crossing Doyel Valley will require pumping and an automatic check valve will be placed in the pipeline to shut off the pump in case of line failure. If tertiary treatment at the staging area proves practical, then only the effluent need be piped across Doyel Valley, but it would be less costly to operate the one plant near the Green River. If necessary, this plant can be expanded to handle the load. Its present capacity is 120,000 gallons per day. When Park City establishes a sewer district, consideration could be given to piping the staging area sewerage there instead of treating it in the park's Green River plant. Before doing so, there must be assurance that the underground streams would not be polluted by the effluent from the Park City treatment facility.

Once the peripheral parking area is in use, it will no longer be necessary to commit rangers' time and energy to parking cars at Historic Entrance, and to towing them out when they become mired in the mud following a rainstorm while their occupants are on a cave trip.

When the Union City development is completed, park operations will become more streamlined to the needs of the day-use visitor. Congestion will have been removed from Historic Entrance and visitor concentration situated in an area of lesser resource value.

To serve the staging area, 3/4 mile of Ky-70 between Chaumont and Union City will be upgraded from two lanes to four lanes. While most of the ridge top is forested, the trees are small. Cave passages are not known beneath this segment of Ky-70, but may exist. Big Clifty sandstone caps the limestone, as at Union City. Again, sediment traps will prevent soil pollution of underground streams during construction, and runoff from the completed roadways will be directed into existing stream channels as at present. Ultimately, an overpass will be required to carry exiting traffic from the parking lot onto Ky-70. This will have some visual impact.

It is possible that at some time in the future enough people will be spending the night at towns nearby or will be coming by railroad excursion trains, to warrant establishing a transit shuttle service to and from the staging area. This could reduce considerably the ultimate size of the parking lot.

Once the staging area becomes operational, visitors will go there to get their tickets for cave and boat trips, and to ride transit vehicles to their in-park destinations. Then not many park visitors will travel over Ky-255 between Turleys Corner and the park boundary at Little Hope Church. There are a few business enterprises catering to tourists along this 1½-mile segment of road that will probably suffer a loss of sales volume.

On the other hand, traffic will increase at Chaumont Junction using both the Mammoth Cave Parkway and the Ky-70 and -255 approach from I-65. By the year 2000, 10,000 or more people will arrive at and depart from this point on a typical summer day.

Because Mammoth Cave Parkway is a limited access, scenic road, it will not become cluttered with commercialism so long as this policy is enforced. It is vital to preserve this attractive approach to the park and to protect the cave systems from pollution.

Park City, on the other hand, is situated on Ky-255 just south of I-65 and 3 miles from Chaumont. Proximity of the staging area and the parkway may help to induce new economic growth now that Park City has adequate water since connecting to the Edmonson County Water District in 1974. However, sewerage is still piped to individual septic tanks, which may be polluting groundwater. Plans have been drawn up for a municipal sewerage system.

When Park City has it in operation, more services for tourists may follow.

Similarly, development could be stimulated along Ky-70 and -255 easterly from Chaumont towards Turleys Corner, 2 miles distant. There is now a theme park and there are several souvenir shops specializing in "cave onyx." The balance of the land is occupied by private homes and small farms. The first ¾ mile east of Chaumont is a narrow ridge crest varying from 200 feet to ¼ mile in width. Farther east, the ridge widens considerably. The road follows the ridge top and it is built on the Big Clifty sandstone. Because this is underlain by cavernous limestone, wastewater treatment and proper waste disposal is critical to prevent the pollution of groundwater. Presently wells are the only source of domestic water in this area. Yields are low and water quality is poor, and that may constrain expansion of business. Signs of traffic congestion are evident now and will worsen if more commercial activity is established. Land values and taxes will rise, also, and that may make it difficult for landowners to retain this property in agriculture.

Growth will continue at Cave City and shoe-string development will multiply along Ky-70 westward from I-65 especially as municipal water service becomes available. Activating the peripheral staging area at Union City should not stimulate growth at Cave City as much as it may at Park City and between Chaumont and Turleys Corner.

3. Extend Transit System

When the first stage of the parking lot at Union City is operating, the present fleet of buses will be expanded to transport passengers in cars stored there about 5½ miles to the staging area at Historic Entrance. As new cave entries are opened, the transit system will be extended to serve them. In time, visitor use will build up to the point where transit is on a continual shuttle system. This will reduce waiting time materially at the terminal building and at the various cave entries.

A transit system greatly reduces air and water pollution, consumption of energy, and cost per individual transported compared with private automobiles. There will also be an opportunity to provide transit vehicle passengers with interpretive messages while en route to their destinations so that their visit becomes more meaningful. It is anticipated that visitors will be able to relax and enjoy their park experience more. Volume of litter along roadways will be reduced also.

Key to fulfillment of the master plan is closing to travel in personal cars about half the mileage of public roads on Mammoth Cave Plateau so that

they may be used exclusively by transit vehicles. At the appropriate time, the National Park Service will petition the court to amend the road deed. When these roads are closed, some motorists will be inconvenienced by being unable to use them for motor sightseeing. However, these people will be able to do so by riding over them in a transit vehicle and be freed from traffic congestion. Public conveyances will be able to maintain their schedules without interference from other vehicles. Establishment of the transit system and closing of roads will not cut off private vehicle access to churches and cemeteries.

Using existing paved roadways on Mammoth Cave and Flint Ridges for the transit roadbed will avoid clearing away more forest. Most of the old wagon road across Doyel Valley can be rebuilt and used between the staging area and Mammoth Cave Ridge. Runoff from its paved surface will enter the cave system. Although there is some savanna vegetation in Doyel Valley, typical of the species that grew on The Barrens of the Pennyroyal Plateau in pre-Columbian times, this crossing is not expected to have adverse effects on this plant community. Savanna vegetation grows in other solution valleys in the park and on some ridge tops as well.

The form of the ultimate transit system will be the subject of further study.

4. Retain Existing Facilities Without Expansion

It is anticipated that the facilities now being operated by the government and the concessioner at Historic Entrance will become outmoded or unneeded in the years to come. Rather than to replace them, the master plan calls for their removal with the object of reverting the area to its c. 1800 appearance, as much as possible. Before any structure is razed, its historical significance will be evaluated professionally and the Park Service will seek the advice of the Advisory Council on Historic Preservation as required by law.

Impacts common to the possible removal of any or all of the buildings and structures includes loss of some unrecoverable construction materials; cost of restoration of the areas disturbed by development to their natural appearance; removal of the threat of pollution or damage to underlying caves by spills of sewage, fossil fuels, and surface runoff; water will be available for other park uses and more of the flow will be restored to the caves; consumption of electric energy and fossil fuels will be reduced and some of the former could be made available for lighting cave passages and operating elevators when public tours are expanded; social trauma occasioned by changes in long-established activities and functions; greater probability of perpetuating park resources without deleterious effects; higher quality of park experience for the benefit of visitors.

Eventual removal of structures and buildings from Historic Entrance including the picnic area and campground, will improve the environment by removing great volumes of vehicle exhaust and heating plant emissions. The congestion of hundreds of cars and thousands of people will be relieved. Quantities of polluted parking lot water pouring into Historic Entrance and Mammoth Dome, will disappear along with the unsightly array of a conglomeration of structures and buildings.

5. Utilize New Source of Domestic Water

In place of the springs and wells, the park will obtain its raw water from Green River. The intake structure on the riverbank and the treatment plant atop Flint Ridge will be minor visual intrusions. The intake structure will have to be designed to withstand flooding and submersible pumps will have to be used. The treatment plant will be located on former farmland that is in the earliest stages of vegetative succession to forest cover. The ditches for the pipelines will be adjacent to existing roads except for about a mile, which will cross mature forestland. Here there will be temporary, minor destruction of vegetation and habitat. Pumping will require a considerable commitment of electrical energy. Treatment of Green River water will require chemical coagulation, sedimentation, filtration, and chlorination in order to satisfy current requirements for safe drinking water. Operating costs for salaries, electricity, chemicals, and routine maintenance will be an ever-increasing demand on the monetary resources available to the National Park Service. The existing water storage and distribution facilities will continue in use. Although the park's sewage-treatment plant will have to be modified to accept the effluent from water treatment, it will have to be upgraded anyway to meet newly established standards. The park's withdrawal of water from Green River will be insignificant compared with its total flow even at minimum discharge. However, the dollar cost of doing so and treating it to make it potable, is probably greater than if an equivalent volume of water was purchased commercially.

B. RIVER VALLEYS

(See Section I, Part B, and Section II, Part B)

1. Provide Additional Sites for Picnicking and Primitive Camping

The practice of launching small motorboats from the ferry ramps at Houchins Ferry and from the north side at Mammoth Cave Ferry will continue. This compatible use permits visitors to see the outstanding riverscapes, geologic features, abundant wildlife, and to go fishing. The master plan encourages this use though it is limited by the small amount of space available for parking tow vehicles and boat trailers at the three ramps, so it is unlikely that motorboat use and associated impacts will become a

serious problem. Because of the river bluffs, narrow floodplain, and steep, muddy riverbanks, there are no other access points for motorboat launching. Nevertheless, increasing use will introduce more pollution, create more noise, alter more habitats, and add to the responsibility of the protective (ranger) force. There are no access points in the park for motorboat launching along the Nolin River.

At the site of Dennison Ferry, no impacts of consequence are anticipated by clearing some undergrowth at the campsite and adding some rock for a stable subgrade; by installing portable, chemical toilets; and by providing a plank with cleats, or wooden steps to facilitate launching and retrieving canoes, johnboats, and other hand-propelled craft. Water could be provided from a spring or well, if tests prove satisfactory. These are measures that relate generally to the health and safety of visitors and to the protection of their property.

The addition of primitive campsites on the north bank of Mammoth Cave Ferry and on the south bank opposite the mouth of Buffalo Creek for the use of boaters traveling between Dennison and Houchins Ferry will have only minimal impact on vegetation where space is cleared of undergrowth. Both sites are accessible to park maintenance vehicles so sanitary facilities can be provided and cleanup done on a routine basis.

It is estimated that about 5,300 boaters launched their boats in Green River in 1974. Most of these people are fishermen and sightseers, but about 15 percent of them take a boat trip that requires an overnight stop. The potential exists for this use to increase and the master plan encourages it. However, the cumulative effect on the resources by these uses appears to be minimal under present conditions. Campsites at Dennison and Houchins Ferries are not being overused and camping at random elsewhere in the River Valleys has not caused problems. Moreover, most evidence of camping on the floodplain and on river islands disappears soon because of rapid vegetative growth and annual floods. Residue is buried by silt, but floatable objects could be carried downstream by floodwater to clutter the floodplain elsewhere, even outside the park. Some may be deposited high in the crotches of trees where it would remain as an eyesore for many years. The park is the recipient of much trash washed downstream by floodwaters. Camper trash is insignificant in comparison.

C. HILLY COUNTRY

(See Section I, Part C, and Section II, Part C)

1. Build Bridge and Improve Houchins Ferry Road

When Mammoth Cave Ferry is discontinued and the transit system becomes fully operational, the single transpark road will be needed. This will be accomplished by improving the existing Houchins Ferry Road and building a bridge probably just downstream from the present ferry crossing. The bridge will be a visual intrusion for river travelers. The road as a whole will cause loss of habitat, modify drainage, create erosion during construction, and more animals will die from traffic accidents. Easier accessibility may result in more poaching and more vandalism. Targets of vandals could be vegetation, rock formations, caves, and archeological sites.

Much of the existing road north of the river lies on the Caseyville formation, which is a sandstone conglomerate that will be a good foundation for the roadway. Engineering, biological, and archeological studies will have to be done before the exact alignment of the new road is determined.

Use of the picnic area, primitive campsites, and boat-launching ramp will continue at Houchins Ferry and automobile access will be accomplished by retaining segments of the present gravel road, 12 feet wide with 2-foot shoulders, which will be tied into the new road at both ends of the new bridge. Because of the dust, the gravel road will receive a surface treatment.

Once the transpark road and bridge are finished, following the general alignment of the existing Houchins Ferry Road, local people will find travel time shorter, less wear and tear on their vehicles, and a more relaxed and safer trip for the driver, compared with using either of the existing "ferry" roads. Travel will also increase to and from the recreational facilities on Nolin River Lake. This should result in personal savings in travel costs, and should stimulate development of new tourist services both north and south of the park, thus increasing the tax base. It may also encourage further sales of real property for vacation homesites near the lake.

Providing a more direct connection between Mammoth Cave National Park and Nolin River Lake, operated by the Corps of Engineers, will tie together two public areas offering diverse, high-quality outdoor recreation opportunities. Together the areas could provide a vacation destination of appeal to a wide segment of the population. Camping and water-oriented recreation coupled with hiking over rugged terrain and cave visits could appeal to every member of the family. This kind of recreation could sustain interest for several days and generate repeat visits over a period of many years.

2. Establish Trail System

A trail system planned and laid out by park specialists will provide an interesting and enjoyable experience for hikers and horseback riders. As the trails become better known, use will build up and there will be times, during peak periods, when the element of solitude will be lost.

Trail construction and use will affect habitats, alter microclimates, increase poaching, produce litter, and vandalism will occur. There is a possibility that more forest fires will be started in remote places because of human carelessness. Horseback riding and hiking over park trails are compatible uses, but motorized vehicles are excluded from trails by park regulations.

A 24-hour ranger patrol will be necessary to protect hikers' cars in the trailhead parking areas along the transpark road, and rangers will be needed to patrol the trails.

Because of the ease of accessibility to the primitive trail system from these parking lots, trail use will increase rapidly in 5 to 10 years. Then the primitive trails will have to be widened and surfaced with gravel or crushed stone to prevent erosion and preserve the environment. This will be a slight aesthetic intrusion and more vegetation will be lost to trail construction. Need for surfacing will be greater on trails used for horseback riding. It may be necessary to lay out a separate trail system for riders someday. An alternative to widening and surfacing is curtailing use somehow.

3. Develop Primitive Campsites

As use builds up, the dregs of camping at random will become displeasing aesthetically, but this can be mitigated by establishing primitive campsites and limiting camping to those areas. Nevertheless, camping alters habitats through the clearing of vegetation; dead trees will be cut for firewood; there will be smoke from campfires; danger of accidental forest fire starts will increase; vandalism will occur; ranger patrols will have to become more frequent; campsites will have to be cleaned up regularly and litter removed; and the sites themselves will be a visual intrusion. They may be relocated periodically if the use appears to be unduly damaging and this will give the sites opportunity to revegetate.

The improved Houchins Ferry (transpark) Road, the trails, and the primitive campsites are expected to open a new dimension of outdoor recreation within Mammoth Cave National Park that will attract a segment of the population to the park who have not visited it before.

D. LAND AND CAVE PASSAGE CLASSIFICATIONS

(See Section I, Part D, and Section II)

1. Land Classification

According to law, national parks are managed both for perpetuating their resources and as pleasuring grounds for the people. The land classification system, defined in Section I of this statement, recognizes this dichotomy. The system is designed so that the various categories may be shown graphically on a map. Resources are classified as IV, V, or VI, and some may be so fragile that use will destroy them. Classes I, II, and III represent decreasing intensity of use. The objective of land classification is to locate compatible developments and uses where they will have the least deleterious effect on the resources.

The National Park Service looks upon land classification as a step in the planning process and as a definition of uses that are compatible with preservation of the park's resources. Once a category is applied to a given tract of land, no development is permissible that is inconsistent with that classification category. Before a nonconforming development could get underway, a change in that category would have to be considered and, if acceptable, the change would be made in the land classification plan to accommodate that type of development. Similarly, new knowledge about the resources could dictate a change in land classification.

Any alteration of the land by man has its impacts, but they vary in intensity. The impacts of a paved road are greater than a foot trail and much greater than a single man walking through the woods. Loss of resource values through use is inevitable, but some losses may be mitigated.

Most public use and management facilities in the park are concentrated on Class I, II, and III lands. Class I bears the greatest concentration of people and the facilities required for their comfort and convenience. Resource values are low and those that are damaged by construction on the site are generally considered to be expendable. Places of lesser people concentration with less space devoted to structures fall in the Class II category. Most park lands are in Class III and here natural conditions prevail to the greatest possible extent. Lands classified IV and VI receive mostly a low intensity of use because it must be consistent with preservation of the resources that predominate in these areas.

The bulk of the Class III, IIIA, IV, and IVA lands in Mammoth Cave National Park will be managed as wild lands much as they have been since the park was established. Mammoth Cave is a relatively small park easily

reached by 80 million people. It is conceivable that future use of its surface lands and waters could become so intensive as to lower its resource values unless some practical control measures can be devised.

2. Cave Passage Classification

The genesis of a cave zoning system was presented in Section I of this environmental impact statement. It was developed by the National Park Service's master plan team aided by the park staff. Later, the Cave Research Foundation proposed an alternative system and that is presented in Section VIII of this statement. Neither is entirely satisfactory and the matter will be deferred to those who will prepare the resources management plan for the park after the master plan is approved. Until more is known and understood about the caves, a satisfactory zoning system cannot be devised. Such an analysis is a prerequisite to further consideration of underground wilderness, should such designation be desirable for portions of the cave system. In the absence of a classification system for cave passages, impacts cannot be identified.

3. No Wilderness

The following impacts are inherent to the Park Service's proposal that park lands are not suited for wilderness designation at this time.

a. Most park visitors view only world-renowned Mammoth Cave and are not aware of the backcountry. To fulfill the Park Service's objective of diversifying park use, compatible recreational opportunities for the backcountry are to be provided. This may attract a broader spectrum of users than wilderness classification would allow.

b. While the Park Service expects to manage the Class IIIA and IVA lands within roadless areas B, C, and D so that they may qualify for wilderness designation at some future date, it is possible that use of primitive trails and primitive campsites may build up to the point that they will have to be improved to a degree unacceptable in wilderness. Much of the soil in these areas is highly erodable requiring surfacing of trails in time. Heavy use could also require developing water systems and providing flush toilets at campsites. This could be avoided, however, if a workable system could be devised to limit backcountry use to the level that only primitive facilities would accept.

c. If "low key" use does not prevail, the integrity of "basin ecosystem" research might be compromised.

d. Motorboating will continue, thus interfering somewhat with solitude.

e. From 1967 onward, some local sentiment has strongly opposed any wilderness designation in the park, surface or underground, fearing that future development would not be responsive to changing use patterns as visitation increases. In their view, this would curtail economic growth of the region.

E. SUMMARY OF CUMULATIVE ENVIRONMENTAL IMPACTS OF THE MAJOR PROPOSALS ON SIGNIFICANT RESOURCES

1. Water Quality

The quality of water in the underground streams should improve when the Great Onyx Civilian Conservation Center is discontinued, two sewage-treatment plants on Mammoth Cave Ridge are eliminated, and 10 miles of public roads are closed and used for the proposed transit system roadbed.

Disposal of additional sewage and contaminated surface runoff resulting from the expansion of commercial activity outside the park could pollute the underground streams in the park. This could be harmful to the cave fauna and might force closing of some cave passages used for tours if the condition became hazardous to public health.

2. Water Supply

Removal of the Great Onyx Civilian Conservation Center will immediately return about 11.5 million gallons annually to the flora, fauna, and geological processes of the Flint Ridge Cave System dependent upon that water.

Once water is available from the Green River to meet the park's total water needs, all the water flow from springs will be restored to the caves. By dilution, the quality of water in the underground streams will improve.

3. Air Quality

Volume of exhaust emissions from any kind of transit system will be but a small fraction of that produced by the private vehicles now being driven to Historic Entrance.

As long as developments remain on Mammoth Cave and Flint Ridges, there will be atmospheric pollution from oil-fired furnaces and private vehicles. This atmospheric pollution can be drawn into the caves.

Gasoline or oil that leaked or spilled from tanker trucks or from underground storage tanks could create an explosive condition of great hazard to visitors or make a stain that could never be removed from the ceiling or walls.

4. Vegetation

At construction sites, vegetation will be cleared and some habitat destruction will result as quantified in the following tabulation:

Site	Acreage	Vegetative Types
Peripheral Staging Area	30	Broomsedge/Eastern Redcedar
Doyel Valley Transit Crossing	5	Oak/Hickory; Broomsedge/ Eastern Redcedar; Savanna
Houchins Ferry (transpark) Road and Bridge	10	Maple/Beech; Sycamore/Boxelder; Broomsedge/Eastern Redcedar; Oak/Hickory
Widening Ky-70	3	Broomsedge/Eastern Redcedar; Oak/Hickory
Ditches for Water Main and Sewer Lines	10	Broomsedge/Eastern Redcedar; Oak/Hickory; Maple/Beech

The following acreages were obtained by measuring the Vegetative Cover Map of May 14, 1966:

Name of Cover Type	Total Acreage
Oak/Hickory	20,880
Broomsedge/Eastern Redcedar (includes Savanna)	14,305
Pine	7,504
Maple/Beech	5,758
Sycamore/Boxelder	2,907
Total Park Acreage	**51,354**

It is readily apparent that the total of 58 acres to be disturbed by construction, even if it affected only one vegetative type, is tiny compared with the park as a whole.

5. Wildlife

Those animals, whose territory now encompasses construction sites, will be displaced. For most, this will be permanent. Included are nesting sites and foraging areas for passerine birds and small mammals over a total of 58 acres. Their population on affected areas is not known.

Gross number of road kills will probably be fewer because of a net reduction in road mileage. At Mammoth Cave, deer, squirrels, turtles, and snakes suffer most from vehicular contact.

Reopening cave passages for tours, lighting them, and improving the trails therein will affect the troglobites (mostly invertebrates) by a reduction in their numbers, but this will be an infinitesimal quantity (probably less than one half of one percent) of the total population of invertebrates.

The five interrelated actions by which the problems of increasing cave visitation will be solved are designed to reduce the volume of polluted air and water entering the caves from in-park sources. Of serious concern, however, is the possibility that cave water sources may become polluted by agricultural pesticides, sewage, contaminated runoff, and the like from commercial development in the vicinity of the park. Polluted water carried into the caves by an underground stream originating outside the park could cause widespread harm to the cave fauna along its course and even result in mass kills of certain species, such as blindfish.

6. Cave Resources

As more of the cave passages are opened to public tours, there will be smaller parties and a wider choice of tours. Visitors will be able to see more of the cave features and understand them better as interpretation improves. More guide positions will be required. There will be an increase of litter and vandalism. Once paved trails, concrete stairways, and metal railings are constructed, the installation is permanent for all practical purposes. Lighting fixtures, electric cables, and transformers are essential, but are a visual intrusion where they cannot be hidden. Lights will remain burning in the Frozen Niagara section for longer periods than presently when this section becomes semi-self-guiding, but the drying effect of lights on the dripstone formations is not known at this time.

Minor trail improvements will be required for public safety before the front parts of Colossal, Crystal, or Great Onyx Caves are reopened for lantern tours. These aesthetic intrusions cannot be avoided. These three caves underlie Flint Ridge wherein are about 90 miles of wild cave passages. Only about 3 miles were shown commercially before the park was established and these are to be reopened to lantern tours when warranted by increasing visitation. Such tours should have little impact on these caves. Parties will be small in number and be accompanied by two guides, so vandalism should be minimal. The environment should not be affected by lanterns nearly as much as by electric lighting (Crystal Cave was so lighted by its private owners, but the wires have been removed). As tours pass, the fauna will scurry to

temporary hiding places and then resume their normal activity. People may introduce substances that are nutritious to some animals and toxic to others.

7. Recreational Use

The master plan's provisions will relieve, until the year 2000, present constrictions on cave visits by providing adequate surface facilities and cave trip capacity to match. The staging area's facilities will be designed for the comfort and convenience of the visitor and be a fitting introduction to his national park visit. There will be some congestion at peak periods because it is uneconomical to build facilities that will be idle most of the time. People will be encouraged to take cave trips at other than peak periods.

Planning for the future was based upon present use patterns, which show that 70 percent of park visits occur during June, July, and August, that the parking lot contains most cars between 10 a.m. and 5 p.m., that most visitors remain in the park 4 hours or less, and that the 1 to 2 hour cave trips are the most popular. By a straight line projection of travel, which occurred during the late 1960s and early 1970s, average daily visitation of 13,265 and 2,320 vehicles are to be expected by the year 2000.

Visitation now is limited by space for storing visitors' cars at Historic Entrance. Expansion there is unacceptable environmentally, hence the selection of the peripheral site at Union City. Special precautions will be taken there in building the parking lot and related facilities to protect the cave systems. There will be loss of surface habitat. Capacity of facilities will be adequate to meet travel projections to the year 2000. Space is available for further expansion when warranted.

Cave trip capacity will be raised and variety of trips increased by offering more trips per day, by making more passage semi-self-guided, by lighting passages now dark, by providing new tunnel or elevator entries, and by adding more lantern trips. Mammoth Cave is scheduled to receive the bulk of the new improvements and of future visitation. This is with the assurance from competent cavers that these modifications and loadings will not result in unacceptable deleterious effects. Through the year 2000, only about 10 miles of the 76 miles of the cave will be developed and used for tours. For the most part, development consists of improving trails in passages shown previously and installation of lights.

After the year 2000, cave capacity can be increased further by applying the same measures to previously undeveloped passages and by opening new entries. By these means, cave capacity can be doubled from the 13,000 average daily visitation expected in August 2000. Whether visitation will ever

exceed 13,000 is purely speculative. Should that happen, it is comforting to know that more visitors can be accommodated. Before physical changes are made in the cave to accept more visitors, careful study will be undertaken of the consequences of such action on the resources the Park Service is obligated to pass on "unimpaired for the benefit of future generations." Developing cave passages is both irreversible and irretrievable.

Besides the staging area, concentrations of people may occur at cave entrances, sightseeing boat dock, and trailheads. The numbers of people will not generally exceed the capacity of a transit vehicle (say 40 to 50 persons) or two. Their guide would be awaiting their arrival and the transit vehicle would be scheduled to meet them at the end of their tour. Waiting time should be minimal. At Historic Entrance, however, a shelter and rest rooms (transit station) will be provided because more trips enter and leave there, and some people will be hiking the trails on the river bluffs.

There are also places in the cave where people congestion could occur, such as Snowball Dining Room, at points where trails intersect, and in passages common to more than one tour. Avoiding congestion is largely a matter of logistics involving guides, schedules, routings, and vehicles. The Park Service has dealt with and solved these problems at Mammoth Cave for 30 years. Furthermore, such problems are similar to those faced by any large city transit system and the technology is available to solve them. Removing personal vehicles from Historic Entrance to the peripheral staging area, and from the transit roadbed will relieve present congestion and allow for the increasing visitation of the future.

When the ultimate transit system is selected, it will benefit from new technology in this field. Environmental considerations, efficiency of operation, and the ability of the system to handle anticipated loadings will all be considered. The present bus fleet will be expanded at the outset.

The two ferries are now closed daily during the early morning hours and at times of high water. Traffic back-ups occur daily in the travel season. Travel over the narrow, dusty ferry roads is unpleasant and is becoming hazardous as use increases. When the transpark Houchins Ferry Road is improved and Green River is bridged, the ferries can be eliminated, though Houchins Ferry may continue to operate seasonally as a "living-history" exhibit. The new transpark road will provide an all-weather crossing of the river, will relieve traffic congestion, will provide better access to the scenic Hilly Country and its trails, and will link adjoining Federal recreation facilities – the park and Nolin River Lake – for the benefit of those who use both. More wildlife will probably be killed by vehicles, and the bridge will be a visual intrusion for

those traveling the river by boat and those who will be picnicking or camping on the riverbanks at Houchins Ferry.

In addition, the transpark road and bridge, new trails, primitive campsites, and more boating will encourage many thousands to use the backcountry comprising 55 percent of the park. About 125,000 people used present facilities in the River Valleys and Hilly Country during 1974. Deleterious effects will include minor loss of habitat, more noise, wood smoke from campfires, adding some pollution and litter, and multiplying the duties of park rangers in such areas as fighting wildfires, search and rescue, and policing for poachers and vandals.

Some congestion could occur in the future at Houchins, Mammoth Cave, and Dennison Ferries when boat use builds up. About 5,300 people boat on the rivers at the present time. Because of the constricted space available on the floodplain at these sites, expansion of parking space for cars and boat trailers is limited. If congestion does occur, it is expected to be limited to a few weekends during the year.

8. Scenic Values

Eventual removal of modern structures and paving at Historic Entrance will allow this area to more nearly resemble its appearance at the time of the cave's discovery. It is anticipated that solid debris from razing structures will be disposed of in a landfill outside the park.

The River Valleys and Hilly Country will become better known as more people discover some of the finest riverscapes in Kentucky and see some of the waterfalls, streams, cliffs, woodlands, and the spring and fall floral displays. Primitive trails and campsites will be intrusions and some fragile resources may be destroyed, as public use increases.

9. Land Classification

Carrying out the provisions of the Land Classification Plan (p. 35), including no lands designated wilderness, will result in shifting some of the present uses of the park to less fragile areas and eliminating others. Through it management is alerted to the location of the park's fragile environments so that only those uses compatible with their perpetuation will be permitted. Thus surface areas, especially above cave passages of paramount scientific value, will never be developed for more intensive use.

"Low key" use of the backcountry by hikers, backpackers, and boaters will continue. Their use will be channeled so natural forest regeneration and associated wildlife will be untrammeled on the bulk of these lands. No other

uses of these lands have been proposed by the Park Service or by others.

10. Cave Passage Classification

The Park Service has obligated itself to pursue this matter after the master plan has been approved. The classification system will become a part of the park's resources management plan. For any classification system to be meaningful, much more must be learned about the cave passages of the park. This may affect present policies of park management.

11. No Wilderness

Some of the public sector maintains that pressures on the Park Service will become so great in the future that the park's present wildlands will lose their character through developments for the comfort and convenience of the visitor. These people advocate that these wildlands be recommended now to Congress for wilderness designation. Others feel that the Park Service has all the legislative authority it needs to perpetuate the wild character of these lands.

12. Visitor Services

Those provided by the major park concessioner — lodgings, dining room, camper's store, and automotive service station — will continue without expansion, as will the picnic area and campground, operated by the Park Service. More of these services are being supplied outside the park by private enterprise. Continuation of these services in the national park is subject to periodic review and evaluation.

13. Historical and Cultural Resources

Restoration of the Historic Entrance area to its c. 1800 appearance will require demolition of a structure(s) that may meet the criteria for entry onto the National Register of Historic Places. Before demolition, the Procedures of the Advisory Council on Historic Preservation (36 CFR, part 800) will be followed. If this shows that the public interest would be better served by preservation, the proposal for restoration of the entrance area will be modified, or appropriate mitigating measures will be taken.

A professional historian will evaluate the old wagon roads of the park as to whether or not they meet the criteria for nomination to the National Register. If so, those abandoned may not be allowed to revert, but will be suitably treated in conformance with their status as national register properties (see paragraph 13, p. 148).

Construction activities could destroy subsurface archeological resources, but the likelihood will be lessened by surface surveys by professional personnel

prior to the decision to proceed with the project. Moreover, such personnel will be on site or on call during construction to investigate and evaluate any resources that may be exposed. Construction will be halted while newly discovered historical, archeological, or paleontological resources are being evaluated.

14. Energy Consumption

More electricity will be needed for cave lighting and for elevator operation as visitation increases. When use of certain facilities lessens or terminates, more electricity will become available thus reducing demand on existing generating capacity for expansion of cave trips.

Transit from the peripheral staging area will use far less fuel than if the comparable number of people transport themselves in private vehicles.

The ultimate form of the transit system has not been determined. It could be surface, elevated, air cushion, or some other system. It will be the subject of a separate environmental study when the time comes. Among the considerations then could be extension of the transit system outside the park to pick up passengers, destined for the park, at their lodgings in nearby towns, and at the L&N Railroad Station.

At the outset, buses will be used to transport visitors from the peripheral parking area, which will be the first stage of development at Union City. From there it is 5½ miles to Historic Entrance. At this transfer point, visitors will take buses, as presently, to cave entrances. The ultimate development, for year 2000 visitation, requires only two new cave entries: an elevator, which will be in the present campground, and a tunnel. Buses to caves on Flint Ridge and the sightseeing boat dock will use existing roads. Therefore, expansion of cave trips and extension of bus routes does not appear to cause any problems new to park management. During peak periods, buses may run constantly between transit stops to reduce waiting time for passengers.

15. Nearby Communities and Parks

If present trends continue, the following functions, now situated in the national park, will eventually be absorbed by private industry and other governmental agencies elsewhere in the region.

a. **By the major park concessioner** – 154 lodging units, dining room with a serving capacity of over 500 persons per hour, camper's store, laundry and shower building, automotive service station, corporate offices, warehouses.

b. **By the Park Service** — 145-site public campground, 75-site picnic area, administrative offices, 17 residences and 12 apartment units for employees, and a utility area with storage building, warehouse, shops, and automotive service station.

As goods and services become available outside, they will be terminated in the national park. This, and increasing visitation to the park, should spur economic growth in the region. There will be more business, more jobs, property values will rise, and the tax base will be broadened. However, the region will have to maintain a high quality of plant and services and take care to prevent polluting the underground streams. Hidden River Cave in the town of Horse Cave, Kentucky, has been closed to public tours for decades by sewage pollution and industrial waste dumped in a sinkhole.

In the absence of county ordinances, private development of tourist-oriented businesses will string out along Ky-70. Traffic congestion unpleasant to tourists will result if the road is not widened. The rural open land now characterizing the highway approaches to the park will give way to "strip" development, thereby detracting from the anticipation of a national park visit.

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

A. MAMMOTH CAVE PLATEAU

(See Section III, Part A)

1. Expand Cave Trips

The Park Service has appointed a resident management scientist to develop and direct a research plan for the park. He may be assisted by a research board appointed by the Regional Director of the Southeast Region. To develop data on the effects of cave development and use, the master plan also calls for establishing monitoring stations in the caves to measure the effects of opening new entries, reopening passages, introducing electric lighting, and increasing numbers of visitors. The stations are to include instruments for measuring air and water quality and temperature, air moisture content, and evaporation rate, heat input of visitors' activities and lighting, and associated information. Data will be collected and compared from used and unused passages. When analyzed, such information will help to guide management so that constrictions may be applied if deterioration is taking place beyond an acceptable point.

With much larger numbers of visitors, carbon monoxide levels could increase and lower air quality. This is not expected to happen because of the normal, constant flow of air through the cave passages. However, carbon monoxide levels will be monitored periodically so that corrective action can be taken if warranted.

Measurement of water quality is primarily to detect contamination levels in the underground streams, so that its origin may be traced. Expansion of cave trips and using more passages is not likely to affect water quality.

Replacement of New Entrance with a sloping shaft bored through solid rock will have a lesser effect on resources than the previous dome-pit entry with its sequence of ramps, stairways, and bridges. The new tunnel portal will be fitted with a stout gate and an air lock, if study determines the need. None of the other portal entries to Mammoth Cave have an air lock, but study of these will be undertaken to determine whether they should. Bats now use some, if not all, of these artificial entrances for access to roosting places within the cave.

The Violet City route is now developed with a trail built during the CCC period except for about a half mile, which was never completed. Access to the Violet City route will be by a new elevator from the campground to Star Chamber. Air locks will be provided at the top and at the bottom of the

elevator shaft. This will prevent air from being pumped out of or into the cave as the elevator ascends or descends.

Like the Violet City route in Mammoth Cave, the foreparts of Colossal, Crystal, and Great Onyx Caves on Flint Ridge were developed years ago with trails for public tours. The dollar and environmental cost of reopening these passages will be far less than opening undeveloped passages. By these actions, coupled with the new tunnel and elevator entries, mentioned previously, cave trips can be expanded to meet visitation levels to the year 2000, provide visitors with more diversity, decrease the visitor load per trip, and increase the frequency of trips.

Installation of lighting will be planned carefully so as to "hide" wiring, transformers, fixtures, and switch boxes as much as possible. In new installations, the Park Service will benefit from past experience at Mammoth Cave and at several other caves in the National Park System, and will seek the advice of consultants.

Advice and assistance has always been freely given by the Cave Research Foundation and by other caving organizations. Regular inspections are conducted at Mammoth Cave by the Bureau of Mines, and these people along with members of the Geological Survey staff and the Institute of Speleology (University of Kentucky) are called upon for advice and assistance when special problems arise. Such consultations are standard practice throughout the National Park System. For instance, some of the cave pools in Carlsbad Caverns were drying up. The Geological Survey determined (1971) that the increased evaporation was caused by winter airflow up the elevator shaft, heat from the electric lighting system, which used mostly incandescent lamps, and the presence of visitors. At Mammoth Cave, air locks were put in when Snowball elevator was installed, and fluorescent lighting has replaced incandescent where practical. Such practices will continue when new passages are developed.

A survey of historical, archeological, and paleontological resources will be undertaken before deciding to begin construction. During construction, evidences will be watched for and any discoveries will be called to the attention of competent people for advice before work proceeds (see paragraph 13, page 148).

2. Relocate Staging Area to Peripheral Site

During construction of the parking lot, terminal building, and widening of Ky-70, siltation will be checked with sediment traps. Following construction the area will be landscaped with native species of trees and shrubs, probably

obtained from a nursery, and slopes will be seeded with indigenous grasses, which will provide a cover until natural vegetation can establish itself. Providing trees in the parking lot islands will make it more pleasant, visually, and the shade will make the area cooler for cars and people. Because of a concentrated peak of visitation in the early afternoon, a total accumulation of 2,320 cars is anticipated in the year 2000. Cave loadings warrant paving of 1,600 parking stalls; for the overflow of 700 additional vehicles, stabilized turf parking will be provided. (Stabilized turf is established by mixing gravel and soil and seeding it with grass. The resulting surface is hard enough for auto traffic, yet permeable enough to permit grass to grow.) Transpiration from the shade trees and turf, evaporation from the pavement, and percolation through the dry wells and turf will all reduce surface runoff from the parking lot.

Before runoff water is directed into existing surface stream channels for entry into the caves, it will be cleansed by processing through dual lagoons in the following manner as suggested by the Atlanta Regional Office of the Environmental Protection Agency (EPA). From the first lagoon, floatable solids and petroleum products will be skimmed off the water surface. The second lagoon will permit suspended solids to settle. Water overflowing from this lagoon will enter surface stream channels. This water, according to EPA, will be superior in quality to runoff from agricultural lands. This water will be analyzed and treated if necessary so that toxic materials will not be released into the groundwater. Surplus clay from parking lot construction could be used in building the lagoons, both in lining the bottom and in forming the dikes.

A considerable quantity of basal aggregate will be needed for the parking lot, and aggregate will be needed for concrete structures of various kinds. This may be obtained from local limestone quarries outside the park. Its production and delivery to park projects could bolster the local economy. Similarly, concrete mix is manufactured locally.

A 3.8-mile extension of the sewer line from the campground at Historic Entrance to Union City has the advantage that sewage from two in-cave comfort stations – Snowball and Mt. McKinley – could be picked up en route. Both are now on septic systems. This part of the line will be gravity flow, but a force main will be required across Doyel Valley. The pumping station will be situated adjacent to Union City and below it an automatic check valve will be installed in the pipe, which will close if loss of pressure occurs. Care will need to be taken in crossing Doyel Valley because of soil slippage areas on the slopes and possibility of slumpage in the sinkhole area of the valley floor. Danger of pipe failure is remote if the line is designed

properly including the use of heavy-duty pipe where foundation conditions warrant it. Natural gas pipelines and water mains across the Sinkhole Plain in similar topography have not experienced any unusual difficulties.

An aerial telephone line now crosses Doyel Valley, which was built during the time the area was farmed before the park was established. If possible, the same corridor will be used for the sewer and water lines.

Before the sewerage is piped to the plant on Green River in the park, other alternatives will be considered including tertiary treatment at Union City, and piping it to Park City for treatment there. Decisions such as this are made during the development concept stage of park planning, which follows approval of the master plan and precedes construction. Environmental considerations are inherent to this stage of planning, also.

In time there could be enough tourists staying in nearby towns desiring to visit the park to warrant establishment of a transit system between the town and the staging area. This could reduce significantly the number of parking stalls to be built, there would be less congestion of automobiles, fewer accidents on approach roads, etc. Except for large families, per capita cost of transit would probably be less than operating a personal car; use of fuel for propulsion would be much less; and air pollution would be reduced.

An archeological and historical survey will be undertaken and the results evaluated regarding the Union City site and the pipeline corridors leading from it to the sewerage disposal plant and the water-treatment plant, respectively. This information will be incorporated in subsequent documents, as appropriate (see paragraph 13, p. 148).

3. Extend Transit System

A transit system using buses has operated effectively at Mammoth Cave for nearly three decades. Removing visitors' cars from existing transit routes will make the system operate more efficiently and will lessen impact on many resources. For example, a 50-passenger bus replaces 15 automobiles. In terms of highway capacity, one bus replaces two automobiles. Conversion to an all-transit system will reduce significantly, on Mammoth Cave Ridge, road maintenance costs, the volume of exhaust emissions, the quantity of polluted water entering the caves from road runoff, the volume of roadside litter, and the numbers of animals killed by auto. It will also reduce waiting time for cave trips.

The new system requires all visitors to ride transit vehicles to cave entrances and the sightseeing boat dock.

Initially, buses will be used, but later another type of transit vehicle could be more economical. Buses have a high resale value and their disposal is not difficult. Transit is the only device known for moving large numbers of people economically in terms of cash, natural resources, and energy for propulsion.

As for the right-of-way itself, existing road corridors are to be utilized to the fullest extent possible. Where sections are abandoned, they will revert to forest in time and will thus be retrieved.

To cross Doyel Valley at grade requires rebuilding part of the old wagon road (unused now except for occasional ranger patrols) between Union City and New Entrance Hotel, and making a new connection from it to the bus roadway on Mammoth Cave Ridge that serves New and Frozen Niagara Entrances. Doyel Valley rests on limestone. Limestone also forms the floor of the Sinkhole Plain, which is crossed by major highways, a railroad, and several pipelines. No unusual problems were encountered during their construction or in their maintenance. It is reasonable to expect a similar experience in crossing Doyel Valley. Any road built over limestone terrain may collapse if the ceiling of an underlying cave falls in. This is more likely to happen where there are large, open sinkholes. This condition does not exist where the roadbed would be constructed across Doyel Valley. During construction, every precaution will be taken to minimize erosion and siltation. Adding more water to the cave systems in the form of surface runoff from the roadbed should not be detrimental. Oil drippings and other contaminants washed from this type of roadbed should be minimal compared with a given length of public road in the park.

Even though there may be some loss to the savanna vegetative community through the construction and presence of the roadbed and pipelines across Doyel Valley, there are other such habitats in the park that will not be affected by any proposals of the master plan. Nonetheless, the bounds of the habitat will be determined beforehand and the roadbed routed to avoid it, if possible. Also, audible and visual encroachment from transit vehicles, the roadbed, and the pipelines should be minimal.

Of the 24-mile road system on Mammoth Cave Plateau, 12.4 miles will be devoted to the transit system when it becomes fully operational. With the reduction of public road mileage, fewer rangers will be needed for road patrol and for assistance to motorists. The accident rate should be reduced also because there will be fewer miles traveled over park roads by private vehicles. Incidents of cave vandalism, such as removal of onyx, should be less

frequent because people so inclined will not be able to drive vehicles as close to cave entries as heretofore. Similarly, fewer animals will be killed on the road. Overall road maintenance costs should be reduced significantly when the ultimate transit system is installed.

Many people who lived formerly on Mammoth Cave Plateau enjoy traveling over the 24-mile road system. Most of the places where they or their friends used to live are impossible to locate any longer because physical remains are gone and vegetation has covered the old clearings. Just traveling over the roads brings back memories and the roads do traverse attractive tracts of second-growth hardwood forests. Of course, this experience will not be lost entirely: 11.6 miles will remain open to private cars and the remaining 12.4 miles will be traversed by transit vehicles. Most park visitors will derive more pleasure from the transit ride in a comfortable vehicle creating less air pollution. Visitors' enjoyment will not be tempered by traffic problems and they will be able to develop a better understanding and appreciation of the park derived from information provided over an amplifying system while en route to destinations.

Funds for planning the transit system are expected to be available in the 1976 fiscal year budget.

4. Retain Existing Facilities Without Expansion

This will cause very little disruption of the status quo for either the government or the principal concessioner. The major exceptions, mentioned previously, are the establishment of the peripheral staging area where all visitors who take cave trips and the sightseeing boat trip will park their cars and buy their tickets, extension of the transit system, and the construction of a transit terminal building to house the present visitor center functions. Otherwise, it will be "business as usual" for both parties at Historic Entrance. Visitors will continue to come here in their personal cars, or arrange a stop-over on the transit system, for lodgings, dining room service, curio purchases, camping, and picnicking.

In accord with congressional policy, there will be periodic reviews of the concessioner's operations and those no longer essential to the needs of the visitor will terminate. Tourist-oriented businesses in the park's environs have been expanding rapidly since 1968. This means a broader tax base for the adjoining counties.

As government and concessioner structures become obsolete or their functions terminate, they will be evaluated professionally for their historical value and their disposition determined in consultation with the Advisory

Council on Historic Preservation as required by Section 106 of the *National Historic Preservation Act of 1966* (80 Stat. 915) (see paragraph 13, p. 148).

No new housing will be built for government employees. Rental housing available at reasonable cost outside the park will be needed for the use of employees subject to transfer.

5. Utilize New Source of Domestic Water

During late summer and early autumn, when water yield from springs is low, nearly all the water is diverted to domestic use resulting in slowing the normal geologic processes and reducing the flow of nutrients to the cave biota. Utilizing the Green River as the source of domestic water will correct this degradation of the natural environment. It will also eliminate water shortages in the park such as have occurred in the past.

While much of the water taken from the river will be returned to it following treatment through the sewage-disposal system, some will be consumed. However, that amount is insignificant compared with the total flow of the river through the park. Neither the quantity or quality of the water returned to the river will have an adverse effect downstream.

As mentioned previously, certain archeological and historical surveys and evaluations will be undertaken before the water-treatment plant is authorized for construction.

B. RIVER VALLEYS

(See Section III, Part B)

1. Provide Additional Sites for Picnicking and Primitive Camping

It is conceivable that random camping under a backcountry-use permit could build up to the point that sanitation becomes a problem. Then use would be confined to the sites named – Dennison Ferry, Mammoth Cave Ferry, Mouth of the Buffalo (south bank), and Houchins Ferry – where sanitary facilities can be provided and serviced by motor vehicle. These sites will also receive a survey and evaluation of their cultural resources in compliance with the National Historic Preservation Act before they are utilized for the purposes indicated (see paragraph 13, page 148).

The topography of the River Valleys, being narrow and steep-sided, is a mitigating factor in itself that limits the number of access points for boat launching. There are only three points on the Green and no access to the Nolin within the park. This constricts the development that can take place, and hence the use.

Forested bluffs along a slackwater segment of the Green River.



Antiquated Houchins Ferry



Should man's works and man's activities be abandoned, evidences of them would soon disappear because of periodic flooding and rapid growth of vegetation on the fertile alluvium of the floodplain. Similarly, few people will hear or see boats on the rivers because the vegetation lining the banks is so dense. This muffles sound and limits sight distance. Thus motorboat use will have little effect on solitude for those who are hiking or riding horseback in the adjoining Hilly Country.

C. HILLY COUNTRY

(See Section III, Part C)

1. Build Bridge and Improve Houchins Ferry Road

This road will maintain regional circulation and will improve existing conditions: by replacing two ferries, by removing two dusty, gravel roads, and by reducing transpark travel time and cost for local people as well as visitors to the region.

The Park Service is obligated by the road deed to maintain north/south circulation for the benefit of local people. The bridge will permit all-weather and 24-hour use. Neither is possible with the present ferry crossings.

A report commissioned by the Barren River Area Development District, Inc. (BRADD), titled *The Year 2000 – A Long Range Plan,* released in 1970, contains a recommendation for six new scenic routes within the 10-county region. Highest in priority of these and to be completed by 1980 is a road connecting US 31W and Nolin River Lake which includes, coincidentally, a transpark segment. The BRADD report recognized also the desirability of providing a closer tie between the recreational opportunities of the park and the lake.

Those who visit both Mammoth Cave National Park and Nolin River Lake use circuitous external roads because they are paved and travel time is shorter. Moreover, most users of impoundments bring their own boat along on a trailer. Generally cars pulling trailers cannot be ferried across the Green River. Of the park visitors using the ferries, only about 1 percent are headed for Nolin Lake. It is likely that more people will visit both areas on their vacation trip when the Houchins Ferry (transpark) Road is improved.

The portion of Edmonson County between the park and the lake is isolated from the rest of the county with only the single road across Nolin Dam as an outlet. The improved transpark road will correct this, and at the same time, provide a scenic drive. The combination of Ky-70 across Joppa Ridge and the new transpark road will enhance motoring in Edmonson County for local people as well as park visitors.

Motorists will be able to obtain an inspiring view of the River Valley from the bridge, possibly unequalled in the region. As far as the eye can see, there will be unbroken hardwood forest, which is probably the condition which would have been observed at this point in pre-Columbian times. The bridge itself, when completed, will not be visible from any distant point.

Exposed earth cuts and fills will be stabilized with plantings to minimize erosion, and drainage structures will be spaced properly and be of adequate size. Drainage will be directed into normal runoff channels.

About 3 miles of the total 6.6 miles along the road corridor lies on the Caseyville formation, which is composed of sandstone, conglomerate, siltstone, and shale. This will be a good foundation for a road. About a mile will lie on the Glen Dean limestone composed of limestone and shale; it is not cavernous. The balance of the roadway will be composed of the bridge and its approaches which will cut across several rock formations, and will pass over the alluvium beneath the bed and on the floodplain of the Green River.

Sand, cement, and gravel will come from sources outside the park, possibly those which supplied I-65 construction needs recently. The new road will probably have a bituminous surface like others in the park.

Driving the present "ferry" roads is an unpleasant and hazardous experience in dry weather. Cars kick up great clouds of choking dust which cuts visibility. Roadside vegetation, coated thickly with dust, is unsightly and damaging to plant growth. The future transpark road will be paved and dust pollution will be eliminated.

Air pollution will be reduced by eliminating current traffic backups at ferry landings. Vehicles idling or driving in stop and go traffic create a great deal more pollution, both atmospheric and from oil drippings, than those moving at moderate to high speeds. In addition to being a pleasant, low-speed drive through the woodland, when the forest becomes more mature, wildlife should be observed more frequently than at present. It will add a new "dimension" to park use, by making easily available to the average visitor a part of the park few have seen before.

An archeological and historical reconnaissance and evaluation of the findings will be made of the road corridor and the bridge site prior to authorizing preparation of plans (see paragraph 13, p. 148).

2. Establish Trail System

Only about 15 acres of the 12-15,000 acres of land between Nolin River and Mammoth Cave Ferry Road will be occupied by trails. Wherever old wagon road traces are located properly with respect to topography and the routing of the ultimate trail system, they will be incorporated into the new system to avoid new scars on the landscape and prevent opening up new corridors through the vegetation. Woody material removed from the 6-foot trail clearing will be cut into short pieces so that it will rot quickly by laying closer to the ground, thus adding nutrients to the soil and creating a new, albeit temporary, habitat. In addition, dead trees and limbs that might fall on passers-by will be cut. Every technique to minimize erosion of the finished trail will be employed.

Some of the adverse effects of establishing a trail system in the Hilly Country will be offset by giving the average park visitor a chance to see and enjoy scenery and natural objects observed by only a few rugged individuals in the past. There may be an increase of litter, vandalism, and poaching resulting from establishing the new trail system, but this may be reduced through education, interpretation, and enforcement of laws and regulations.

About 3½ miles of cave passages, some newly explored, were mapped north of the Green in 1974. The caves are short in length compared with those south of the river, and shallow. Establishment of the trail system will not make these any more vulnerable to vandalism than they have been in the past. A permit must be obtained from the park superintendent before any wild cave may be entered. If required for the caves' protection, stout gates will be placed to block entry.

Because of greater accessibility through construction of the trail system, some archeological sites will be more subject to vandalism than in the past. Others can be protected and interpreted, thus enhancing the hiker's appreciation of past events. Those sites that qualify for entry onto the National Register of Historic Places will be nominated after a study and evaluation are conducted by professional archeologists. This work will be undertaken before the trail system is laid out so that these resource values will be known to those planning the routes, and proper protection will be accorded the sites (see paragraph 13, p. 148).

3. Develop Primitive Campsites

In our experience, it is far better for the resource to establish campsites at designated locations rather than to allow the hiker to camp wherever he chooses. An area designated and developed concentrates use; it can be serviced and patrolled; it reduces total damage to the environment; and the areas selected are adaptable to this kind of activity.

Simple shelters at Maple Springs will make it unnecessary for school groups pursuing environmental education studies to bring and carry their own tents.

Patrolling rangers are especially watchful for forest fires, signs of poaching, and other unlawful acts in the vicinity of campsites. Violators are more likely to be apprehended. On the other hand, closer surveillance will probably reduce the number of these incidents.

Before primitive campsites are developed, the areas will be examined, as explained previously, by professionals trained in the identification of historical, archeological, and paleontological resources. In addition, workmen will be instructed to look out for such evidence so that if artifacts are uncovered that were missed on surface examination by the professional, work will stop and the professionals can reevaluate the find. These investigations are required by the *National Historic Preservation Act of 1966.*

D. LAND AND CAVE PASSAGE CLASSIFICATION

(See Section III, Part D)

1. Land Classification

The system applied recognizes that national parks are to be managed for the benefit and enjoyment of the present generation, but this must be done in a manner that "will leave them unimpaired for the enjoyment of future generations." From the in-depth analysis required for classifying land, the resources were identified and developments situated where they will have the least deleterious effects. Furthermore, action will be taken to mitigate the damage that does occur.

Basically, park land management will continue as heretofore, except that provision has been made to encourage more visitor use of surface areas of the park seldom seen in the past.

2. Cave Passage Classification

Until a specific zoning system is developed, impacts cannot be identified. A group of people knowledgeable about the cave passages will classify them as

part of the resources management plan to be prepared after the master plan is approved.

3. No Wilderness

The aura surrounding wilderness attracts a certain group of people who would not come to the park otherwise. By not designating wilderness, some of the pressures on the wildlands would be relieved.

In the event of intensive use without wilderness designation, measures may be taken to channel or concentrate use in such a way that the effects of overuse may be mitigated. Developed campsites, for example, require servicing. To do so by using motorized equipment might not be acceptable under wilderness designation.

E. SUMMARY OF MEASURES TO MITIGATE ADVERSE EFFECTS OF THE PLAN

1. Water Quality

Sewage from the peripheral staging area, both in-cave comfort stations, and Historic Entrance transit station will all be carried by a trunk sewer line to the existing treatment plant near the Green River, which will be enlarged and operated to meet all applicable county, state, and Federal standards.

Sediment traps will be built to collect surface runoff during construction of the staging area and the widening of Ky-70. This will prevent soil pollution of the underground streams.

Runoff from the parking lot at the peripheral staging area will be reduced by transpiration from the shade trees and stabilized turf, evaporation from the pavement, and percolation through dry wells and turf. That remaining will be channeled through dual lagoons to remove solids and petroleum products. This method was suggested by the Environmental Protection Agency (EPA). Water so treated will be superior in quality to runoff from agricultural lands, according to EPA. Nevertheless, lagoon water will be analyzed. Should it contain toxic substances, they will be removed, if practical, so that the cave fauna will not be harmed. Overflow from the lagoons will enter surface stream channels and will eventually find its way underground.

When segments of present roadways and parts of parking lots are closed, the quantity of petroleum products washed into the caves from the transit roadbed will be insignificant compared with the drippings from the tens of thousands of private cars using these facilities now.

Water quality in the cave is being monitored. If substances harmful to health are discovered, they will be traced to their source, if possible, within or outside the park, so corrective measures may be taken.

2. Water Supply

Present sources of water in the park are inadequate to meet future requirements. Withdrawing water from Green River will relieve this problem. The only restraint will be the capacity of the treatment plant to deliver the quantity of water needed. Should this become a problem in the future, the plant and associated facilities could be enlarged resulting in little more impact than the original installation.

Tapping Green River at Floating Mill Hollow is closest to the treatment plant location on Flint Ridge. The two points can be connected by a water line laid along existing roads, thus minimizing disturbance to the ground and vegetation. By locating the treatment plant adjacent to the water storage tanks now in place, the existing water system can be used to the greatest extent thus reducing costs – monetary and environmental – of new construction.

When the Great Onyx Civilian Conservation Center terminates, about 7.2 million gallons annually will be released to flow into the caves. If this occurs soon it will relieve peak season demands that occur at the same time the water yield from the springs begins to drop.

The Kentucky legislature is in the process of considering criteria for land use in the Commonwealth. Mammoth Cave National Park plays a major role in the future of Cave Country. To this end, the Park Service is willing to cooperate with state, regional, or county agencies empowered to plan and control development in the region surrounding the park. Planned development and a high standard of service will go a long way towards maintaining the economic viability of the region. With water soon to be available in quantity, from county-wide water districts, one of the chief constraints to development in the past will be lifted.

3. Air Quality

Carbon dioxide readings in the cave will be monitored. Should they ever reach toxic levels, steps will be taken immediately to discover the source and correct the problem. Toxicity is now believed to be unlikely because of natural air movements in the cave and the immensity of the passages. Temperature, humidity, and evaporation rate will be monitored also.

4. Vegetation

The peripheral staging area occupies old farmland only recently invaded by tree seedlings. When construction is finished, the area will be landscaped and the parking lot will be tree-shaded.

Wherever possible, the transit system roadbed and new roads and trails will incorporate old roads and trails to minimize clearing vegetation and cutting the larger trees.

Raw cuts and fills, ditch lines, and places where structures are razed will be seeded to prevent erosion and to hasten re-establishment of native vegetation. Trails will be surfaced with crushed stone or gravel when warranted by local conditions or projected use.

Although some savanna vegetation may be disturbed in Doyel Valley, other plant communities of this type in the park will not be affected by any development. None of the forest to be disturbed is old-growth; it is all in the process of regenerating as the vegetative cover re-establishes itself on land previously tilled, grazed, or cutover. No rare or endangered species are present at construction sites, and special precautions are being taken to prevent contamination of runoff water during construction and afterwards.

5. Wildlife

Habitats disturbed and species composition are both common to the park and region.

The probability of visitors seeing wildlife will be heightened through observations from transit vehicles, from personal cars traveling on the improved Houchins Ferry (transpark) Road, from hiking, and from boating.

Wildlife will be disturbed in only 10 of the 76 miles of passages in Mammoth Cave. There some species will die out, but others will thrive in the new environment.

In general, cave life should benefit from fulfillment of the plan, including endangered and rare species, because of improvements in the collection and treatment of sewage and reduction of oil drippings along park roads resulting from the shift to transit vehicles.

6. Cave Resources

Tunnel and elevator entries, previously constructed at Mammoth Cave, have posed no special problems in construction and have had no unacceptable deleterious effects. New entries will be closed with stout doors and air locks will be installed at elevator shafts and at tunnel portals.

For the most part, cave passages shown previously will be reopened and lighted. Thus existing trails will need only to be upgraded to modern standards of safety. Of the remaining passages, much is not suitable for public use because of constricted space (crawlways), and flooding. The most advanced techniques known will be used in rebuilding trails and installing lighting to preserve aesthetics as much as possible.

Reopening the front parts of either Colossal, Crystal, or Great Onyx Caves for lantern tours is not expected to have deleterious effects other than litter and vandalism. These passages were developed for commercial tours before the caves were purchased for the park. Presence of two guides and parties not to exceed 40 each will tend to minimize damage.

7. Recreational Use

Less surface land will be devoted to intensive public use thereby allowing natural processes to operate with minimal interference by man's works and activities on the 45 percent of the park underlain by major cavern systems.

Except for some localized botanical habitats, Indian sites, "basin ecosystems" selected for research, and scenic spots that may be damaged, more intensive use of the River Valleys and Hilly Country is an acceptable and highly desirable outdoor recreation pursuit, not yet developed to its full potential.

Even though the tick population of the park is heavy, and backcountry users are exposed to their bites, no incidents of contracting disease from these contacts have been reported. Moreover, exposure to noxious and pestiferous forms of life and to the presence of danger is a daily challenge met by man everywhere and to which he must adjust as circumstances dictate.

8. Scenic Values

Not all scenic spots will be located along trails, nor will trails be built into those "basin ecosystems" designated for study. Nevertheless, these choice places are a vignette of what more of the park will become as the area reverts, over time, to a more pristine condition.

9. Land Classification

The Park Service has committed itself, through the master plan, to continue to manage the park's wildlands essentially as they have been for the past 30 years, viz. to let nature hold sway over the bulk of the roadless areas or 76 percent of the park, while permitting compatible uses of the River Valleys and the Hilly Country, as described previously.

10. Cave Passage Classification

Before cave passages can be classified, more knowledge about them must be obtained. These studies will be undertaken to derive that part of the park's resources management plan. New knowledge gleaned from exploration may entail changes in the management and use of the caverns as a whole.

11. No Wilderness

As successive master plan studies are undertaken, the Park Service will re-assess the condition of park lands as to whether or not they meet the criteria for wilderness defined in the Wilderness Act. When they do, a recommendation will be made to Congress that they be so designated.

If surface lands are designated wilderness, underlying cave passages will be managed as wilderness also, but caves could be designated wilderness independent of the surface if Congress so rules. There is no legal barrier to this, but other considerations could override. This matter will also be considered as part of the review of park management during the preparation of the resources management plan.

Experience in other parts of the country has shown that wilderness designation, of itself, often attracts large numbers of people. With no wilderness, this additional pressure will not occur at Mammoth Cave, which is situated within a day's drive of 80 million people.

12. Visitor Services

In 1970, average annual occupancy rate of Mammoth Cave Hotel facilities was reported to be 50.2 percent, and 90-100 percent for the June-July-August period. Comparable figures for the motel/hotel facilities at Cave City were 58.6 and 93.3 percent, respectively. Since 1970, new motel and campground units have been built, indicative of private industries' response, in this area, to increasing travel. It is congressional policy for concessioners to provide in the national parks only those services that are essential to the needs of the visitors. This is determined by periodic review. If a service is to terminate, it is probable that National Park Concessions, Inc., employees affected could secure identical or similar jobs in the growing hotel and restaurant industry in the region.

13. Historical and Cultural Resources

Although Mammoth Cave National Park is managed by the National Park Service under the natural area category, it has historical and cultural resources that come under the purview of the *National Historic Preservation Act of 1966* (80 Stat. 915, 16 U.S.C. 470) and the Park Service's historic preservation policies. Studies of the historical and cultural resources began in the late 1960s and are continuing.

Before any of the proposals described in Section I, Parts A through C, are authorized for construction, it will be necessary to document the onsite studies and evaluations made by professional archeologists, historians and/or historical architects. Those that meet the criteria for eligibility will be nominated to the National Register of Historic Places.

If the proposal affects a property entered on the register, the Procedures of the Advisory Council on Historic Preservation (36 CFR, part 800) must be followed. Nominations are in process for the seven sites mentioned heretofore, and others are being considered for nomination.

The compliance work will be completed before any project is started. Moreover, an archeologist will be on site or on call during construction to prevent damage to known archeological resources and to assist in the recognition of any new resources that may be discovered, as deemed necessary by the Regional Director. Should historical, archeological, or paleontological resources be exposed during construction, work will be halted pending the investigation and evaluation of the resources and completion of the steps required by the Procedures of the Advisory Council.

14. Energy Consumption

Transit vehicle fuel consumption will be much less than operation of personal vehicles in the peak season. In 2000, 13,265 average daily cave visits are expected. This requires 3,800 automobiles. If these cars were driven the 11 miles between Union City and Historic Entrance and return, they would consume 3,800 gallons of gasoline. Buses moving the same number of people over the same distance would use only 750 gallons. However, during the off-season, when passenger volume is less, transit operation could be more costly. This can be mitigated by running transit trips less frequently.

Presently, buses have a long, useful life and a high resale value. This should result in considerable savings in operating and amortization costs, as well as reduce costs if and when another transit vehicle is used in the ultimate system.

15. Adjacent Communities

The park plan should contribute strongly to the economic growth of the region. For example, by replacing the gravel-surfaced Houchins and Mammoth Cave Ferry Roads with the all-weather, Houchins Ferry (transpark) Road, regional transportation patterns will be retained and enhanced, and new business opportunities should develop. Similarly, a greater variety of cave trips and a higher quality experience, more use of the River Valleys for recreational boating and camping, and increasing hiking and horseback riding in the Hilly Country will attract more people to the park and region, all of which should produce some economic benefit.

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

A. MAMMOTH CAVE PLATEAU

1. Expand Cave Trips

No one may travel beyond a cave entrance without light. Modern cave lighting for public tours requires wiring, switch boxes, transformers, and fixtures. Various techniques are used for "hiding" these objects, but none are totally successful, so this intrusion has a visual impact that is unavoidable. Moreover, the process of hiding what can be hidden, usually by burial or placement behind rocks in the shadows, is an intrusion upon the natural environment.

Except for spot lighting of certain features, cave lighting is at a low key. This is true especially in Mammoth Cave because the predominant color of the walls is grey and the cave dirt is brown. In these circumstances, trails must be built with special care for the safety of the visitor. Trails must be wide, have a smooth surface, and sharp projections must be avoided especially at head and shin level. Frequently, foreign materials must be brought in to assure a non-skid and strong wearing surface. Guard and hand rails, stairways, bridges, and the like are constructed of treated wood, metal, and concrete. Once a passage is developed for tours, it is modified forever. Even wood rots slowly in the constant temperature and humidity of the cave. These modifications and intrusions are unavoidable in developing the caves for public tours where visitor safety is paramount and lighting is essential to viewing the passages.

Disturbance to cave life through loss of some habitat and gain in other habitats; visual intrusion of the lighting system and the trails; introduction of a higher level of carbon dioxide and odors from human traffic; possible changes in temperature and humidity; scars of construction of elevator shaft, tunnel, trails, and lighting installation; vandalism and litter caused by construction and visitor use: these things cannot be mitigated entirely, but can be reduced somewhat through careful surveillance during and following construction.

2. Relocate Staging Area to Peripheral Site

Loss of habitat of the entire 35 acres, plus space required for entrance roadways, transit roadbed, and lagoons, and the influence of the staging area itself on the surrounding park lands cannot be avoided. Similarly, rights-of-way for utility lines – electric, water, and sewer – will create scars, although these will heal in time. Similar lands and habitats extend the length of Joppa Ridge.

While the staging area is undergoing development, some siltation of underground passages could occur despite every reasonable precaution, as the result of unexpected torrential rain. The area is subject to downpours during periodic electric storms. At worst, this might plug a natural drainage channel. Plugging and unplugging of sinkholes is of regular occurrence throughout the region, hence some siltation is a natural process.

There will be a greater volume of runoff from the parking lot and the roof of the terminal building than from the area with its present vegetative cover. Surface outflow from the site is now limited to wet-weather streams, which owe their origin to temporary ponds and swamps. They overflow during the 7-month period from late December to mid-July. Thus, the cave fauna is adjusted to a 5-month "drought." There will probably be an overall increase in quantity of water because of the parking lot and roof of the transit terminal, but the dual lagoon system should act in much the same way as the swamps do now with a gradual and continual outflow from December to August. There will be some outflow during the "dry" period because a heavy rain in the August-December period would probably result in some runoff, which could not be absorbed. Additional water input to the caves should be beneficial rather than harmful, unless it occurs at a critical time in the life cycle of some organism. This is a risk that cannot be avoided.

Accidental spillage of sewage or water, because of pipe failure, is remote. If it did occur, extent of damage would depend on the location of the rupture. Soil erosion could produce an unsightly scar and cause a temporary loss of vegetation. A severe line break in Doyel Valley would result in spillage of a maximum of about 3,800 gallons of sewage because the automatic check valve to be installed in the force main below the pumphouse at Union City would shut off the pump if there was loss of pressure. This quantity of spillage, entering an underground stream through a sink or fissure, would probably be unnoticeable, except that the nutrients introduced would add to the food supply of certain troglobites, but some other elements could be harmful to other troglobites. Of chief concern in a water main break would be soil pollution of an underground stream. This is of regular occurrence, however, as witnessed by the turbidity that prevails most of the year in the streams draining the Sinkhole Plain, which pass through Mill Hole and Cedar Sink.

Although land-use planning and zoning are the responsibility of cities and counties in Kentucky, no controls exist in either Barren or Edmonson Counties traversed by Ky-70 and Ky-255. Landowners may use it as they wish. The result could be displeasing aesthetically and congestion could make travel over these roads hazardous and unpleasant; thus reacting

unfavorably upon Cave Country as a vacation destination or recreation area.

3. Extend Transit System

The transit roadbed across Doyel Valley will cause loss of habitat. Serious erosion damage could occur if there were torrential rains during the construction period or before the disturbed ground is stabilized by vegetation.

4. Retain Existing Facilities Without Expansion

Each of the structures that will be razed eventually represents a considerable capital investment, most of which cannot be offset by the salvage of the materials. Unsalvageable materials will have to be hauled outside the park and disposed of somewhere, probably in a sanitary land-fill. Some backfill will have to be hauled in to restore the contour of the ground especially where basements had been excavated. Native trees and shrubs will be purchased and planted to hasten re-vegetation. This is to say that dollar costs of restoring the areas to their natural condition could be much greater than the salvage values recovered.

5. Utilize New Source of Domestic Water

Withdrawing water from the Green River and pumping and treating it for use in the park represents a sizable commitment of electrical energy, chemicals, and funds both for the initial investment and then the annual operating costs. These have to be accepted because water is essential to public health and structural fire protection.

B. RIVER VALLEYS

1. Provide Additional Sites for Picnicking and Primitive Camping

When the facilities at Houchins Ferry are completed, there will be a greater number of visitors' cars, boats, and boat trailers than at present and this will create some congestion in the parking lots and picnic areas. Similarly, there will be more motorboats on the slackwater portions of the Green and Nolin Rivers, which will produce more noise, their wake will cause some bank erosion, petroleum products will be spilled while refueling motors, more fish will be caught, more litter will be discarded, and more accidents will occur. There will have to be a larger ranger staff to patrol the river. More trash will be removed from the picnic areas, and the sanitary holding tanks at the new comfort stations will have to be pumped out periodically. Expansion of the facilities will result in partial loss of habitat on 4 or 5 acres of floodplain.

The primitive campsite at Dennison Ferry will be enlarged to accommodate 10 or 12 parties by clearing undergrowth from an acre or two of floodplain forest, and by planting grass and spreading gravel to form a small, stabilized turf parking area. The present gravel road will remain and be upgraded only to the extent of providing better drainage. Employees' time will be lessened on road maintenance, but increased for campsite cleanup and sanitation. This site is envisioned largely as a put-in point for float and canoe trips on the Green River.

Similarly, there will be a modest additional commitment of natural resources and manpower in establishing, maintaining, servicing, and policing the two additional primitive campsites, each 200 to 300 square feet in size.

C. HILLY COUNTRY

1. Build Bridge and Improve Houchins Ferry Road

This will be the only bridge across the Green River along its 26-mile course across the park. The proposed site at Houchins Ferry is about 6 miles upstream from Lock and Dam 6 at the park's west boundary.

From points within ½ to 1 mile, the bridge itself — its deck, railings, piers, headwalls — and the earth cuts and fills leading to it will always be a visual intrusion: to the river traveler, to the motorist, and to those who use the facilities on the riverbanks at Houchins Ferry. The transpark road will not be visible from any scenic viewpoint except possibly Brooks Knob fire lookout tower.

There will be additional runoff from the new roadway, compared with the old, because the new one will be wider. The present road, which is to be replaced, is one to two lanes wide and has an impervious gravel surface.

More animals will be killed along the new road, because traffic will move more silently and at a higher speed. There will be no dust-laden vegetation along the roadside to deter browsing animals, and they will not be forewarned of approaching traffic as they have been with a gravel road.

Visitors will cause littering, vandalism, and pollution, and there will be some ecosystem damage that cannot be mitigated. It is not likely that any habitat, unique to the park, will be destroyed or damaged along the alignment being considered for the road.

2. Establish Trail System

Where the trail crosses cliff lines, construction will scar the landscape. There will be some erosion of the trailbed during and following construction, which cannot be avoided. Vegetation will be lost in thickety places, but where the forest has reached some maturity, there is little undergrowth, and only minor clearing will be required. Intensive use of trails on the highly erodable soils of the park may require surfacing with gravel or crushed rock. This would detract aesthetically and be more tiring to walk upon.

Tree stumps, scars on trunks where branches were cut off, pruning stubs, logs, and fresh grading of the trailbed will all be an eyesore for a time. Trees that must be felled in the process of clearing the trailbed, or as a safety measure, may damage other trees when they fall and this will be unsightly.

There will be some loss of habitat, food, and shelter for animal life, e.g., in the felling of a hollow, dead tree. On the other hand, some new habitats will be created along the trailside itself as microclimates are disturbed and as logs rot and become soil.

When new areas are developed, some people will drop litter, vandalize the trailside by carving in tree trunks, plucking wildflowers, etc.; and poaching may increase as the area becomes more accessible. Besides being a violation of law, it would be even more serious if an animal was killed, which is rare in the park.

There will be an investment of funds for construction and maintenance, and of funds and manpower for ranger patrol of these trails to assure proper care of them and to protect the countryside from fire and vandalism. Increased use will result also in more frequent encounters between man and noxious animals, and some, like stinging insects and poisonous snakes will be killed. Visitors will be exposed to poison-ivy, stings, and bites, requiring first aid treatment. Some who stray from the beaten path may have to be sought out, causing more frequent emergency search and rescue operations with their expenditure of time, manpower, and funds.

Trails used jointly by hikers and equestrians will be unpleasant to some of the former because of the piles of horse dung along the way with their odor, and their swarms of flies and wasps. The dung should disappear rapidly in this humid climate. The problem can be corrected by establishing a separate system of horse trails, but that duplicates some of the adverse impacts on the resources.

The quality of solitude desired and sought by many trail users will be degraded as use increases and be absent for various periods of time on popular trails when use is heavy.

3. Develop Primitive Campsites

Stubs of trees cut for firewood, axe marks on living trees, trampling of vegetation and other signs of use and misuse are to be expected at and in the vicinity of any campsite, whether temporary or permanent.

It will be necessary to make a clearing of an acre or two in the forest at Maple Springs in which to place shelters for use by hikers and school groups. Trees cut might be used to build the shelters or might be cut up for firewood. A natural habitat will be replaced with an artificial one, but this might be used as part of the environmental studies being carried on by school groups. For awhile, the stumps will remain and be unsightly. Limbs and tops will have to be disposed of by burning or by cutting them up into smaller pieces and allowing them to rot. It is unlikely that the latter procedure will cause an insect or disease infestation.

D. LAND AND CAVE PASSAGE CLASSIFICATION

1. Land Classification

As pressures build up through increasing travel or from other sources, the Park Service could so modify its plan that the objectives defined in 1975 were nullified.

2. No Wilderness

There are 80 million people in close proximity who have diverse interests in outdoor recreation. It is possible that wilderness qualities could erode as the Park Service meets their needs.

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

A. MAMMOTH CAVE PLATEAU

1. Expand Cave Trips

Mammoth Cave has been exploited commercially since 1809 with the mining of saltpeter followed by public tours commencing in 1816. Trails were constructed and have been rebuilt many times as visitation increased. Artificial entries by tunnel and elevator have been constructed. Cane torches carried by Woodland Indians smudged the ceilings with smoke as did the lanterns carried by explorers and visitors. Names and initials have been burned on and carved into walls and ceilings. The front part of Great Onyx, Crystal, and Colossal Caves on Flint Ridge were developed for public tours.

The master plan continues use of these passages and wisely holds expansion to those which have been developed previously but are not shown now to the public. New artificial entries to Mammoth Cave, to make those routes accessible, are not expected to cause greater environmental effect than those constructed previously. Moreover, only 10 miles of the passages surveyed so far in Mammoth Cave and about 2 to 3 miles of Flint Ridge passages have been developed for public tours. The Mammoth-Flint Ridge Cave System is the longest in the world, 167.1 miles having been surveyed through December 1974. Many miles of cave passages have been recently discovered at the east end of the cave north of Frozen Niagara.

In spite of all the use and abuse of the past, the cave systems of the park are of uncommon worth to mankind because they still contain a population of primitive eyeless and colorless animals, some of which are found nowhere else; aboriginal artifacts; circumstances favorable for scientific studies of biology, meteorology, archeology, geology and hydrology, physiology and psychology; and a rare opportunity for effective interpretation of cave resources for the enlightenment of the public.

Some authorities predict that continued exploration will reveal twice the mileage of cave passages in the park than are known presently. No doubt, most of this will be virgin cave never before seen by a human being, even primitive man. Unlike the surface of the earth, evidence of man's passage through a cave will never be erased. Each successive visitor compounds the evidence. Under these circumstances, one wonders the wisdom of encouraging the few who have the stamina and physical skills to explore the remote fastnesses of the cave passages. Surely, some should remain untouched for the future benefit of mankind.

The cave environment is "inhospitable" to most men. Experiments show that living in a cave over a period of weeks is physically and mentally deteriorating. Because caverns are soundless, odorless, and dark, use of man's sensory organs is limited to detecting subtle changes in temperature and humidity.

The National Park Service is committed by basic legislation, applicable also to Mammoth Cave National Park, to administer the cave resources for the "benefit and enjoyment of the people" while passing them on "unimpaired for the use of future generations." The master plan's proposals are within these guidelines. It appears most unlikely that the present and projected public use of 10 percent (more likely 5 percent) of the caverns will adversely affect the whole. Fulfillment of the master plan will allow more people to enjoy a cave trip in the future under less crowded conditions.

2. Relocate Staging Area to Peripheral Site

Relocating peripherally takes care of increasing visitation over the long-term and concentrates visitor impact in an area where park values are less important and less likely to create long-range damaging environmental effects. Except for the chances of cave water contamination from the parking lot and a leak or break in the sewer line, which are considered improbable, the long-term advantages of the peripheral site outweigh the short-term degradation of park resources and low quality of visitor experience at Historic Entrance.

It is true that there are cave passages beneath the Union City site. It is unlikely that a site could be found anywhere in the southeast quadrant of the park where there are no caves. Every reasonable precaution will be taken to minimize any adverse effects that may arise from developing and using the staging area. Knowledge of the interaction of the surface and underground environments is greater and better understood than it was when public tours began in 1816. Park use is still "locked into" the patterns that were established then.

3. Extend Transit System

Removal of the staging area from Historic Entrance to Union City shortens by 11 miles the distance most visitors would drive in their personal cars. During the peak period in 2000, 13,265 average daily cave visits are expected. To bring this number of people to the park requires 3,800 automobiles. If all of these cars were driven the 11 miles mentioned, they would consume approximately 3,800 gallons of gasoline. Buses moving the same number of people over this same distance would use only 750 gallons. It is obvious that long-term productivity will be enhanced greatly by lessening demand on fossil fuel reserves.

Even though exploitation of Mammoth Cave and the ridge above it began in 1809, removal of visitors' cars from "Old 70" will reduce the level of air and water pollution significantly, and will help in offsetting the greater intensity of underground use occasioned by expansion of the cave trips.

Expansion of the bus fleet, initially, will add to employment both for operators and for fleet maintenance. This increase is likely to continue at a much higher level than at present, but is dependent somewhat on the type of transit system selected, installed, and operated in the future. For example, some rail systems may be automated resulting in a net decrease in employment of operators.

4. Retain Existing Facilities Without Expansion

By congressional mandate, it is the mission of the National Park Service to conserve the resources of Mammoth Cave National Park so that both present and future generations may enjoy it. Hence, the master plan calls for a peripheral parking lot of adequate size, a modern terminal structure, and a transit ride to cave entrances, boat dock, or trailheads to relieve congestion at Historic Entrance. On the transit ride, the visitor should develop a feeling of anticipation that will enhance his appreciation for the great natural wonder he has come to visit and understand.

5. Utilize New Source of Domestic Water

Unacceptable damage to the Flint Ridge Cave System and its fauna is occurring from the withdrawal of water. Geological processes are being inhibited and troglobite populations may have been reduced by fluctuations in water quantity or reduction of nutrients transported by water. The seasonal fluctuations that will occur once natural flows are restored will have minimal effect in comparison.

The following information was supplied by the District Chief, Water Resources Division, Geological Survey, Louisville, Kentucky: compared with the low flow of Green River, the park's withdrawal would be a "drop in the bucket." Low flows of Green River are augmented by two Corps of Engineers' reservoirs: Green River Lake and Nolin River Lake, both upstream from Brownsville. The 7-day minimum discharge at Brownsville prior to regulation by the Nolin and Green River dams was 137 cfs (cubic feet per second) for the climatic years (year beginning April 1) 1925-30 and 1939-61. Regulated flows can be expected to be equal to or greater than this amount.

Park needs are estimated at 31.5 million gallons per annum. Even if this amount is used during 100 days (approximate length of season from

Decoration Day to Labor Day), this would represent 315,000 gallons per day or 0.5 cfs, a considerably smaller quantity than discussed above as available flow in the Green River. Furthermore, much of this water will be returned to Green River following treatment. The quantity of Green River water to be used by the park is insignificant compared to its flow, even its minimum low flow. There will be a larger commitment of tax dollars for operation and maintenance, of chemicals for treatment, and for electricity than at present.

B. RIVER VALLEYS

1. Provide Additional Sites for Picnicking and Primitive Camping

Past use of riverbank developed areas at Mammoth Cave National Park has had no unacceptable effect on the environment. Space for expansion is quite limited, alluvium is a poor foundation, and periodic flooding suggests mostly temporary-type construction. Future development, therefore, is not expected to affect the environment to a significant degree above present development.

Similarly, river use can be deployed over 32 miles. The number of boats that can be launched in a day could not come near to saturating the resource and preventing the majority from having the enjoyable experience to which they are entitled. On peak days in 1972, as many as 15 motorboats and five canoes were launched. Boat use, especially motorized, is constricted by the very limited parking space available (see I.B.1.a.).

C. HILLY COUNTRY

1. Build Bridge and Improve Houchins Ferry Road

Providing for increased visitor use of park lands north of the Green River was one of the objectives of the master plan. This wild land area is conducive to compatible outdoor activity of greater intensity than it has received in the past. The public is entitled to know better its scenic and natural resources. Many of the latter are of great interest to the scientist. Heretofore, the park's primary feature, for most visitors, has been Mammoth Cave. When the transpark road is improved and the bridge is built, visitors will find their park experience enhanced by a recreation visit to the Hilly Country and to Nolin River Lake.

2. Establish Trail System

Each year, since the park's establishment in 1941, has witnessed progression in return of the Hilly Country to a natural condition. Farming, grazing, and logging have ceased; hunting pressure has lessened. Thus, man's influence on the land has been relieved greatly. No one knows the exact composition of the forest and its wildlife that existed prior to man's exploitation of it. Some species like the American chestnut and passenger pigeon have become extinct, so the 19th-century environment can never be restored.

Still, the Hilly Country today is a valuable part of the American heritage, because it has had 30 years to recover from past uses of its resources. Here is a choice laboratory where dynamic natural processes may be observed and studied for the benefit of mankind. As long as the area remains a unit of the National Park System, it will be preserved from further spoliation. Yet man is entitled to use the area without abusing it and trail development and use is compatible with this concept. Channeled use is preferable to casual use, which is far more destructive of the environment and of resources, e.g., vegetation would be trampled; accidents and lost person incidents would occur more frequently.

3. Develop Primitive Campsites

A developed campsite can be used for many years before it "wears out," depending on site conditions and intensity of use. Ordinarily it is good planning to select a site initially that is large enough so that use can be alternated to allow the area to recover. The site at Maple Springs meets this criteria. Over the long term, experience demonstrates that developed campsites are less harmful to the resource than camping at random locations.

D. LAND AND CAVE PASSAGE CLASSIFICATION

1. Land Classification

This is a short-term commitment of the park's resources that is subject to periodic review in the ongoing master planning process. As such it is responsive to changing conditions that may be ecologic, economic, or sociologic in origin. Long-term productivity should be enhanced by the flexibility of taking action before deleterious effects become irreversible.

2. No Wilderness

Similarly, management retains control and can respond quickly to unforeseen conditions that might develop. Wilderness designation by Congress could constrain the application of some management techniques to mitigate damage that could occur from use.

E. TRADE-OFFS

Inherent in the foregoing paragraphs of this section are some environmental trade-offs encompassed by the plan, among which are:

1. Expanding cave trips to accommodate more people, to provide for a greater variety of experience, and to enhance the quality of the trip by reducing party size, requires more storage space for visitors' cars on the surface.

2. Larger parking lot capacity will only add to congestion at Historic Entrance. A peripheral site was selected.

3. Once relieved of their personal vehicles, visitors will be transported by public conveyance to cave entrances, boat dock, and trailheads with a concomitant reduction in energy consumption and pollution entering the caves.

4. Providing more public services means increasing expenditures for personnel and for facilities that do not now exist.

5. As private industry and other public agencies absorb certain functions, the park will become predominantly day-use. Electric energy consumed in present developed areas will be used for the expanded cave trips and the new terminal building.

6. Future park water needs cannot be met from the present collection system on Flint Ridge, hence it will be withdrawn from Green River. The flow of spring water will be restored to the caves thus assuring perpetuation of their fauna and continuance of normal geologic processes.

7. In time, a water main will be laid along Ky-70 to the park boundary and various tourist accommodations and services will spring up along it. This will change the present rural approach to the park into a "strip" development*. Traffic problems will be created and a greater volume of waste will find its way underground. If carried into the caves by underground streams, the polluted water could kill the fauna and create public health problems, which would require closing Mammoth Cave to tours. Other sources of underground stream pollution are agricultural pesticides and fertilizers, petroleum products, and dumping of solid wastes and liquids into sinkholes.

8. Closing two antiquated ferries and their narrow, dusty approach roads and substituting a single transpark road and bridge will maintain long-established regional circulation patterns and make Mammoth Cave National Park and Nolin River Lake into a more completely integrated recreation unit.

* BRADD is the regional planning organization, but it has no enforcement powers in effectuating its plans. Authority rests with the cities and counties. The Kentucky legislature is considering land-use planning as this is being written. Too much development as well as substandard accommodations and services could discourage travel to the region.

9. The park is within 8 hours driving time of 80 million people (1975). Presently the Ohio River Valley contains adequate outdoor recreation opportunities for this population with its system of state resort parks, TVA and Corps of Engineers recreation lakes, and national forests. As the demand rises, some of it can be absorbed by the park's wild lands, which will provide opportunities for river boating, hiking, backpacking, and horseback riding. These uses could become so intense that the element of solitude could be lost and aesthetics compromised by litter and vandalism. Increasing backcountry use will require employment of more protective and maintenance personnel.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

A. MAMMOTH CAVE PLATEAU

1. Expand Cave Trips

Underground, the only totally new construction is boring the tunnel entry to replace New Entrance and digging the elevator shaft to Star Chamber. If either became unused in the future, it could be sealed off and the entry camouflaged. However, once a natural cave passage has been altered from its pristine condition by exploration, by development for public tours, or by vandalism, it can never revert, because many of the natural processes that "heal" the surface of the earth do not operate underground. The passages were formed by running water and by solution. Neither of these processes can be restored because of geomorphologic changes that have taken place over time. Unless a catastrophe occurs, man's alterations of the cave, physically and environmentally, will never be erased; they are irreversible and irretrievable.

2. *Relocate Staging Area to Peripheral Site*

Some construction material would be lost that could not be salvaged, if this action is implemented. Development could be stopped at any point following completion or all the improvements could be removed; then the area at Union City would revert, in time, to forest as it has been doing for the past 30 years.

Unlike the earth's surface, the rate of change in the cave environment is almost static. Therefore, any action that alters its pristine condition is irreversible and irretrievable for all practical purposes. Every effort is being exerted to prevent this from happening as a result of establishing and operating the staging area.

It has been suggested that leakage of sewerage from a pipeline across Doyel Valley might jeopardize the Kentucky cave shrimp, an endangered species, that has been seen in Roaring River. That is unlikely for that underground stream lies beneath Sloans Crossing Road 1½ miles northwest of the place where the pipeline might cross Doyel Valley.

3. Extend Transit System

Regardless of the mode of transportation used ultimately, there will be an irretrievable commitment of resources in the form of energy consumed in the operation of the system. Similarly, the manufacture and installation of the equipment will require an expenditure of energy offset only by its

salvage value. At the present time, this value is believed to be higher for an all-bus system than for other types of surface transportation.

It will always be possible to re-open the roadways to public travel in personal cars, should this become desirable in the future, so there appears to be no irretrievable or irreversible effects of closing certain public road segments to serve as the transit roadbed.

4. Retain Existing Facilities Without Expansion

There will be no irretrievable or irreversible commitment of resources stemming from this action alone. However, the master plan calls for demolition of structures that have reached their economically useful life or are no longer used for the purposes for which they were built, if it is then in the public interest to do so. Once these structures are removed, the action is irreversible, but not irretrievable because they could be reconstructed.

5. Utilize New Source of Domestic Water

Park water use in 1973 was approximately 31.5 million gallons. This is rising each year visitation increases. Once the springs and wells in the park are disconnected and the park's own water-treatment plant is activated, appropriated funds will have been committed to an ever-increasing obligation. In a "tight" budget, this might cause curtailment of some other activity.

B. RIVER VALLEYS

1. Provide Additional Sites for Picnicking and Primitive Camping

Flooding and rapid growth of vegetation on the floodplain would "heal over" very rapidly any signs of man's activities. Hence, nothing irreversible or irretrievable is involved in this action.

C. HILLY COUNTRY

1. Build Bridge and Improve Houchins Ferry Road

The materials used in road improvement and bridge construction, obtained off site, could not be salvaged – sand, gravel, cement, aggregate, bitumen, steel, and the energy used to manufacture and place them. Fill material – soil and rock – obtained on site might be retrieved, in part, as backfill along with pavement, bridge deck and piers, retaining walls, etc., should it ever be decided that the road should be obliterated.

As a practical matter, the bridge and the cuts and fills for the road prism leading to it will always be a visual intrusion, and the movement of groundwater there will always be affected by the construction. The impact will be greatest on about 1/2 mile of the 6.6-mile corridor. That is the area involved in the river crossing.

2. **Establish Trail System**

Several thousand people have hiked and have ridden horseback in the past 2 years over the 15 miles of old wagon roads that have been brushed out. As more people learn of the availability of these trails, use will increase. The Park Service is committed to patrolling and maintaining them and will have to obtain more resources to do so satisfactorily in the future.

When a new trail system is laid out, the corridor will be cleared to a width of 6 feet, but the trailbed will be only 2 feet wide. Hence, the amount of grading will be minimal. The intent is to establish a primitive trail system with adequate attention to the safety of the user. Some steep places, however, will require movement of considerable earth to establish even a simple trail, and here the scar will last a long time after the trail is abandoned, should this occur. Similarly, places where it is necessary to place gravel or crushed stone to prevent erosion will be evident for many years. While an abandoned trailbed can be regraded and the clearing will revegetate in time, the dollar cost of establishing, patrolling, and maintaining a trail system is irretrievable.

It is possible that the trail system may make Indian rock shelters or village sites more accessible than heretofore. Some people may stray off the beaten path and discover one or more of these and vandalize them. Once the evidence is destroyed, it is lost forever. Archeological investigations have been carried on in the park, but it is always possible that new sites will be located. It is to be hoped that such discoveries by visitors will be brought to the attention of park staff, so competent personnel can be brought in to study and evaluate them. Similarly, any action destructive of a geological formation, surface or underground, is both irreversible and irretrievable.

3. **Develop Primitive Campsites**

The Maple Springs campsite is to be located near a one-lane, gravel-surfaced public road, which is to remain open to provide access to Good Spring Church and cemetery. Church services are held now only on Decoration Day each year, and rarely on other occasions. Burials in the cemetery are becoming less frequent. The feeling of solitude predominates now, but, as time goes on, pressure may build to convert the primitive campsite to an auto campground. This would be untenable, for the master plan recommends that future auto campgrounds be provided by private enterprise outside the park.

Once established, the campsites at Maple Springs will require maintenance, clean-up, and ranger patrol, thus committing men, material, and monetary resources to their up-keep. Normal vegetative growth would soon hide much

of the area disturbed by development should the campsites be abandoned in the future.

D. LAND AND CAVE PASSAGE CLASSIFICATION

1. Land Classification

Under the system currently in use, land is classified on its ability to withstand use without undue jeopardy to its resource values. Should later discoveries show that an error in judgment was made, the damage could be irretrievable, but the action would be reversible by changing the use.

2. No Wilderness

If park lands designated Class IIIA and IVA do not qualify for wilderness in the future, because of pressures of use, the disqualifying uses could be reversed and wilderness values retrieved by management action when desirable.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

This section of the report is organized as the foregoing sections have been with three major headings – Mammoth Cave Plateau, River Valleys, and Hilly Country – representing the geographic areas of the park recognized by Congress as being of national significance. Following these three discussions, this section concludes with alternatives to the master plan's land and cave passage classifications and the "no wilderness" recommendation.

A. MAMMOTH CAVE PLATEAU

Any planning proposal that purports to resolve problems for a period of 30 years is hazardous at best. In doing so, the Park Service's basic assumption was that travel would continue to increase. It was recognized, however, that one or more of the following conditions could occur that would alter travel patterns and lessen the number of people or automobiles coming to the park. These are beyond control of the Secretary of the Interior:

- Major political, economic, or social crises affecting mobility of the population
- Major transportation shift from the family automobile to mass transit
- Drastic drop in population growth
- Staggered vacations by industry, a 4-day work week, and/or a quarter system in the public schools, which could space visitation more evenly through the year and reduce the summer peak.

A temporary alteration would only postpone for a time the need for carrying out the proposal. If the shift was permanent, a different set of planning problems would arise from those that prevailed from 1968 through 1973. In those circumstances, a new study would have to be undertaken.

In its study, the master plan team identified the following problems and recognized their consequences if solutions were not found and implemented:

Major Problems	Collective Future Consequences
Parking lot overflowing Visitor center overcrowded Cave trips overloaded Visitor services substandard Physical plant deteriorating Domestic water supply insufficient	Eventual adverse public reaction. Harm to the concessioner's businesses and to the region's economy that relies heavily on the drawing power of Mammoth Cave. Cave animals, and geological and mineralogical processes could be damaged further through lack of water.

The 1975 master plan's solution is in the form of an interrelated series of five actions to meet the needs of increasing visitation: expand cave trips, relocate staging area to a peripheral site, extend transit system, retain existing surface facilities at Historic Entrance without expansion, and utilize a new source of domestic water. *Increasing cave capacity is for naught without solving the problem of automobile storage on the surface.*

The foregoing five interrelated actions have been described and their impacts discussed in the preceding pages of this report. Discussed below are the consequences of "no action" and the other alternates considered before the actions were selected that are explained in Section I.

1. Expand Cave Trips

Problem: For decades, Mammoth Cave was a vacation destination and visitors took leisurely cave trips. This has changed dramatically in recent years. During the 1950s, annual cave visits averaged about 200,000, but during the late 1960s and early 1970s travel spiraled. In 1970, there were 611,000 cave visits. In 1973, cave visits peaked at 675,167. There was a drop in 1974 to 590,625 because of fuel conservation and economic recession, yet this total is equivalent to 1969 and 1970 visits. Cave trips are still overcrowded on busy days. During 1970, 78 percent of the visitors selected trips of 1 to 2 hours duration. Trips of this length prevail in most commercial caves. Day-use of the park predominates.

Solutions and Their Impacts:

No action – Over the years and season by season, the number and variety of cave trips has fluctuated as has the operating day (see chart on p. 7). Similarly, the capacity of trips fluctuates. During the summer vacation period, when more guides are available, the variety of trips is greater, but party size is large because of heavy visitation. The point has been reached where major construction must be undertaken to open new entries and light more passageways in order to accommodate increasing numbers of people. Therefore, taking "no action" has the effect of restricting visitation to present levels. This would be tenable if cave visits did not increase in the future, but that is contrary to the record of the past 30 years. Moreover, overloading of cave trips is of regular occurrence. Many people prefer not to be "herded" through the cave with limited opportunity to observe its features. This could cause a reverse reaction and Mammoth Cave could lose its reputation as the foremost tourist attraction in Kentucky.

2. Relocate Staging Area to Peripheral Site

Problem: The "as-built" capacity of surface facilities at Historic Entrance is as follows: parking lot, 3,414 cave visits per day; visitor center, 4,000.

During June, July, and August 1974, an average of 800 visitors per day would have been turned away had this limit of 3,414 been imposed. This overflow situation accompanied by parking on grassed areas, is expected to continue into the future, and it will worsen both in summer and on weekends in spring and autumn.

Solutions and Their Impacts:

a. **No action** – If action is not taken to relieve congestion at Historic Entrance, increasing visitation will continue to cause more rapid deterioration of the physical plant. For several years, there has been more intensive use than the facilities were designed to accept. Regular use of grass areas for parking automobiles is compacting soil, reducing aeration, and increasing erosion. Loss of shade trees will occur in time. In addition, the unsightliness of overflow parking and the congestion of cars and people does not contribute to a relaxed and pleasant national park visit to which the public is entitled. Runoff water from the parking lot flows into Historic Entrance where the floor is sinking; water runoff from the campground enters Mammoth Dome seen by 45 percent of the cave visitors. People taking shortcuts between the parking lot and Historic Entrance trail have compacted the soil and this has resulted in loss of vegetation, caused erosion, and has turned a pleasant woodland vista into an unsightly eroded hillside. These conditions are causing people to become careless and vandalistic acts are increasing in number and in extent of damage.

b. **"Freezing" visitation to the "as-built" capacity of surface facilities at Historic Entrance** – This would have certain advantages including realizing the useful life of structures instead of accelerating their replacement through over-use; staffing and maintenance would continue at present levels; volume of travel would be stabilized so materials and supplies could be purchased at predetermined levels. On the other hand, tens of thousands of people could be denied a cave trip at the time of their convenience (though a workable reservation system might be established for a brief period of the year); economic growth in Cave Country and the Commonwealth as a whole would be lessened, although some business might be diverted to other caves in the region.

The foregoing sociological and economic considerations might be tenable if cave trips could not be expanded, or provision could not be made for greater surface use of the park. Therefore, the master plan calls for providing more facilities for more people in the park, within acceptable limits of impacts, while concurrently strengthening the local and regional economy.

The possibility of spreading use beyond the summer months was considered. It was assumed that 70 percent of the visitors spend one night or more away from home. The balance are local people. If they would make their visit sometime other than July and August, there would be some temporary relief from peak loadings. Many local people, however, cited the presence of out-of-state guests as the prime motive for their visit to the park.

c. **Expanding facilities at Historic Entrance to meet increasing visitation** – Revamping the Historic Entrance area to accommodate projected travel by the year 2000 would require major alteration of the appearance and use of the Historic Entrance area when 13,265 average daily cave visits and 3,800 vehicles are expected. Paved parking spaces would have to be expanded from the present 597 to 2,320 and this could be provided by building a multilevel, reinforced concrete parking garage on the site of the present parking area, picnic area, and Woodland Cottages. The entrance road would have to be widened to four lanes for 6 miles back to Chaumont and a separate roadway provided for buses transporting visitors to the sightseeing boat dock and to cave entrances except Historic to which people would walk as at present. The bus road would have to overpass or underpass intersecting roads. The administration building would be remodelled to serve as an enlarged visitor center and transit terminal. A new park office building would have to be built probably in the vicinity of the utility area. Under this scheme, "Old 70" would be closed to private cars between Cox Store Road Junction and Carmichael Junction, and the entire Northtown Road would be closed so that the transit system could operate.

Expanding facilities at Historic Entrance would have the following impacts:

- The parking garage, 2½ stories high, with entry and exit ramps, would dominate the area and be an unsightly intrusion.

- More of the surface over cave passages would be paved increasing runoff of polluted water into Mammoth Cave.

- Campground would be retained, but could not be expanded. Amphitheater would be lost to the transit roadway.

- Woodland Cottages and picnic area would be lost to the parking garage. There would be no space to replace the picnic area.

- Hotel dining room could not be expanded, but could be converted to fast food service.

- More lodging units (50-75) could be built.

- Existing utility systems could be used, though a new water source would be required.

- Widening 6 miles of two-lane road to four lanes, across the karstic part of the park, would be a visual intrusion, runoff of polluted water into the cave system would increase greatly, and destruction of forest and wildlife habitat would be considerable. Cuts and fills for widening the 1.6-mile segment of Sloans Crossing Road across Doyel Valley would have a greater impact on the underlying caves during construction than the ridge top sections. Beneath Doyel Valley is Roaring River, an underground stream, which contains a school of large blindfish. Soil pollution of this stream could cause loss of the fish and the stream habitat could be altered permanently by the four-lane road. The microclimate of Doyel Valley would surely be affected.

- On Mammoth Cave Ridge, 1½ miles of the four-lane entrance road would be paralleled by two lanes of transit roadbed. In addition, overpasses or underpasses would be required: two crossings of the four-lane road and one crossing of a two-lane road. While these have not been designed, it appears that two would have to be underpasses. This is undesirable in this terrain because of drainage problems and the possibility of opening up fissures in the sandstone cap rock. The overpass crossing four lanes would be unsightly and foreign to a national park environment.

- Once this major construction of roadways and parking garage was completed, the Historic Entrance area would be even more congested with people and cars in 2000 than it was in 1970.

d. Relocate staging area outside park – Two sites, adjacent to the southeast park boundary, were studied: near Cedar Hill Church and near Turleys Corner. The impacts of using either of these sites are as follows:

- Both sites would have to be purchased. The legislative process of authorizing funds for purchase of private lands, their acquisition, and then development would require too much time.

- The Cedar Hill Church site is in Edmonson County where there is strong opposition to taking more land off the tax rolls.

- The Turleys Corner site would require others to widen Ky-70 and -255 and that would affect established business, residential, and agricultural enterprises.

- Both sites are underlain with cavernous limestone and would be subject to the same constraints in development as a site now within the park. Neither is served by water or sewer.

- Transit system routes would be longer, requiring more vehicles and greater operating cost.

e. **Relocate staging area inside park north of Green River or west of Turnhole Bend** – These sites have the distinct advantage of being outside the karstic area of the park. They were rejected early in the planning process because of logistical problems, and because they were too far removed from the region's primary transportation corridor (I-65) with the large commitment of tourist-oriented business along it.

f. **Relocate staging area to peripheral site in southeast part of park** – Several sites on Joppa and Mammoth Cave Ridges were considered, but the choice was narrowed down to one on each ridge: Union City on the former and Frozen Niagara vicinity on the latter. The Union City site was selected and it is described and its impacts assessed in I.A.2., III.A.2., etc., in preceding parts of this report.

The Frozen Niagara site is situated north of "Old 70" about ¾ mile inside the park boundary. It and the Union City site have a similar vegetative cover; are underlain by impervious sandstone, which is a good foundation for construction; cave passages are beneath each site; electric service and water is nearby, but sewer is not; construction problems would be the same; and the same visitor facilities would be provided as at Union City.

Impacts unique to the Frozen Niagara site are:

- Extensive level land allowing considerable flexibility in siting parking lot and transit terminal building.

- Terminal could be situated within a half mile walking distance of either Frozen Niagara or New Entrance portals.

- For transit to operate, "Old 70" would be closed westerly from the staging area. Mammoth Cave Ferry (including the ferry), and Northtown Roads would also be closed.

- Water and sewer lines would be shorter and not have to cross Doyel Valley.

The capacity of state road (Ky-255) from Turleys Corner 1½ miles to the park boundary near Frozen Niagara staging area is inadequate to handle the volume of cars expected in the future. That segment would receive traffic from both Cave City and Park City interchanges on I-65. Upgrading this road to four lanes will be costly including the additional right-of-way.

In time, the entire 5 miles of Ky-70 and -255 between Cave City interchange and the park boundary via Turleys Corner would have to be widened, for it would carry the majority of park traffic from I-65. This road is fast becoming lined with various business enterprises serving the tourist – souvenir sales, service stations, information booths promoting private caves, motels, chair lifts, pioneer village, and wax museum. Such enterprises could multiply quickly if a water main is extended westward from Cave City parallel to Ky-70. Once more business is established, cost of additional right-of-way to widen Ky-70 could become prohibitive.

Many park visitors prefer the open farmland and private residences, which have characterized the Ky-70 approach to the park in past years. Unless some local action is taken, this will prevail only along the Mammoth Cave Parkway portion of Ky-255 between Park City and Chaumont, because state highway planners foresaw the need for a parkway-type approach to the main park entrance from I-65 at Park City.

g. **Establish "satellite" visitor center at Frozen Niagara** – Under this scheme, the facilities at Historic Entrance would remain as presently constituted.

At Frozen Niagara, the government and the concessioner would provide and operate these facilities and services: parking lot, visitor center, rest rooms, cave trip ticket sales, transit vehicles and loading dock, food services, and curio sales. To this extent dual facilities would be operated 3½ miles apart on Mammoth Cave Ridge. This development at Frozen Niagara has the same advantages and constraints described in the

preceding discussion. In addition, no park roads would have to be closed and congestion at Historic Entrance would be relieved. Traffic congestion on approach roads outside the park would be less since there would be two park entrances instead of one.

Providing these duplicate facilities and services so close together on Mammoth Cave Ridge would be a costly investment in plant and staffing for both the government and the concessioner. Two major staging areas would create confusion for the visitor in trying to choose in advance where to go and what cave trip to select. In a few years, cave visits will build up again to the point where both Historic Entrance and Frozen Niagara would be congested. In time, "Old 70" would have to be straightened and widened to carry the additional traffic flow. At best, the idea of a satellite visitor center would be a short-term solution.

3. Extend Transit System

Problem: It is too far for the average person to walk from the staging area to cave entrances, sightseeing boat dock, or trailheads. These places will be served by a transit system operating on its own roadbed. At busy times, private vehicle traffic has often disrupted cave bus schedules.

Solutions and Their Impacts:

a. **No action** – The present transit system uses the same roadway as private cars over most of its route. These roads are becoming more congested making it impossible for the buses serving cave entrances to keep their schedule during certain hours of the day during the travel season. Without action, the condition will worsen.

b. **Ultimate method of conveyance** – This will not be activated until the peripheral staging area is ready for full use. The state of technology is advancing and a different transit system than any known now may be selected after a full assessment of its impacts. The ultimate system could be on a surface road or rail, elevated, aerial, air cushion, or some other.

Since buses are being used now for this purpose from the Historic Entrance staging area, it seems logical to add to this fleet at the outset and to continue to use buses until a better system is planned.

c. **Widening existing roads and building new parking lots** – The present bus system could be discontinued if roads were widened and parking lots provided at each cave entrance. The additional grading and paving required would result in loss of habitat and be detrimental hydroecologically to the underlying caves. At each cave entrance, also, tickets would have to be sold, a staff of guides made available, a shelter and comfort station built. In sum, the total investment would be much greater than at present in staff, facilities, and physical plant. Trips that

enter at one portal and exit at another would have to be discontinued for lack of a surface transit connection. In time, congestion would occur at each cave portal instead of at Historic Entrance alone.

d. **Build paralleling transit roadbed** – This solution was considered above under VIII.A.2.b. with the discussion of expanding facilities at Historic Entrance. In brief, this is undesirable because of the loss of forest habitat, the additional polluted runoff entering the caves, and the unsightliness of underpasses and overpasses required for separating transit from private vehicular traffic.

4. Retain Existing Facilities Without Expansion

Problem: During the summer travel season and on busy weekends in spring and fall, visitors overcrowd the Historic Entrance area. The paved parking spaces and the visitor center are both inadequate. Cars park on the turf; people take short cuts. Both are unsightly, cause erosion, and damage vegetation. Space for lateral extension of the parking area is not large enough for future needs. Delivery and storage of liquid fuels (gasoline, diesel, and heating oil) is potentially hazardous, and could be disastrous if sufficient quantities reach the caves through accidental spillage or leakage from underground tanks. Tourist-oriented private enterprise is expanding in the park's environs, which suggests a review of the role of the principal concessioner.

Solutions and Their Impacts:

a. **No action** – The Park Service and the public could continue to live with the problems for the indefinite future. This would postpone or preclude corrective action and continue the threat of serious damage to the caves.

b. **Phase out existing facilities** – The 1970 draft master plan advocated the gradual phasing out of all government and concessioner facilities situated on Mammoth Cave Ridge including the Historic Entrance area. This would take place over a 10-20 years period as facilities became available for public use at the peripheral staging area. Neither the principal concessioner or the local people agreed with this proposal and so expressed themselves at the master plan public meeting held on May 28, 1974.

5. **Utilize New Source of Domestic Water**

Problem: Water consumption is fast increasing and present supply from in-park springs and wells will not meet future requirements.

Solutions and Their Impacts:

a. **No action** – As travel and water consumption increase, there will be times when water shortages will occur. In these circumstances, emergency measures would have to be instituted including curtailing water for certain activities such as closing the campground, and hauling water from an outside source. Moreover, reserve supplies would be low for building fire suppression. Diversion of spring water now, at periods of low flow, is harmful to the cave flora and fauna and retards geological processes. If a sustained drought occurred, the result could be disastrous to many of the creatures living in the caves.

Once the Great Onyx Civilian Conservation Center is terminated, about 11.5 million gallons of water will be available annually for other park needs. By August 2000 water consumption at the peripheral staging area along will exceed 4 million gallons (assuming 10 gpd per person).

b. **Provide more storage capacity and drill more wells** – Presently the park's storage capacity is 1,750,000 gallons. This could be expanded. More wells could be drilled but yield is low and water quality is poor, being high in sulfates. No more springs can be tapped so their purer water could not be used to dilute the additional well water. Furthermore, groundwater yield is lowest in late summer and early fall when demand is high. This solution would not be desirable because it still relies on the park's groundwater, which is needed for the continuing geological development of the caves, and to supply nutrients and provide habitat for the cave animals.

c. **Purchase water from an outside source** – Both the Barren River and the Edmonson County Water Districts have adequate water to supply the park's needs. The former would extend its main along Ky-70 westward from Cave City; the latter would follow Ky-70 eastward from Brownsville. At the park boundary, the Park Service would make its own connection to the existing water lines within the park. This would require about 2½ miles of pipe from Chaumont on the east park boundary, or about 7½ miles of pipe from Silent Grove Church on the

west boundary. Obtaining water by purchase is generally considered to be less expensive to the government than to develop and operate its own treatment facilities.

Once a water main parallels Ky-70, more shoe-string, commercial development will take place. It will be oriented to such tourist services as meals, lodgings, curio sales, automotive supplies and fuel, amusements, and the like. Done tastefully, and with a high level of customer service, this could be an asset to the park and region.

However, experience has shown that such development is more likely to degrade into a "neon strip." These are common throughout our land. Such an approach would detract from the anticipation of a national park visit, in contrast with the present rural countryside. Strip development creates traffic congestion that can be solved only by widening the roadway. Once the development is established, the cost of doing so becomes prohibitive.

In the absence of a sanitation district, improper disposal of wastewater and solid wastes could pollute underground streams and cause closure of some cave passages now open to public tours, or cause loss of some rare or endangered species of cave animals. It is common practice to dump waste into sinkholes.

All of these problems can be solved by forthright local action. BRADD is staffed to provide advice and prepare plans for the use of cities and counties, at their request, in the 10-county area it serves. In turn, the cities and counties have full authority for local planning and zoning, but it is not politically expedient to exercise that authority in the environs of the park. In time, then, only Mammoth Cave Parkway will remain as a scenic approach to the park from I-65, provided that the proper officials of the Commonwealth continue to enforce its status as a limited access roadway.

If the park obtains its water from a water district outside, its account would help that district expand its system so that other customers could be served. This will encourage further development of the region by private capital, which will increase the tax base, offer new employment opportunities, and raise the standard of living.

B. RIVER VALLEYS

1. Provide Additional Sites for Picnicking and Primitive Camping

Problem: The master plan seeks to perpetuate the "wild rivers" character of this unit of the park, but it can accept more use. However, development on the floodplain is constrained by annual, or at least, periodic inundation. Alluvium is a poor foundation for structures.

Solution and Their Impacts:

No action – Present volume of use does not exceed the capacity of existing facilities, so no action is required now. Should overcrowding occur in the future, no action would cause degradation of the sites through trampling, loss of vegetation, littering, and vandalism, and unhealthful conditions could develop because of inadequate sanitary facilities.

C. HILLY COUNTRY

1. Build Bridge and Improve Houchins Ferry Road

Problem: North/south travel across the park is accomplished over two gravel roads and their antiquated ferries. The roads are narrow and dusty, sight distance is limited, the ferries are closed between 11 p.m. and 6 a.m. and during periods of high water, and the Park Service is obligated to keep these roads open because of a deed reservation. Commuters use the ferries en route to and from work. A direct connection between the park and Nolin River Lake is desirable for regional development. Better access to the Hilly Country will encourage more use.

Solutions and Their Impacts:

a. **No action** – Ferries are disappearing and their continuation would perpetuate a facet of "living history." Traffic over the roads is increasing, causing backups at the ferries and potential rise in the accident rate as more cars travel the one-lane gravel approach roads. Dust reduces visibility, traffic moves at a slower pace, and these two coupled together keep animals away from the road and reduce fatalities.

There are alternate roads, however, outside the park, built to modern standards. Traffic might be encouraged to use them. Those visitors who do so would have no contact with the scenic Hilly Country and its trail system as proposed in the master plan.

b. **Treat road surface to relieve dust and replace ferries with pontoon bridge** – These "improvements" would increase traffic volume because the trip would be more pleasant without the dust, and the wait for the river crossing would be shortened or relieved entirely if there was no oncoming traffic.

Surface treatment of the road would not be sufficient. It would have to be widened as well and realigned in places to improve safety. It is questionable that a pontoon bridge would be practical. As the river rises and falls because of fluctuations in flow, personnel would have to be available to extend or shorten the deck and add or subtract pontoons. During minor floods, the pontoons are likely to be damaged or sunk by floating debris, which is the prime hazard faced by the ferry boats. During major floods, the pontoons would be swept away with the probability of causing major damage to structures and possible loss of life downstream. If Mammoth Cave Ferry is retained, the master plan could not be carried out. The plan is predicated upon a transit system operating on its own roadbed and providing service to the sightseeing boat dock as well as to cave entrances and trailheads south of the river.

c. **Other corridors for transpark road** – The only solution to an all-year, all-weather crossing is to bridge the Green River. Before the bridge is built at Houchins Ferry and the existing road upgraded, other corridors will be studied and evaluated, including their bridge sites. It was beyond the scope of the master plan to conduct detailed engineering studies. A road corridor east of Turnhole Bend is untenable because of the presence of the cave systems. A bridge at Turnhole Bend would destroy the most spectacular river valley scenery in the park and a classic example of an incised meander.

Among the considerations in selecting a road corridor are engineering standards, soil conditions, and effect on natural, historical, and scenic features and resources.

d. **Effect of Kentucky's Wild Rivers Act** – To build the transpark road and bridge would be in violation of the Wild Rivers Act of the Commonwealth of Kentucky (Chapter 146, Kentucky Revised Statutes, 1972) as are the present activities on the Green River of motorboating, the sightseeing boat trip, access to the river at the Dennison Ferry site, and the Houchins and Mammoth Cave ferry operations with their approach roads required by deed reservations (see II.B.1., p. 94).

e. **Route outside park** — A north/south scenic route could be constructed east of the park between Highland Springs and Wax, which would accomplish the same purpose in regional circulation as the transpark road and bridge. It, too, would require a bridge across Green River. Much of the right-of-way would be over private lands and would involve entirely new construction. The section between Highland Springs vicinity northward to the Green River crosses the eastern portion of the Mammoth Cave Plateau, which is dissected there also by sinks and solution valleys. A road across the plateau would be subject to the same constraints in protecting underground values as a road across similar terrain in the park. It could bring pressure to bear upon the park to open an east entrance to Flint Ridge. If a road were built in this corridor, it would be in the province of the Kentucky Department of Highways since no Federal land is involved. Unless the right-of-way was protected by limited access and scenic easement agreements, it would open up a new area for development, which could be detrimental to the park. It is best that the park's integrity not be compromised and that its environs remain in small farms and woodlots.

2. **Establish Trail System**

Problem: The master plan calls for trailheads along the transpark road so the Hilly Country with its scenic and natural values will be more accessible and become better known.

Solutions and Their Impacts:

a. **No action** — A facet of the park unknown to most visitors and of national significance would generally remain inaccessible if trails are not built. Segments of old wagon roads have been brushed out by the Park Service, but they do not offer the scenic interest and views of natural objects that a trail system would as laid out by professional landscape architects, engineers, and interpreters.

b. **Substitute one-way motor nature trails for hiking trails** — It has been suggested that a one-way motor nature trail system be laid out in lieu of, or to supplement, the hiking trails recommended in the master plan. These would be very destructive of the resource in that the topography is rugged, cuts and fills would be deep, bridges and drainage structures would be required, surfacing would be needed, much more habitat would be destroyed, landscape scars would be greater, and commitment of funds for construction and maintenance would be many times larger. It would be possible to connect the Houchins Ferry and Mammoth Cave Ferry Roads with an east/west motor nature trail, about 4 miles long, across the top of the watershed and just within the

north park boundary. This would involve both new construction and rebuilding segments of old wagon road traces. It is difficult to see the merit of such a road after weighing its deleterious effects on the watersheds it crosses. One of these, the Wet Prong of Buffalo Creek, contains some of the finest scenery in the park along a cool stream that runs clear all season long.

3. Develop Primitive Campsites

Problem: Providing primitive campsites would add further incentive for visitors to become acquainted with the Hilly Country.

Solutions and Their Impacts:

No action – None is required until use builds up. Established sites are preferable to allowing the hiker to camp wherever he chooses. A designated area concentrates use; it can be serviced and patrolled; it reduces total damage to the environment; Maple Springs and other areas to be selected are adaptable to this kind of activity.

D. LAND AND CAVE PASSAGE CLASSIFICATION

1. Land Classification

Problem: Visitor activities and management needs both require facilities. These should be located where they will have the least deleterious effect on the park's resources, and the magnitude of development must not exceed the ability of the resources to accept it though some loss of values is inevitable.

Solutions and Their Impacts:

No action – Classifying land under the system described in Section I at the beginning of this document is mandatory under current National Park Service planning standards. No other system has been devised that serves the purpose.

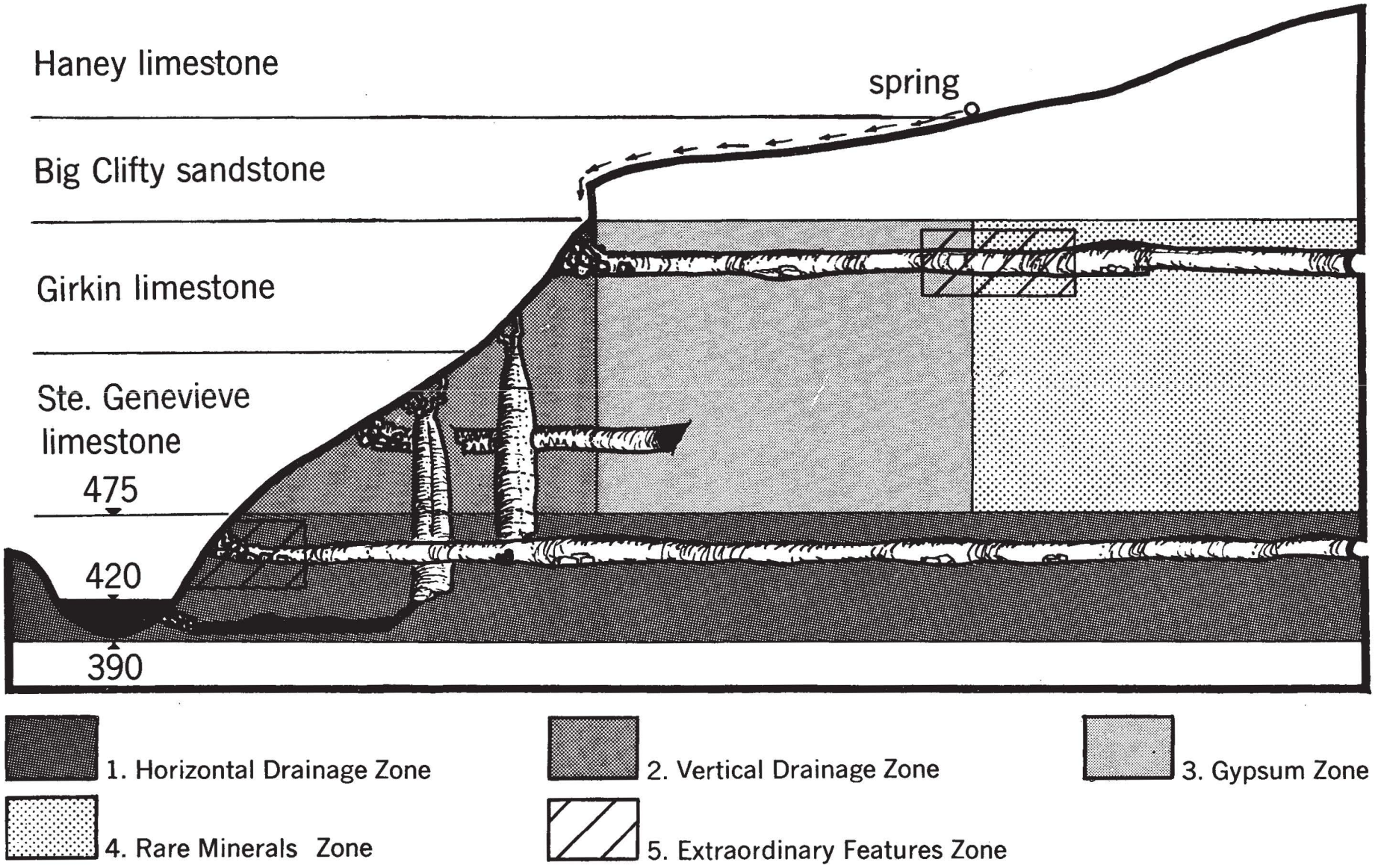
2. Cave Passage Classification

Problem: Because "time stands still" underground, most activities of man are both irreversible and irretrievable. Classification is a means of identifying the values inherent to the cave systems.

Solutions and Their Impacts

a. **No action** – Without a classification system, the Park Service lacks an important management tool, and the public may be deprived of a possible diversification of cave use.

b. **Cave Research Foundation's System** – This organization was issued a Special Use Permit and has been exploring and mapping park



Schematic Diagram of Cave Passage Classification for Mammoth Cave National Park.

caves for 15 years. At the Park Service's request, CRF applied its knowledge and developed a classification system based on the geological and hydrological characteristics of the passages and their biological provinces. Thus it is unique to Mammoth Cave National Park and cannot be applied to other cave systems without considerable modification.

The exploration and mapping were done with great care, but also at considerable personal risk and participants faced uncommon danger. Even this work had its impacts. For instance, it was necessary to mark the way so the parties could find their way out of the cave, be located by a rescue party if that became necessary, and to establish survey points. These marks are not erased over time. Each successive party inadvertently left other signs. Some cave passages must be open for public use; others should be dedicated to research. Hence, a thorough knowledge of cave resources is essential to management.

The system devised by CRF is described in detail in a booklet titled *Wilderness Resources in Mammoth Cave National Park: A Regional Approach* (1971). The data in the booklet was supplemented with maps, at a scale of 1"=100', color coded to the five zones proposed. A set of the maps has been deposited in the park's files. The following tabulation of zones was derived from the presentation in the booklet and the accompanying illustration appears in it:

Zone	Definition	Examples
1	Horizontal drainage zone	Pohl and Columbian Avenues, Eyeless Fish Trail, and Northwest Passage in Flint Ridge; Echo and Roaring Rivers in Mammoth Cave
2	Vertical drainage zone	Colossal Dome, Twin Domes, Overlook, Big Canyon, Jones Shaft, Wow Shaft, Black Avenue, Colossal and Great Onyx entrances, and Davis Hall in Flint Ridge; Bottomless Pit, Mammoth Dome, Cathedral Dome, and Frozen Niagara in Mammoth Cave
3	Gypsum zone	Portions of Grand Avenue, Floyd's Lost Passage, and Storts Trail in Flint Ridge; Broadway and Cleaveland Avenue in Mammoth Cave

4	Rare minerals zone	Bennington Grotto, nearby areas of Turner and Mather Avenues, Upper Salts Avenue, and Indian Avenue in Flint Ridge; New Discovery, and Chief City in Mammoth Cave
5	Extraordinary features zone	Indian Avenue, Upper Crouchway, Mather Avenue, Bennington Grotto, Davis Hall, and Foundation Hall in Flint Ridge; New Discovery, Rotunda, and Booths Amphitheater in Mammoth Cave

A manager might use this zoning system somewhat as follows:

Some Zone 1 passages are flooded periodically. A party of cavers could become trapped by a sudden rise in the water level caused by runoff from thunderstorms on the Sinkhole Plain or elsewhere in the Green River watershed.

Zones 4 and 5 should be visited rarely and only by experienced cavers because they contain fragile objects easily broken by contact or damaged by changes in humidity, temperature, or water quality. In them also may be found irreplaceable pre-Columbian Indian artifacts and rare animals.

Because Zones 2 and 3 have fewest fragile features and much horizontal passage is dry and of large dimension, they are best-suited to visitor activity.

Surely the group assigned to develop a cave zoning system will consider both systems presented in this environmental statement and make innovations of their own. Until then, there is little value in analyzing impacts of CRF's zoning system.

3. No Wilderness

Problem: The Wilderness Act required the National Park Service to study park lands and to report to Congress, through the President, as to their suitability or nonsuitability for wilderness designation.

Solutions and Their Impacts:

a. **No action** – In effect, this is the position taken by the Park Service as expressed in Section I. Its impacts were discussed previously.

b. Alternatives to "no wilderness" – The following wilderness proposals, listed in order of decreasing wilderness acreage, were considered in the planning process:

Name of Organization Making Proposal	Exclusions* A	B	C	Acreage** Acres	Percent of Park
National Parks Association	x			47,700	93
The Wilderness Society	x	x		42,000	84
National Speleological Society	x	x	x	26,680	52

* Exclusion A is Mammoth Cave Ridge, a tract south of Turnhole Bend, and the triangular area at Maple Springs bounded by roads; Exclusion B includes Flint Ridge and the solution valleys separating it from Mammoth Cave Ridge, plus the Nolin River and the 17-mile slackwater of the Green; Exclusion C is the land west of Turnhole Bend south of the Green and west of the Nolin. There are additional minor differences in the various wilderness configurations.

** Acreages suggested for Wilderness Act "protection" are approximate; park lands total 51,354 acres.

(1.) National Parks Association (now National Parks and Conservation Association)

Proposal – After conducting an independent study of the park's surface area and cave passages in 1967, the National Parks Association recommended that 96 percent of the surface area (47,000 acres) be designated wilderness, as shown on plate 1. Four visitor-use areas were excluded from wilderness: the existing major visitor-use area and cave entries along Mammoth Cave Ridge (2,520 acres), a potential future visitor access area south of the Green River near Cedar Sink (403 acres), a future visitors' reception area on the north-central park boundary near Lincoln School (403 acres), and the Maple Springs Ranger Station area (288 acres). Access corridors, totaling about 40 acres, to Temple Hill Cemetery, Wilkins Cemetery, the Maple Springs Ranger Station, and the Great Onyx Civilian Conservation Center (i.e., Job Corps Camp on plate 1) are also excluded.



WILDERNESS PLAN FOR MAMMOTH CAVE NATIONAL PARK

PLATE I

Federal Graphics

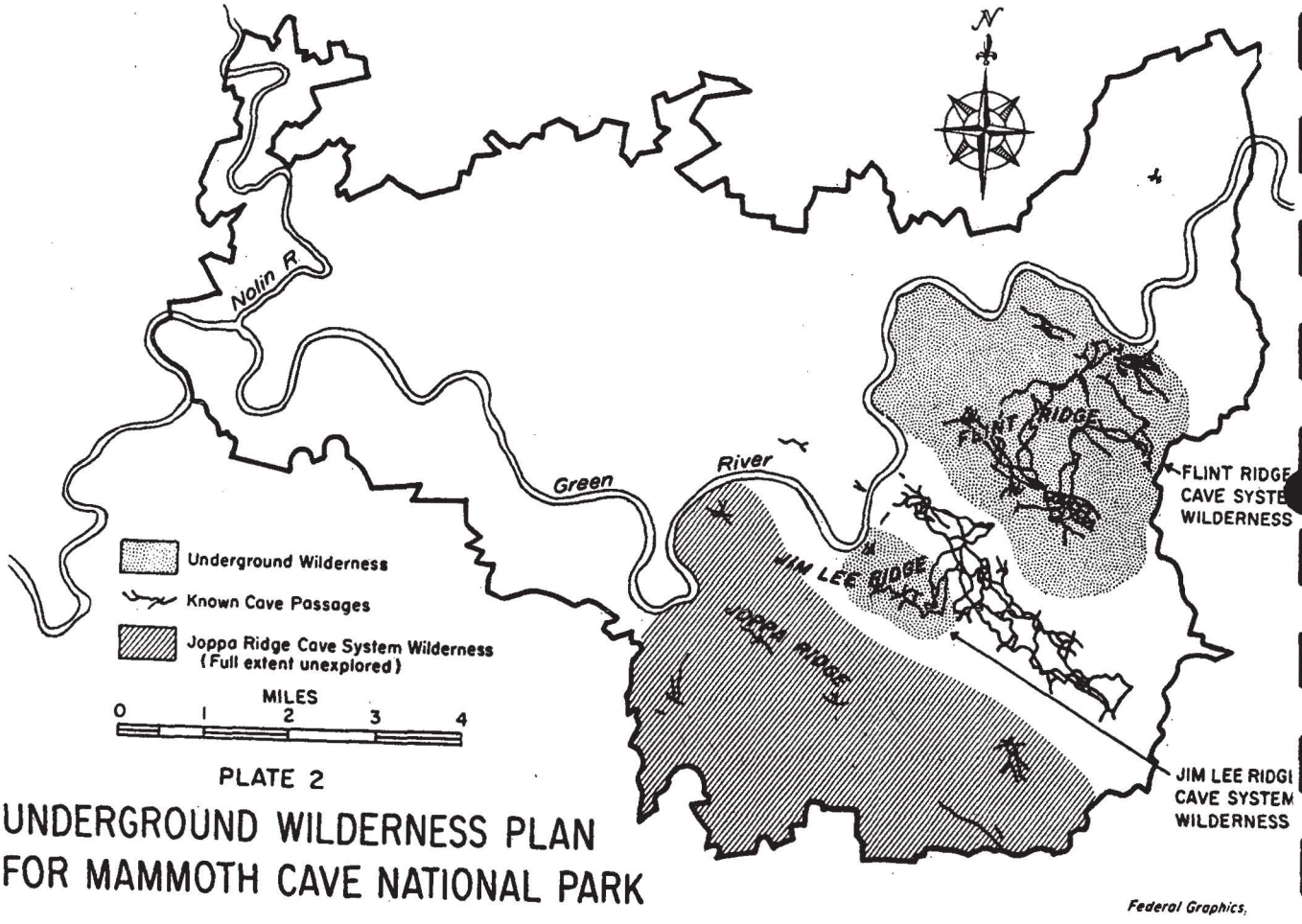


PLATE 2

UNDERGROUND WILDERNESS PLAN FOR MAMMOTH CAVE NATIONAL PARK

Federal Graphics,

NATIONAL PARKS MAGAZINE

JAN. 1968

In addition to the surface wilderness, the National Parks Association also recommended that cave passages underlying Flint, Jim Lee, and Joppa Ridges be designated underground wilderness (plate 2). The 6 miles of passages open to visitors in Mammoth Cave, along with about 70 miles of presently unused passages, are excluded from the underground wilderness area. Passages that may lie beneath valleys peripheral to the recommended wilderness are also excluded.

Impacts on vegetation and wildlife. The park presently supports a diverse mosaic of vegetation, which developed as a result of the area's long history of logging and agricultural uses prior to establishment of the park. Old fields in various stages of succession are widespread, and they provide valuable habitat for mourning doves, bobwhite, opossums, raccoons, rabbits, mice, voles, and Virginia white-tailed deer. Many of the species, such as deer and opossum, which require oldfield or early regrowth forest habitat, are valuable game animals. Others, such as field mice and meadow voles, provide an important food source for red fox, grey fox, bobcat, and various predatory birds such as the horned owl and the loggerhead shrike. Since establishment of the park in 1941, lack of vegetation management has allowed succession to proceed toward the climax oak/hickory forest, and the diversity of habitat for wildlife has been declining. During the past 30 years, the populations of at least 35 species of birds have declined, about 49 have remained relatively stable, and about 30 have increased (Wilson 1968). In general, species requiring mature forest habitat have increased at the expense of those requiring successional habitats.

The impacts of the recommended wilderness on vegetation and wildlife result from the preclusion of nonprimitive land use and the restrictions on resource management techniques. On the one hand, long-term preclusion of development will ensure protection of these natural resources and will allow the reestablishment of mature climax vegetation, which is now regionally rare because of the area's long record of disturbance. The value of the wilderness area as an undisturbed natural reserve will increase as regional development and economic growth continue to claim progressively more acreage. On the other hand, restrictions on the use of mechanized equipment in the wilderness could impair the ability of the National Park Service to manage the environment in ways that would create the optimal diversity of plant communities and wildlife populations. Wilderness designation, in effect, would

continue present National Park Service policy to allow the reestablishment of pre-Columbian ecological conditions. However, the long-term implications of this management policy have not been determined for the park.

The Virginia white-tailed deer is the region's principal big game species. In the park, the deer population has declined substantially during the past 15 years (present population estimated at 2,000 animals). Although no hunting is allowed in the park, the Kentucky State Fish and Game Commission traps about 5 percent of the park's population annually for release on state lands outside the park. If the proposed wilderness resulted in further declines in the park's deer population due to losses in suitable habitat, the state's trapping program would be less productive, the number of deer emigrations onto private lands where deer may be hunted would be less, and the quality of hunting as a regional recreational activity would be reduced to an unknown degree. Similar, but probably less significant regional impacts on hunting, could result from long-term declines in populations of mourning doves, opossums, and raccoons in the park.

The proposed underground wilderness designation will have no immediate impact on cave life, because these passages receive only occasional use by visitors. However, the National Park Service will be permanently prevented from developing the designated passages for general public use and interpretation. This action will also ensure that the cave biota has minimal disturbance from man's activities.

Similarly, surface wilderness designation precludes development on 96 percent of the park's acreage. Such developments could cause pollution of groundwater and thereby indirectly impair the integrity of cave life. However, the wilderness will have no impact on land uses outside the park, but some uses on the groundwater watershed outside the park could be harmful to the animal life of the caves. This could stem from pollution of groundwater by sewage, by leaching of materials placed in sinkholes, by road runoff, and by accidental spills of toxic materials. The potential of these impacts on cave life generated from outside the park could exceed by several orders of magnitude the potential impacts from future in-park use or development.

Impacts on cave features. The proposed surface wilderness will have no immediate effect on the integrity of the physical features

of the cave system. Long-term protection of these features may be enhanced by the restrictions wilderness designation places on the development and use of park lands.

The probability of polluting spring water from in-park sources will be negligible in the wilderness area. However, polluted groundwater from sources outside the park could affect the rate of solution of limestone within the phreatic zone.

The proposed underground wilderness will preclude development of additional visitor-use areas outside the 76-mile network of passages in Mammoth Cave itself. Thus, Mammoth Cave will continue to receive impacts of visitor use, such as vandalism and littering. An analysis of existing visitor-use data collected during the master plan study indicates that Mammoth Cave can be developed to accommodate potential increases in visitation through the year 2000, provided additional entrances are established, presently unused passages redeveloped for visitor use, and scheduling of cave trips rigidly controlled. Damage to cave features within Mammoth Cave probably can be controlled within acceptable limits by park management, at least until the end of this century. Ultimately, if visitation exceeds the carrying capacity of the cave to sustain use, and if wilderness precludes redistribution of use into other areas, a permit system might have to be implemented. Such restrictions would inconvenience the visitor and cause congestion in aboveground areas of the park. The probability that such impacts would ever occur remains speculative.

Impacts on aesthetics. The proposed surface wilderness will result in a decline in aesthetic diversity as a result of plant succession, which will eventually reestablish the oak/hickory climax forest association as the predominant feature of the landscape. Clearings, oldfields, and regrowth thickets will become progressively less conspicuous features. The mature forest will provide to the wilderness user substantially greater isolation from the sights and sounds of human civilization; the atmosphere of solitude therefore will be enhanced for many users. The determination of whether decreased aesthetic diversity and increased solitude constitute adverse or beneficial impacts will depend on how the environment is perceived by the individual wilderness user.

Impacts on access and circulation. The proposed surface wilderness would entail closure of several park roads including the 8-mile section of Ky-70 across the Woolsey Valley wilderness. (Note that the stippling on plate 1 comes up to the edge of the road in contrast with the Flint Ridge Road, which is bordered on one side with a white zone. The latter is to remain open for public use.) This route, which connects the Green River Parkway to the west and I-65 to the east, receives moderate traffic by local residents as well as substantial use by commercial vehicles. From an analysis of automatic traffic counter records, those who simply cross the park on Ky-70, using it as a segment of the state highway system, totals 37 percent of park travel. Closure of this section of Ky-70 would inconvenience park visitors arriving from the west who would have to follow circuitous alternative routes to get to the principal visitor-use area on Mammoth Cave Ridge. Local residents and commercial interests would experience time delays as long as 20-30 minutes in traveling from the junction of Ky-70 and Ky-255 at the southeastern boundary of the park to the town of Brownsville immediately west of the park. Access to a small church and adjoining cemetery on Joppa Ridge as well as to a small cemetery on Ky-70 near the southeastern park boundary would be restricted and, in the former case, nearly impossible. Public use of these areas is minor, but the impact would be significant to those affected by closure of the road.

The proposal would require closure of all in-park roads providing access to, or ferry crossings over, the Green River. Existing roads between Ky-70 and Temple Hill Cemetery with a ferry crossing (not shown on plate 1), between the visitor-use area on Mammoth Cave Ridge and the Maple Springs Ranger Station with ferry crossing (not shown on plate 1), and an access road to the Green River in the northeastern part of the park would all be closed. These closures would have impacts on circulation within the park by eliminating all transpark traffic and road access to the Green River. Travel time between the Mammoth Cave visitor-use area and the Maple Springs Ranger Station would require a 40-mile 1 hour drive via the existing external roads. The inconvenience which the wilderness proposal entails would be less in driving between other points, but would still be a significant impact.

Impacts on recreational use and development. The surface wilderness proposal, if implemented, would result in a substantial reduction in the diversity of recreational opportunities. The Green

River would be inaccessible by private automobile within the park. Launching of private motorboats and use of the existing concession-operated 125-passenger sightseeing boat on the river would no longer occur. Use of rubber rafts and canoes on the river would decline, because visitors would have to carry them on foot for considerable distances to get to suitable launch sites (most of the river is flanked by steep cliffs, which preclude boat launching). A picnic area along the road to Temple Hill Cemetery south of the Green River would no longer be accessible by automobile and would be about a mile walk from the nearest road access; use of the picnic area would decline. A primitive campsite and popular boat-launch site south of the Green River in the northeastern corner of the park that is now accessible by road would be about a 2-mile walk from the road terminus at the park boundary; use of this facility also would decline. Use of Green River by individuals or small groups would be much less also due to the difficulty of access to the river for boat launching. The wilderness proposal would have no impact on existing recreational use of the remainder of the designated area, which is used only for backcountry hiking and primitive camping. The master plan contemplates no change in the types of use in this area, so impacts on use in the foreseeable future would likewise be negligible.

The surface wilderness proposal would have substantial impacts on future development of 96 percent of the park. The peripheral staging area could not be located along Ky-70 at Union City nor could the transit system operate as described in the master plan. The congestion at Historic Entrance would continue unless relieved temporarily by a satellite visitor center, or by locating the staging area at Frozen Niagara (see VIII.A.2.f. and g.). Wilderness designation would also preclude construction of a transpark road with a bridge over Green River. North/south vehicular travel through the park would be permanently impeded. However, natural resources and aesthetic quality would not be impaired by construction activities and the presence of a low-speed road.

Development of any facilities at or in presently unused caves (Great Onyx, Colossal, and Crystal) on Flint Ridge, as well as other potential sites, would be difficult after the land above them was designated wilderness, because the only access would be on foot. Foreclosure of the option to initiate additional development near other interpretive sites will tend to concentrate future development on limited available acreage at Mammoth Cave Ridge.

If visitation continues to increase, exacerbation of an existing crowding problem and a general deterioration of environmental quality will have significant impacts on the visitor experience. Opportunities to relieve congestion by dispersion of development will be foreclosed. Development of picnic areas, primitive campsites, trails, and interpretive facilities on non-karst land north of the Green River would no longer be possible.

The underground wilderness proposal would preclude development of additional caves for interpretive use, because the extensive environmental modification and use of motorized equipment to make the environment usable and safe for the visitor would not be possible. The underground wilderness would result in concentration of additional development at Mammoth Cave after the year 2000, where crowding is already a serious problem. The underground wilderness would tend to reinforce the possible long-term impairment of the visitor experience cited above.

Evidence from other parks in which wilderness has been designated suggests that the publicity generated by formal wilderness designation may result in substantial increases in the use of wilderness areas. If this trend proves valid at Mammoth Cave National Park, the impacts of wilderness designation would include increased levels of environmental abuse associated with the increases in visitation that would occur earlier than if the area continued to be managed as wild land. These impacts may pertain to any wilderness proposal but are impossible to predict for a particular area.

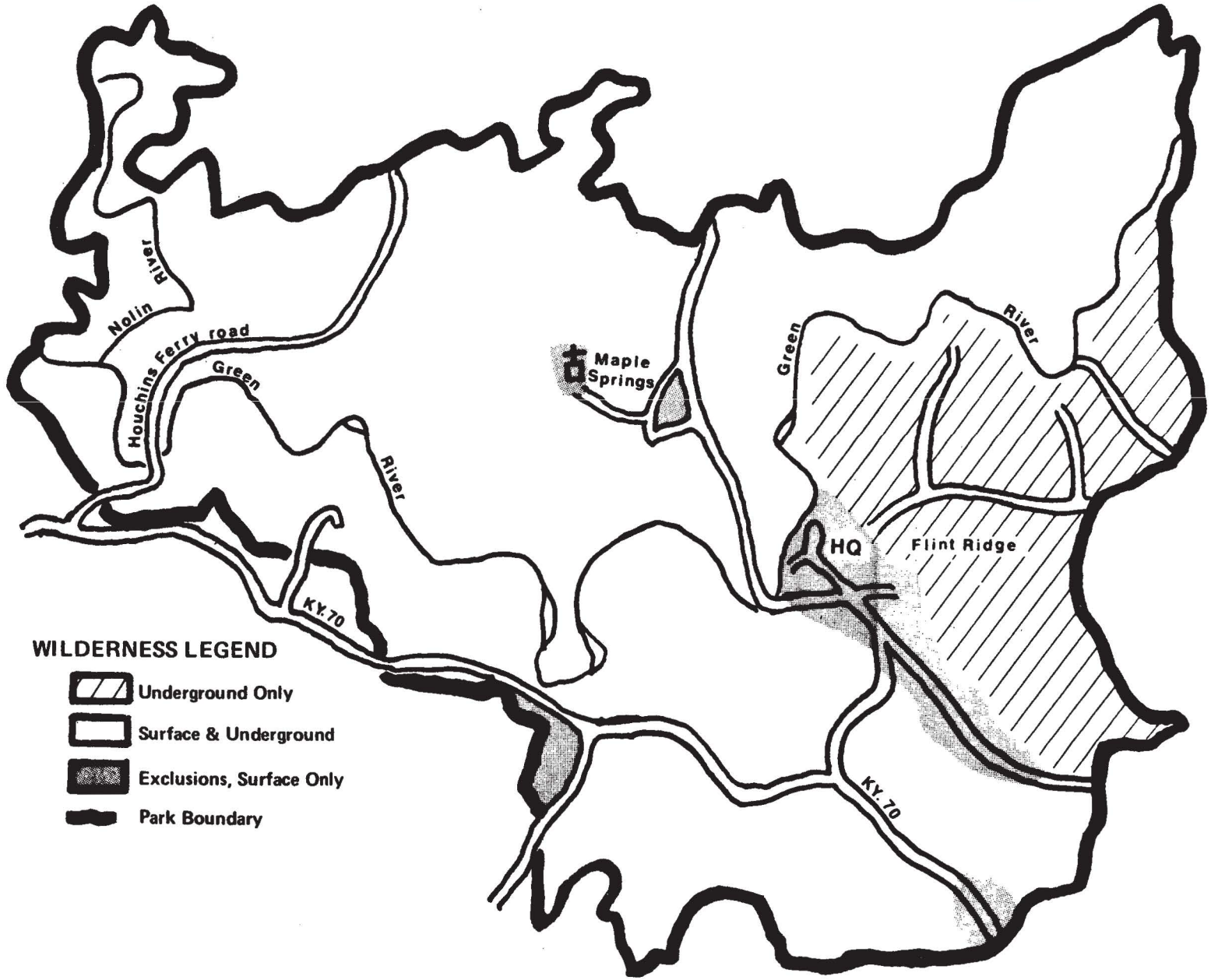
(2.) The Wilderness Society

Proposal – After the National Park Service's master plan and wilderness study were released for public review in 1972, The Wilderness Society developed the wilderness proposal depicted graphically in plate 3. The proposal recommends both surface and underground wilderness areas. The surface wilderness proposal, encompassing 84 percent (about 42,000 acres) of the park's surface area, differs from the National Parks Association proposal in five important respects.

- All the land surface between Mammoth Cave Ridge and the Green River are excluded from wilderness.

- All existing public roads and some management roads are excluded.

MAMMOTH CAVE



Prepared by The Wilderness Society
1972

- The slackwater portions of the Green and Nolin Rivers are excluded.

- A 320-acre area in the extreme southeast corner of the park is excluded to permit development of a staging area, as recommended in the master plan.

- Good Spring Church, the Maple Springs Ranger Station, and adjacent land are excluded.

The underground wilderness proposal is substantially more inclusive than the National Parks Association proposal. All underground features in the park are included in wilderness, except for "approximately nine and one half miles of electrically lighted passages under Mammoth Cave Ridge." (Currently in use are 6 miles of electrically lighted passages and about an equal length of passages not lighted.)

Impacts on vegetation and wildlife. The impacts of the surface wilderness proposal on vegetation and wildlife are similar to those indicated for the National Parks Association proposal, except that the magnitude of impacts will be reduced, because the acreage affected is about 10 percent less.

The general impacts of the underground wilderness are the same as cited under the National Parks Association proposal.

However, unlike the more limited NPA proposal, the underground wilderness will provide the protection of wilderness status to all cave biota, except in the intensively used portion of Mammoth Cave itself. Declines in the populations of the cave fauna in the latter area will almost certainly occur as the pressures of increased visitation continue, particularly because the National Park Service will not be able to expand the existing trail system into adjoining wilderness areas or establish new use areas in other caves.

Impacts on cave features. Impacts are essentially similar to the National Parks Association proposal except that (a) impacts associated with visitor use in Mammoth Cave, such as minor vandalism and littering, would be greater by an unknown amount, because the National Park Service would be unable to expand the existing use area and (b) the long-term impacts associated with precluding the development of cave features outside the Mammoth

Cave use area for intensive visitation would be substantially greater.

Impacts on aesthetics. Same general impacts as described for National Parks Association proposal.

Impacts on access and circulation. The immediate impacts of the surface wilderness proposal on access and circulation by visitors, area residents, commercial interests, or park personnel, would be negligible, because no public-use roads or essential management roads would be closed.

Even though the proposal recommends the exclusion of appropriate land for establishment of a mass transit staging area in the park's southeast corner, implementation of the mass transit system as recommended by the master plan would be impossible, because the necessary vehicle corridor between the staging area and Mammoth Cave Ridge could not be constructed through a wilderness area. The described impacts of this proposal (Section III) would not be realized.

The wilderness proposal would have no impact on use of motorboats on slackwater portions of the Green River and Nolin River for internal park circulation, because such waters are excluded from wilderness. Free-flowing sections of these streams that are included in wilderness generally are not suitable for motorboat use. Inconvenience to visitors due to their inclusion in wilderness should be negligible.

The long-term impacts of the wilderness proposal on access and circulation will depend on the types and locations of future development and land uses. These impacts are impossible to predict at this time.

Impacts on recreational use and development. The surface wilderness proposal would have no immediate effects on development and recreational use. No recreational uses, other than primitive camping and hiking, have been proposed for the wilderness area, and the impact on use in the foreseeable future is likewise negligible.

The extensive underground wilderness will severely restrict future development of trails and interpretive facilities in both Mammoth

Cave and other caves now unused. Use of Mammoth Cave would probably have to be regulated by a permit system in the near future to preclude overcrowding by visitors. The proposal therefore will have no impact on the kinds of use presently occurring in the cave system, but will significantly limit the numbers of people who can be accommodated in the future.

(3.) National Speleological Society

Proposal – Prior to completion of the master plan in 1967, the National Speleological Society conducted a study of the park's resources and prepared a proposal for designation of surface and underground wilderness areas (plate 4). The surface wilderness proposal, encompassing about 52 percent of the park's land acreage, excludes the following areas from wilderness.

- All lands south of the Green River and north of Ky-70, (except that the Flint Ridge lands between Mammoth Cave Ridge and the Green River are recommended for wilderness designation pending removal of development and a determination by the Secretary of the Interior that they qualify).

- Lands north of the Green River and west of the Nolin River near the western boundary of the park.

- Lands on the park's north boundary at Ollie that were recommended for a visitor contact station and campground.

- Lands adjacent to the ranger station at Maple Springs.

- A small tract south of Ky-70 and west of Ky-422 on the south-central park boundary that was considered too small for wilderness designation.

- All public-use roads and major management roads, except the Houchins Ferry Road at the western end of the park.

The proposed underground wilderness includes all cave features south and east of the Green River in the karst southeastern part of the park, except for the 75-mile-long network of cave passages under Mammoth Cave Ridge.

Impacts on vegetation and wildlife. The impacts of the surface wilderness proposal on vegetation and wildlife are similar to those

indicated for the National Parks Association proposal, except that the magnitude of the impacts will be considerably less, because 44 percent less surface land area will be affected.

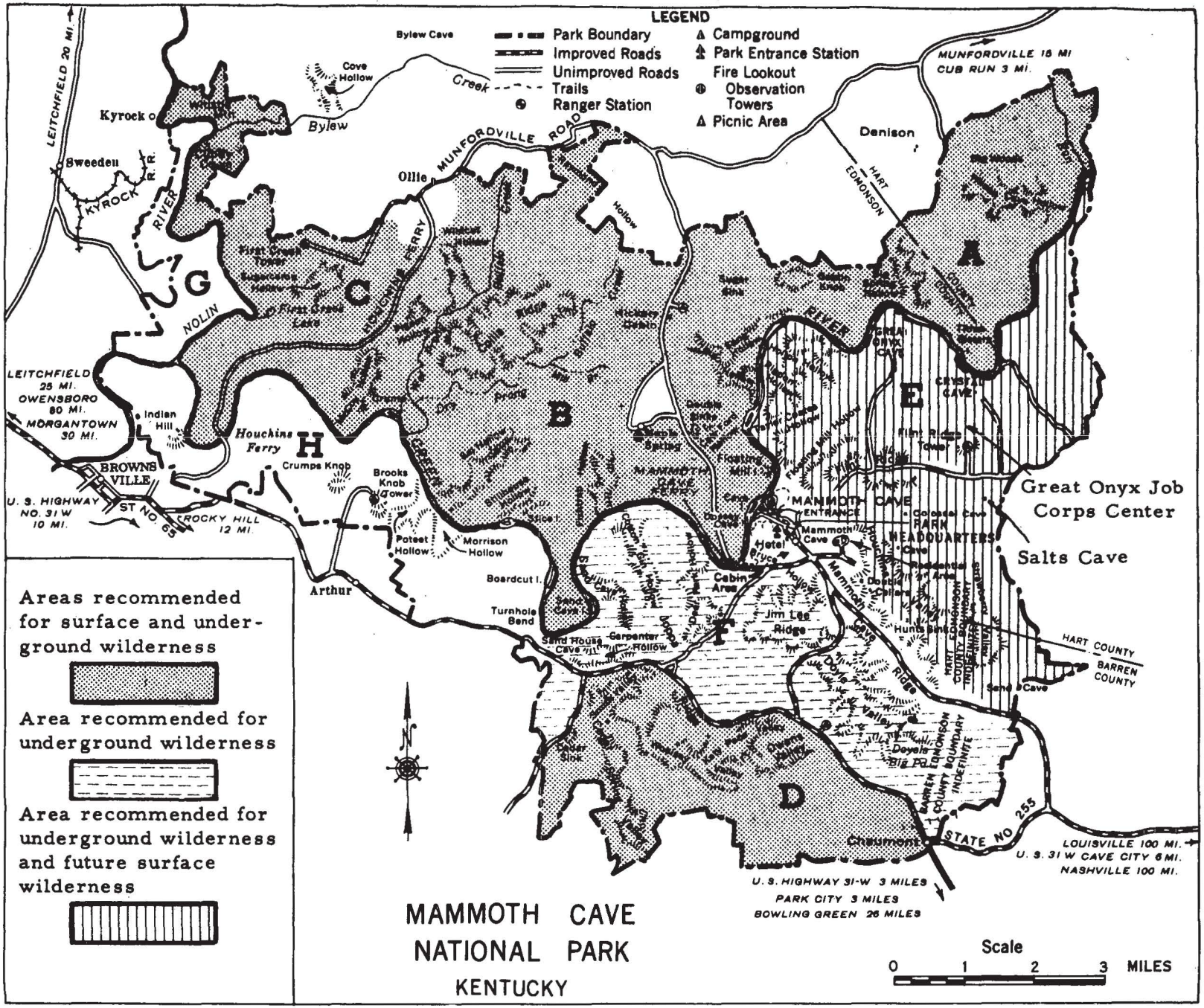
Impacts of the underground wilderness designation should be similar to those identified for the NPA proposal, because the same general areas are included in wilderness.

Impacts on cave features. Impacts are identical or nearly so to those described in the National Parks Association proposal.

Impacts on aesthetics. Impacts are similar to those described in the National Parks Association proposal, except that the reduced surface wilderness acreage increases the flexibility of the National Park Service to manage the park in ways that create greater aesthetic diversity (controlled burning of forests, clearing of vegetation, establishment of new developments, etc.). Establishment of an aesthetically uniform environment as a result of natural plant succession will be somewhat less likely under this proposal than under the NPS alternative.

Impacts on access and circulation. Impacts are similar to The Wilderness Society's proposal, except that closure of the Houchins Ferry Road between the Green River and Wildcat Hollow will limit transpark vehicular travel at the western end of the park. By retaining Mammoth Cave Ferry Road, through the center of the park, few visitors will be inconvenienced. Closing the transpark shortcut between Brownsville and Ollie will be considered a significant impact by a few local residents (numbers undetermined). The actual time delays should be minor. The low-standard road to be closed requires a 5 to 10 minute delay at the ferry crossing of the Green River; the higher-standard roads skirting the park on the west would require traveling about 8 miles farther between Brownsville and Ollie, but increased speed and absence of the ferry crossing should make the duration of the longer trip about the same.

Impacts on recreational use and development. The proposal differs from the National Parks Association and The Wilderness Society proposals in that large areas in the western and southwestern parts of the park are excluded from wilderness and are therefore available for development and nonprimitive recreational uses. The immediate impacts of the proposal on



PREPARED BY NATIONAL SPELEOLOGICAL SOCIETY

recreational use and development should be minimal, as there are no plans to develop these excluded lands.

If NSS wilderness proposal was accepted, the following actions of the master plan could not be carried out: peripheral staging area, transit system operating on its own roadbed, or the single transpark road and bridge at Houchins Ferry. Impacts of the proposed underground wilderness designation are the same as for the National Parks Association proposal.

IX. CONSULTATION AND COORDINATION WITH OTHERS

A. CONSULTATION AND COORDINATION IN THE DEVELOPMENT OF THE PROPOSAL AND IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL STATEMENT

In the development of the proposals in the master plan, the National Park Service consulted closely with the following citizen members of the planning team:

Dr. Thomas C. Barr, Jr., Professor of Zoology
University of Kentucky, Lexington.

Dr. William B. Holton, Retired Scientist
Chevy Chase, Maryland.

Don Lockwood, Park Planner, National and Historic Parks Branch
Ottawa, Canada.

Dr. Bassett Maguire, Jr., Associate Professor of Zoology
University of Texas at Austin.

Consultations were held with representatives of the park's concessioners:

National Park Concessions, Inc.
Miss Green River Boat Concession.

with representatives of the following agencies of the Federal Government:

Geological Survey
Corps of Engineers
Bureau of Outdoor Recreation
Bureau of Public Roads (Federal Highway Administration)

with representatives of the following offices in the Commonwealth of Kentucky (July, 1968):

Office of the Governor
Department of Highways
Department of Parks
Department of Natural Resources
Department of Public Information
Department of Fish and Wildlife Resources
Fiscal Court Judges of Edmonson and Barren Counties

with representatives of the following conservation organizations:

The Wilderness Society
Cave Research Foundation
National Speleological Society
National Parks and Conservation Association

and with National Park Service specialists in geology, landscape architecture, architecture, engineering, transportation, history, park maintenance, interpretation, biology, visitor and resource protection, concessions management, park management, and park planning.

The master plan team also had the benefit of the papers presented at and resulting from a "Symposium on the Application of the Wilderness Act as the means for preserving the surface and the underground features of Mammoth Cave National Park," which was held at the park May 22-26, 1967. Attending were representatives of the concessioners, members of the park staff, representatives of the Geological Survey, National Speleological Society, Cave Research Foundation, a Regional Coordinator of the office of the Secretary of the Interior, and Dr. Bassett Maguire, Jr., of the University of Texas.

A public meeting was held at the park on May 25, 1968, by the master plan team to listen to comments by public officials, organized groups, and citizens about the future use and development of the park. A statement was made in behalf of Congressman William H. Natcher (Ky.). Then there were seven county and city officials, 16 representatives of various state agencies and public bodies, 18 representatives of organized groups, and 13 individuals who spoke and expressed their views. In addition, a few statements were sent by mail.

Subsequently, many newspaper articles and editorials have appeared, a host of resolutions have been passed by civic bodies, several articles have been printed in periodicals, and conservation organizations have refined and published their comments upon the proposals in the master plan.

While much of the same background material was used for evolving the proposals in the master plan and for preparing this environmental impact statement, more specific data for the latter was obtained when necessary by further consultation with specialists.

A complete list of those who participated in the preparation of the master plan is printed on the concluding pages of that report. The principal author of this environmental impact statement is W. Drew Chick, Jr., park planner and environmental analyst, in the National Park Service's Denver Service Center, Denver, Colorado.

B. COORDINATION IN THE REVIEW OF THE DRAFT ENVIRONMENTAL STATEMENT

The following agencies and organizations were asked to comment upon the draft environmental statement. Those who did are marked with an asterisk and their letters are included in the appendix.

Department of the Interior
- *Bureau of Outdoor Recreation
- *Bureau of Sport Fisheries and Wildlife
- *Bureau of Mines
- *Geological Survey

Department of Agriculture
- Forest Service
- *Soil Conservation Service

Department of Defense
- *Corps of Engineers

Department of Transportation
- Federal Highway Administration

Department of Commerce
- Economic Development Administration

***Environmental Protection Agency**

***Advisory Council on Historic Preservation**

Commonwealth of Kentucky
- State Clearinghouse
- *State Historic Preservation Officer
- Barren River Area Development District
- County Judge of
  - Barren County
  - Edmonson County
  - Hart County
- City Council of
  - Brownsville
  - Cave City
  - Horse Cave
  - Park City

The Wilderness Society

National Parks and Conservation Association

Sierra Club

National Audubon Society

Cave Research Foundation

***National Speleological Society**

National Park Concessions, Inc.

Miss Green River **Boat Concession**

Mammoth Cave National Park Association

In addition, the following submitted comments and their letters are also included in the appendix:

Tennessee Valley Authority

Commonwealth of Kentucky
Department for Natural Resources and Environmental Protection

Individuals:
Kip Duchon
James Hedges
Gary K. Soule

Identical letters from:
Cheri Casper
R. J. Ehr
Ronald F. Gietkowski
Thomas H. Umheit

A public meeting on the master plan was held at Bowling Green, Kentucky on May 28, 1974, and a public hearing on the "no wilderness" proposal was held the following day at the same place.

The master plan public meeting was attended by about 125 persons of whom possibly 100 were residents of Kentucky, mostly from the counties in the vicinity of the park. Forty-three persons spoke and only five came from out-of-state. Four of these represented national conservation organizations all of which generally favored the Park Service's master plan proposals, as did Governor Wendell Ford. On the other hand, most Kentuckians "opposed" the master plan. The major provisions at issue were the eventual discontinuance of overnight lodgings, phasing out of concessioner and government facilities at Historic Entrance, and closing roads to private automobiles so that transit vehicles could operate freely. Despite the time frame of 10 to 20 years to accomplish the foregoing, local people feared that these changes would make the park less attractive to visitors and that would adversely affect tourism in Cave Country.

Resulting from this open forum, the Park Service has modified the master plan. Lodgings and the other facilities at Historic Entrance will continue without expansion. Under congressional policy, concession-operated visitor services will be evaluated periodically and those not needed any longer will be terminated. It is the intent at this time to remove the structures they occupy so that the area will return to its natural appearance. This is a long-term objective to improve the cave environment.

The Park Service will commence development of the peripheral staging area at Union City as soon as practicable. Then all tickets for cave tours and sightseeing boat trips will be sold there and all visitors will be transported by buses operated by the Park Service without fee to the riders. Buses will compete with private vehicles over existing roads except that "Old 70" between Little Hope Church and Carmichael Junction and the paved portion of Mammoth Cave Ferry Road will be used exclusively by the buses. The transpark road and bridge corridor will be shifted westward from Brooks Knob, as originally proposed, to coincide with the present Houchins Ferry Road. This will minimize scars of new construction. Cave trips will be expanded and use of the River Valleys and Hilly Country will be encouraged. The park's domestic water supply will be obtained from Green River rather than from an outside water district so as not to stimulate regional development that could be deleterious to the cave systems in the park and change the rural atmosphere along the park approach roads that now enhances a national park visit.

About 60 people attended the public hearing on wilderness held May 29, 1974. The Park Service's proposal of "no wilderness" was discussed. Kentuckians generally stated that most park visitors are not seeking a wilderness experience, that wilderness designation would be contrary to the original intent of the park, and that visitation would be reduced, thus seriously damaging the economy of the area. National conservation groups took the opposite position and urged the Park Service to recommend that extensive areas of the park, surface and underground, be designated wilderness now. The Park Service and the President have concluded, in reporting to the Congress, that none of the lands in the park are suitable at this time for wilderness designation because most of the area has been developed in the past and the imprint of man's work is still substantially noticeable. It was brought out also that there is no legal barrier to recommending to Congress that qualifying cave passages be designated wilderness even though the land surface above them does not qualify.

The Park Service will periodically evaluate the condition of park lands and will recommend them for wilderness designation when they meet the criteria. Exploration of the caves will continue and the knowledge so gained will aid management in directing the use of the cave system as a whole in keeping with the purposes of establishing the national park.

In the following paragraphs, we have responded to the comments made in the letters received. The page numbers in the comment sections refer to the draft environmental impact statement.

Bureau of Outdoor Recreation

Comment:

Generally, we have found the draft statement to be informative with a clear and factual examination of environmental impacts and alternatives. We believe the National Park

Service should be commended for devising plans that would significantly increase the number of cave trips and the quality of visits while protecting the unique character of the resource. We are encouraged by the plans for facilities to expand sightseeing, fishing, picnicking, and primitive camping in the River Valley Section and primitive camping and hiking in the Hilly Country Section. In view of these recreation proposals, the fact that the land within the park has received considerable modification by man, and the fact that the area will be managed primarily as wild land, we agree that the wilderness designation may not be appropriate for portions of the park at this time.

Response:
Thank you for your endorsement of the master plan/wilderness study.

Bureau of Sport Fisheries and Wildlife

Comment:
The discussion of effects of various actions on surface and subterranean fish and wildlife resources is inadequate.

Response:
We did not discuss the effects on surface fish and wildlife resources in any depth because it is the policy of the Park Service, in natural areas, for the fauna to revert, insofar as possible, to its pre-Columbian state. We recognize, though, that this is impossible to attain at Mammoth Cave for the passenger pigeon and American chestnut are extinct; black bear have been extirpated and it would be undesirable to reintroduce them. Other species are extinct or have been extirpated. It appears to us that the actions proposed in the master plan will have only localized effect on wildlife, not greater in magnitude than exists presently.

Regarding subterranean fish and wildlife, the plan was designed to benefit these species over the long term. For example, natural flow of water into the caves from the springs on Flint Ridge will be restored when domestic water is obtained from Green River. We also pointed out the dangers to the cave fauna of polluting underground streams whose watersheds are outside the park. We urged that regional zoning be established to control location and extent of development. Hopefully, water quality standards will also be established for underground streams as they have for surface streams. Such standards will need to recognize the absence of sunlight and vegetation, and the high humidity of the subterranean conduits that lowers the purifying qualities of underground stream flow as compared with surface flow of the same velocity.

Comment:
We suggest that the vegetation in certain areas of the park be arrested in various stages of plant succession so as to increase the variety of wildlife and enhance visitor enjoyment of it.

Response:
As mentioned previously, this is contrary to Park Service policy for managing natural areas. Even when the deciduous forest reaches a climax state many decades hence, there will still be a variety of wildlife. The habitats represented in the park are diverse because of the rugged topography, rivers and streams, and types of soils. Each habitat provides a variety of foods and nesting sites. Each of these influences and adds to the wildlife species represented.

We agree that, unlike most national parks, there is an opportunity at Mammoth Cave to purposefully manage the vegetation and the wildlife in the manner you suggest, because of past land uses. Should Park Service policy change in the future, we will be happy to consult with members of your staff before implementing such management techniques.

Bureau of Mines (June 10, 1974)

Comment:
On page 62, 5th paragraph, it was stated that atmospheric contamination may occur in caves in winter when the dry outside air is inhaled, and that caves exhale in summer. This should be clarified because caves cannot exhale without simultaneously inhaling, hence atmospheric contamination may occur at any season.

Response:
Thank you for pointing out this inaccuracy. We have corrected the wording in the text.

Bureau of Mines (June 12, 1974)

Comment:
Since mineral activity is not permitted under national park status, there will be no change in the future. We concur that the area studied for wilderness designation does not meet the criteria of the Wilderness Act.

Response:
None required.

Geological Survey

Comment:
We believe the draft statement is well done in regard to the park itself, but that it could be strengthened by including more definite steps to be taken to mitigate adverse impacts, especially related to waste disposal, that would result from the probable increasing development of neighboring areas.

Response:
Such measures are beyond control of the Secretary of the Interior and are difficult in the Commonwealth of Kentucky because of traditional resistance to any form of land-use control. In our view, local zoning and establishment of water quality standards for underground streams are essential actions to mitigate environmental effects of increasing development outside the park. For example, a study considering all factors could well recommend cluster development in lieu of strip development along a water line or highway that is the anticipated result without land-use controls. In fact, strip development is taking place now along Ky-70 eastward from the main park entrance at Chaumont and westward from Cave City.

Comment:
Discussion of plans for improved sewage disposal (pages 9 and 80) fail to specify whether wastes only from Park Service facilities or also from peripheral commercial developments will be treated. If not adequately treated, the latter could cause serious deterioration of the subterranean environment.

Response:
The Park Service will treat only the wastewater from in-park development. Its level of treatment will conform with all applicable Federal and Commonwealth water quality standards. The effluent will be discharged into the Green River.

In the absence of a centralized regional sewage disposal system to collect the sewage from Park City and from homes and businesses along the approach roads to the park, this effluent is going underground from each of the separate treatment facilities. Collectively, this effluent affects the quality of the water in the streams that pass through the caves in the park. In time, the underground streams will reach a saturation point of pollution load that will create unsafe, unpleasant, or unhealthful conditions for cave visitors. Before that point is reached, the wildlife in these streams including blindfish, shrimp, crayfish, etc., might not be able to live in the polluted water. Besides the potential closure of cave passages to public tours and loss of irreplaceable cave fauna, uncontrolled surface development will also decrease scenic values. Such occurrences would be tragic to the national park and could be ruinous to the economy of Cave Country.

Comment:
Phasing out the use of "spring water" (page 23) should be done gradually to avoid problems resulting from any unrecognized changes that have occurred in groundwater hydrology, such as blocked passages.

Response:
We anticipate that this will take place as the plan is fulfilled.

Comment:
It would be more appropriate in the list of cities in Kentucky and nearby states (page 53) to give populations of metropolitan areas rather than just the incorporated cities.

Response:
Agreed. This graphic has been changed.

Comment:
The traditional term for the kind of terrain in the photograph opposite page 90 is "cedar glade" rather than "cedar karren."

Response:
"Cedar karren" is the term proposed for this disclimax vegetative type by the botanist at the University of Kentucky who is studying this habitat in the park.

Comment:
Consideration might be given to burial of electrical cables (page 96).

Response:
Burial is one method that will be used to "hide" cables from view.

Soil Conservation Service

Comment:
The statement should describe the effect upon the deer and other wildlife with the establishment and use of the trail system in the Hilly Country. Large numbers of people visiting the area may disrupt the daily and seasonal movements of deer. Human activity during late May and June, when the deer are having fawns, could be particularly adverse. Human use will, at least to some extent, preempt the use of the area by deer and other wildlife creating more pressure on the surrounding habitat. This human intrusion could cause much more damage than the physical loss of habitat described in the draft environmental impact statement.

Response:
Thank you for identifying an impact that has not occurred to us. If the problem develops, such management techniques as limiting visitor use during the fawning season could be applied.

Corps of Engineers

Comment:
If the proposed master plan is adopted, there would be a critical need for phasing the various redevelopmental elements in order that the local economy be able to absorb the changes without suffering economic imbalances.

Response:
Redevelopment of the park will take place gradually over a 10- to 20-year period, which should allow ample time for the local economy to adjust.

Comment:
The master plan's objectives to protect the park resources from overuse could be enhanced by encouraging park users to utilize Nolin River Lake as a resource for overnight use and active day uses such as boating, fishing, and swimming. This concept, however, would have to promote not only Mammoth Cave National Park but all of the recreation resources of the region.

Response:
Agreed. This is one of the major reasons for the master plan's proposal of an improved transpark road with a bridge across Green River.

Comment:
Extending the length of the activity day should be given consideration as an alternative to total park redevelopment as proposed by the master plan. Extending the length of the activity day would stimulate the local economy by creating more demand for overnight facilities and related services while lessening the demand for increased parking and accommodating an increasing number of visitors.

Response:
We have experimented with this in past years without experiencing the results you suggest. Moreover, since the private caves of the region receive their heaviest visitation during the evening hours, extension of the park's activity day would result in direct competition with that portion of the local economy. Nevertheless, this suggestion has come from many sources and we lengthened the visitor day, beginning July 1, 1974, and inaugurated a 6:30 p.m. Frozen Niagara Tour. This will be continued during the 1975 summer season. We will observe its effects with considerable interest for their bearing on future planning.

Comment:
Page xii of the environmental impact statement states that sightseeing accounts for over half of the park's annual visitation. If the park is redeveloped as proposed in the master plan the park visitation gained through sightseers' use of internal roads would no longer exist. Was this absence of over one-half of the annual visitation considered when future visitation was projected for the redeveloped park?

Response:
No. The projections were for cave visits alone. In order to preserve and protect the cave systems, it was necessary to curtail motor sightseeing.

More refined data on visitor use (1973) shows that 36 percent of the annual visitation take cave trips, 27 percent participate in surface activity such as the sightseeing boat trip, hiking, picnicking, and "people watching," and 37 percent simply drive across the park on Ky-70. The latter consists of local, intrastate traffic including commuters and commercial travelers on business trips who receive no park services though they are using a park road.

Comment:
The proposed master plan limits all access to the park to a mass transit system. This single method of visitor access would seem to have a dehumanizing effect on the visitors. Perhaps this "herding" method of management would be more appropriately used in the park areas that are heavily used or in areas that are most environmentally sensitive and controlled use is absolutely necessary.

Response:
This is precisely the condition that prevails in the cavernous southeast segment of Mammoth Cave National Park. Increasing travel has impacted existing automobile storage capacity and traffic congestion on roadways is increasing. Expanding the present parking area and widening existing roads would have unacceptable deleterious effect on the environmentally sensitive cave systems.

Comment:
The last paragraph on page 35 of the environmental impact statement states that some abandoned roads will be available for use by horseback riders. This proposal does not seem consistent with the master plan concept of management. Also, the master plan makes no provisions for stable facilities or delineation of roads that will be used.

Response:
We see no inconsistency inasmuch as riders have been trucking in their horses from distant points after making advance arrangements with the park superintendent. The abandoned roads are situated in the Hilly Country north of Green River. Should a significant demand for rental horses develop, this service would be performed under a concession contract. Before this was done, an environmental assessment would probably be written so that those interested could comment on the proposal.

Comment:
The master plan fails to clearly explain the relationship that possible wilderness designation has to the proposed redevelopment.

Response:
The master plan recommends no wilderness designation now because the land does not qualify under the criteria established by Congress. There is no need in that document to postulate on the relationship between wilderness designation and redevelopment.

Environmental Protection Agency

Comment:
Neither of the park's wastewater treatment plants – lagoon and trickling systems – is likely to meet the latest secondary treatment requirements published in the Federal Register of August 17, 1973 (Vol. 38, No. 159, Part II, Water Programs).

Response:
Thank you for pointing this out to us. We anticipate removal of the Great Onyx Civilian Conservation Center including the lagoon there. The trickling filter plant will undergo modernization as soon as funding is available, and will be expanded, if necessary, to handle sewage from the peripheral staging area, the three in-cave comfort stations, and the government housekeeping area, as well as that from the Historic Entrance area.

Comment:
Data should be supplied to the Kentucky Air Pollution Control Commission to conduct an "indirect source review" as stipulated by 40 CFR 52 (Federal Register 2-25-74).

Response:
We will comply with this requirement.

Advisory Council on Historic Preservation

Comment:
Subsequent versions of the impact statement and the master plan should reflect the contact that has been made with the Kentucky Historic Preservation Officer and incorporate her recommendation pertaining to the early nomination of historic places within the park that might qualify for listing in the National Register of Historic Places.

Response:
This has been done.

Comment:
The Council is pleased to note that a full survey of historic, cultural, and archeological sites and objects is being made and that any proposed action affecting a resource that has qualified or that appears to qualify for listing in the national register will be submitted for review and comment to the Advisory Council in accordance with Council procedures.

Response:
None required.

Kentucky Heritage Commission (State Historic Preservation Officer)

Comment:
We trust that the Park Service will proceed to nominate those sites determined to be eligible (for nomination to the National Register of Historic Places).

Response:
Nomination forms are being processed for several sites and studies are underway to determine eligibility of others.

National Speleological Society, Inc.

In the following paragraphs, we have addressed each of the six general topics summarized in your cover letter.

Comment:
It (the environmental impact statement) needs a better discussion of park visitation and its effects, especially the economic impact of the master plan proposals upon the surrounding region.

Response:
We did not have the capability of doing this inhouse, and time did not permit obtaining this information by contract with an outside firm. Moreover, the recent decision of the regional director, following the public meeting on May 28, 1974, to fulfill the park's domestic water needs by tapping the Green River instead of buying water from an external source, relieves the strongest impact of the master plan upon the surrounding region.

Comment:
A better analysis of the effects of visitation upon the cave should include a determination of carrying capacities for the cave resources, a better understanding of the effects of short-term uses on the long-term productivity, and a consideration of the irretrievable nature of vandalism.

Response:
We can see the merits of determining the carrying capacity of cave resources and obtaining a better understanding of the effects of short-term uses on the long-term productivity. We question whether the data is now available to do either. Gathering data of this type is one of the functions of the resident scientist on the superintendent's staff.

There is ample opportunity to compare effects of use with conditions in unused passages. A maximum of 10 of the 76 miles of passages in Mammoth Cave will be

lighted for tours, under the level of development now foreseen. Also not more than 3 miles of the 90 miles of Flint Ridge passages will be reopened for semi-wild-cave trips for small parties with hand-carried lanterns. When the decision was made to propose expanding cave trips, the Park Service was convinced, upon consultation with scientists knowledgeable about Mammoth Cave's resources, that the level of use contemplated would have no unacceptable deleterious effects. A greater threat, in our opinion, stems from underground stream pollution resulting from human wastes and the potential of contamination from pesticides, fertilizers, and accidental spills of toxic chemicals and petroleum products introduced outside the park.

Once a passage is developed for public tours, the action is irreversible and irretrievable. By using previously developed passages to expand cave tour capacity, we have mitigated further damage to the cave as a whole. Moreover, we are not entering pristine passages and disturbing habitats that have not adjusted to the tours that began in 1816.

Use of any resource is consumptive to a greater or lesser extent. Some costs are inevitable and have to be accepted, but it is incumbent on the Park Service to minimize those as much as possible. Vandalism is one of these; it can be reduced, but not eliminated.

Comment:
The staging area discussion should give better consideration to sewage and parking lot runoff problems and to the effects of the proposed staging area upon the endangered Mammoth Cave shrimp and the wilderness cave systems under Joppa Ridge.

Response:
We are at a loss to know what we can add to this discussion. Alternative sites outside the park near Chaumont and near Turleys Corner were studied. Both appear to overlie caves.

Admittedly, crossing Doyel Valley with a transit system roadbed, a waterline and a sewerline are undesirable, but all this has been done on the Sinkhole Plain, a similar area geologically, without complications or special problems. Moreover, transit vehicles crossing Doyel Valley will introduce a tiny volume of pollutants into the ecosystem compared with the number of personal vehicles required to transport the same number of visitors. It is doubtful that the Mammoth Cave Railroad grade across Doyel Valley followed by the present-day Sloans Crossing Road did as much damage as decades of farming and soil erosion prior to establishment of the park. If a surface roadbed for the transit system was shown to be unacceptable environmentally, it is probable that an aerial system, such as a tramway, could be designed and built.

Wastewater from the staging area will be piped to a treatment plant on Green River where the treated effluent will be discharged into the river. Thus wastewater will not

enter the ground at any point in any form, save it be from an unlikely accidental rupture of the sewerline. Heavy-duty pipe will minimize this possibility and automatic check valves in the line will reduce the quantity lost from such a spill.

Parking lot runoff is to be collected and treated before it goes underground. Its quality can be upgraded, if the discharge is found likely to be toxic to the cave fauna. We know of no other parking lot in the karst region where such precautions have been taken.

As for the Mammoth Cave shrimp, it has not been observed in Mammoth Cave or Flint Ridge since 1967. It may have been exterminated already as a result of pollution and flooding on the Green River. However, both Roaring River and Echo River underlie Doyel Valley. The location of the former is beneath Sloans Crossing Road about 1½ miles northwest of the peripheral staging area site at Union City.

It is probably impossible to find any location for a staging area on Mammoth Cave Plateau, within or outside the park, that does not overlie a cave. The impervious sandstone cap rock provides mechanical protection against collapse due to surface loadings, and assures that dry passages will remain dry.

Comment:
The road and bridge discussion is based upon misunderstanding of the probable use of the road by nonpark users.

Response:
There is no way that the sole benefit of a transpark road will accrue to the park. It is inevitable that such a road will carry nonpark traffic.

The master plan calls for discontinuing one of the two existing transpark roads by closing Mammoth Cave ferry so the transit system from the peripheral staging area will operate without competing with personal car traffic on the same road.

The other transpark road is tied to Houchins Ferry. In essence, the proposal is to replace the ferry with a bridge and raise the roadbed to a higher standard. The proposal is to do this in the present corridor. However, the best corridor for such a road will be determined by separate engineering and environmental studies.

Comment:
There is an inadequate discussion of environmental problems within the caves themselves, especially relating to water balance and air quality.

Response:
Again, we lack data for a meaningful discussion. With respect to water balance, this is of concern in very limited portions of the cave passages such as Frozen Niagara,

Mammoth Dome, and the front part of Great Onyx Cave where flowstone has and is forming. Possibly over 95 percent of the lineal extent of the cave passages in the park are dry, i.e., not decorated with flowstone. These passages, however, have a uniformly high relative humidity. Therefore, the proposal contains a provision that all new artificial entries be equipped with air locks. Elevator shafts will have air locks at the top and bottom, as required, to offset the pumping action as the elevator cab ascends and descends.

There is no evidence, so far, to indicate deterioration of air quality through the presence of people, smoking, the carrying of gasoline lanterns, or the inhaling by the cave of outside air. Probably this can be attributed to natural air movements coupled with the vast size of the passages. However, the potential exists for a deterioration of air quality and this will be monitored.

Comment:
The wilderness discussion is completely inadequate as an environmental impact statement. It contains an arbitrary analysis of the data and a misinterpretation of the legal definition of wilderness; it completely ignores Secretary Reed's letter of June 1972; it proposes overdevelopment of potential wilderness without justification; it contains a completely inadequate discussion of wilderness and non-wilderness impacts; and its discussion of alternatives consistently misinterprets the conservationists's (sic) wilderness proposals and argues against "straw men." We recommend that the Wilderness Study section be separated from the master plan section and completely rewritten to reflect an adequate consideration of the wilderness resources of the park and the environmental impacts of the wilderness recommendation.

Response:
We appreciate the suggestions you made in your detailed analysis and have taken them into consideration in our revision of the draft statement into the final statement. Department of the Interior guidelines require separate environmental statements only when wilderness designation is proposed, hence the discussion on wilderness at Mammoth Cave remains as part of the final environmental statement on the master plan.

Comment:
In general, the Park Service and its planners are to be congratulated on preparing a reasonably strong EIS, which identifies most of the environmental impacts of the master plan, although the Wilderness Study section of the EIS has serious deficiencies. The discussion and analysis that follow are not intended to denigrate the master plan, but merely to provide a basis for improvement of the EIS. It is a difficult process to prepare a complete and comprehensive EIS; in fact, a perfect one has probably never been prepared and never will be. Part of the process of preparation is a comprehensive review by the public and interested parties. It is hoped that the discussion to follow

makes a positive and beneficial contribution to the overall improvement of the environmental impact statement.

Response:
None have shown the dedication and interest that the National Speleological Society has demonstrated through its analysis and suggestions for improving the EIS. Thank you. We have incorporated into the final draft most of the suggestions contained in the 15-page analysis prepared by your Committee on Conservation, though in several instances we lacked the data for discussing the subject in greater depth.

Tennessee Valley Authority

This agency stated it had "no comment" since the proposed project is outside the Tennessee Valley and the TVA power service area.

Commonwealth of Kentucky: Department for Natural Resources and Environmental Protection

Comment:
The environmental review agencies found the impact statement to contain no inadequacies, but the planned construction of a 2,320-vehicle parking lot requires that an application for a permit be filed with the Division of Air Pollution of this agency before work is started.

Response:
Application will be made.

Individuals

Kip Duchon

Comment:
Water quality standards should be formulated for underground streams to protect the cave environment.

Response:
The Park Service will request the appropriate state and Federal agencies to establish such standards.

Comment:
A comprehensive regional land use plan and a sewerage district should be developed to protect the cave environment.

Response:
These matters are the responsibility of the respective county governments. The counties may call upon BRADD to prepare the plans, but only the counties can carry out the plans that are developed. Obviously, neither zoning nor establishment of a sewer district can be accomplished without citizen support. We are informed that citizen support is unlikely at this time.

Comment:
An addition to the master plan must be the appropriation (sic) of the remaining 20,000 acres authorized for the park.

Response:
The addition of any land to the park at this time would meet strong local opposition because of tax losses.

Comment:
My last objection to the master plan is the proposed bridge over the Green River and the crosspark road. Perhaps an improved road could be built to the west of the park.

Response:
This is a possibility that would come under the jurisdiction of the Commonwealth of Kentucky.

James Hodges

Comment:
I would like to see all the areas suggested as "wilderness" by the Wilderness Society included in the NPS master plan as "wilderness goals" in addition to the Class IIIA and IVA lands alone.

Response:
The Park Service, through its normal master plan process, will restudy park lands in several years. Meanwhile, no development is proposed that would affect the wild character of most of these additional lands.

Comment:
The most serious defect in the master plan and draft EIS is the matter of the paved road crossing the park. It would be much better to build a road to the east of the park as described under alternate "e."

Response:
The road proposal and its location are subject to further study, and there will be opportunity for further public comment.

Comment:
My other major objection concerns "underground wilderness." The arguments against it are semantic. Moreover, polluters upstream could be prosecuted more readily if the caves were in wilderness rather than merely zoned.

Response:
Because the cave environment is dependent on the surface environment, it does not seem appropriate to separate the two legislatively. Where the surface qualifies for wilderness designation, the practical result is that the underlying caves are wilderness also. The major problem area is Flint Ridge where essential park management and visitor activities, present and future, preclude wilderness designation for the surface.

The Park Service considers it unwise to put all but the presently developed passages into wilderness now while exploration is still underway. It could be in the public interest to open and develop new passages for tours and that would be precluded by wilderness designation.

Comment:
It is an unnecessary use of energy and resources to air-condition anything at the park.

Response:
This will be considered in future stages of planning.

Comment:
Strip development along approach roads could be controlled by regulating access to the roadway or to water, or both.

Response:
The device(s) used are for the counties to determine and to enforce.

Comment:
Why allow any power boats even on the pool area of the river? The boat racing crowd and the water skiers already have two Corps of Engineers lakes nearby. Noise, bank erosion, and oil pollution are part of power boats.

Response:
Most power boat use is by fishermen using an outboard motor on a rowboat. Limited launching places and facilities will always constrain use and exclude large boats.

Comment:
Wilderness goal lands should be allowed to revert naturally to whatever they will, rather than to "arrest" them at some successional stage for educational or scientific use.

Response:
This is not part of the proposal. It was cited as an impact of wilderness designation if such management practices become desirable in the future.

Gary K. Soule

Comment:
I feel it is my duty to protest the lack of wilderness consideration for Mammoth Cave National Park, surface and underground, yet I must compliment you on deciding to open some other caves in the park under limited conditions. I would rather see many caves opened under moderate traffic conditions, with little noticeable effects, than just one main cave that would be ruined if it took too heavy a tourist load.

Response:
The possibility that more of the cave passages may be needed for public tours is one of the reasons underground wilderness was not recommended at Mammoth Cave. Use of wild caves is limited to the very few people who have the physical stamina to visit them. Therefore, some development of the cave passages with trails and stairways is required for the safety of the greater numbers of people who do not belong to the previous category. Even for semi-wild cave tours, a trailbed is necessary for the safety of visitors carrying their own lights.

While our studies indicate that the presently developed passages plus new artificial entries will accommodate anticipated increases in visitation for the foreseeable future, this may not prove to be true. We feel it is too early to set aside as wilderness all the cave passages except those presently developed.

Comment:
All parking lots should be *OUTSIDE* (sic) of the park boundaries so as to protect the park's features. An excellent spot for this would be below the Dripping Spring Escarpment.

Response:
While the site you suggest is outside the park, once it becomes Federal land it is subject to the same constraints that exist on land now within the park. A staging area so located would be farther away from the cave entrances and the sightseeing boat trip. The longer bus ride would consume more fuel and require more of the visitor's time. More buses would be needed in order to maintain a reasonable schedule. There would have to be a transit terminal to house the same functions described for the one at Union City. A water source would have to be found; sewage and parking lot runoff would have to be treated. Since the site you propose would be on the Sinkhole Plain, special precautions would have to be taken to prevent contamination of the underground streams that pass through the park. Moreover, there would be the added

cost to the taxpayer of buying the land. In sum, it appears to us that nothing would be gained environmentally in shifting the staging area to the site you suggest.

Identical letters were signed by Cheri Casper, R. J. Ehr, Ronald F. Gietkowski, and Thomas H. Umheit.

Comment:
The Draft Environmental Impact Statement is hopelessly inadequate, particularly in its discussion of wilderness alternatives. I urge the reevaluation of the environmental impact and the drafting of a more comprehensive and realistic environmental impact statement to be included with the master plan and associated wilderness documents.

Response:
The draft statement has been substantially rewritten and we hope you will find the final statement more acceptable.

BIBLIOGRAPHY

Anonymous, "An Appraisal of Potentials for Outdoor Recreation Development in Barren County, Kentucky," 1972, prepared jointly by Soil Conservation Service; Cooperative Extension Service, University of Kentucky; and Farmers Rural Electric Cooperative, Glasgow, KY, 69 pp., 13 plates, 22 tables, 2 maps

------, "Potential Visitation to a Vacation Complex in the Barren River ADD," prepared by Spindletop Research, Inc., for Kentucky Program Development Office, October 20, 1971, 36 pp., 3 figs., 17 tables

------, "Reconnaissance Report on the Tourism Situation in the Mammoth Cave Park Area, Kentucky," prepared by Ernst and Ernst for Economic Development Administration, U.S. Department of Commerce, April 1971, 60 pp., 4 figs.

------, "The Year 2000: A Long Range Plan," 90 pp., illustrated, prepared (1970) by the Department of Geography and Geology, Western Kentucky University in cooperation with the Barren River Area Development District, Inc., P.O. Box 154, Bowling Green, Kentucky 42101

------, "Comprehensive Water and Sewer Plan," prepared by Hensley-Schmidt, Inc., for the Barren River Area Development District, July 1973, 238 pp., 23 tables, 72 figs., plus an appendix of 39 pp. containing 10 tables and 2 figs.

------, "1974 Data Book," 78 pp. of statistics relating mostly to economics and sociology derived largely from the 1970 U.S. Census; prepared by BRADD staff for the ten counties in the district

------, "An Open Space and Recreation Plan," prepared by BRADD staff, July 1974, 6 tables, 4 maps, 4 drawings, 4 photos

------, "The Mammoth Cave Area – A Planning Proposal," prepared for BRADD under the direction of Dr. E.E. Hegen, Department of Geography and Geology, Western Kentucky University, 1974, 47 pp., 3 maps, 5 tables

------, "Kentucky Travel Guide – Welcome to Kentucky," Vols. I, II, III, published by Editorial Services Company, 445 Baxter Avenue, Louisville, Kentucky 40204

------, "A Wilderness Proposal for Mammoth Cave National Park, Kentucky," 20 pp., 2 maps, (1967) publ. by the National Speleological Society, 609 Meadow Lane, Vienna, Virginia 22180

------, "Speleological Research in the Mammoth Cave Region, Kentucky – Elements of an Integrated Program," Cave Research Foundation, June 1960, 18 pp.

------, "The Flint Ridge Cave System, Mammoth Cave National Park, Kentucky – A Cave Research Foundation Cartographic Project in cooperation with the National Park Service," First Edition 1964, 3 pp., 3 figs., 31 plates

Barr, Thomas C., Jr., "The Blind Beetles of Mammoth Cave, Kentucky," in *The American Midland Naturalist,* Vol. 68, 1962, No. 2, pp. 278-284

------, "Refugees of the Ice Age," in *Natural History* 82 (5), 1973, pp. 26-35, 72-73; 9 photos, 3 figs., 1 map

------, "Ecological Studies in the Mammoth Cave System of Kentucky I: The Biota," in *International Journal of Speleology,* Vol. III, 1967, pp. 147-204, Plates 37-64

------, "Cave Ecology and the Evolution of Troglobites," in *Evolutionary Biology,* Vol. II, 1968, pp. 35-102, 24 figs.

------, "Cave Carabidae (Coleoptera) of Mammoth Cave," in *Psyche,* Vol. 73, pp. 284-287, and Vol. 74, pp. 24-26, 1966-67

Braun, E. Lucy, "Deciduous Forests of Eastern North America," pp. 146-150, 155, 195, Hafner Publishing Company, facs. 1967, New York

Bridwell, Margaret M., "The Story of Mammoth Cave National Park, Kentucky: A Brief History," 5th Ed. 1966, 64 pp., 17 figs., privately printed

Brucker, Roger W., "Truncated Cave Passages and Terminal Breakdown in the Central Kentucky Karst," in *National Speleological Society Bulletin,* 1966, Vol. 28, No. 4, pp. 171-178, 7 figs.

Copeland, Lewis C., "Travel Survey in Kentucky 1966," prepared for Department of Public Information, Commonwealth of Kentucky, 36 pp., 26 tables

------, "1966 Travel Survey of Kentucky's 12 Red-Carpet Vacation Regions: Region 4, Cave Country," prepared for Department of Public Information, Commonwealth of Kentucky, 11 pp., 7 tables

------, "1972 Survey of Travel in Kentucky," prepared for Department of Public Information, Commonwealth of Kentucky, 33 pp., 20 tables

Davidson, Joseph K. and William P. Bishop, "Wilderness Resources in Mammoth Cave National Park: A Regional Approach," 1971, 34 pp., 7 figs., publ. by Cave Research Foundation

Delecour, F., F. Weissen, and C. Ek, "An Electrolytic Field Device for the Titration of CO_2 in Air," in *National Speleological Society Bulletin,* Vol. 30, No. 4, October 1968, pp. 131-136, 8 figs.

Hart, William J. and Walter S. Boardman, "A Wilderness Plan for Mammoth Cave National Park and the Surrounding Region," prepared September 1967 for the National Parks Association, 13 pp., 3 figs.

Livesay, Ann, "Geology of the Mammoth Cave National Park Area," Special publication 7, Kentucky Geological Survey, 1962, 40 pp., 17 figs., 9 plates

McLean, J.S., "The Microclimate in Carlsbad Caverns, New Mexico," open-file report prepared by the U.S. Geological Survey for the National Park Service under NPS Research Project CACA-N-1a, May 1971, 67 pp., 19 figs.

Miotke, Franz-Dieter and Arthur N. Palmer, "Genetic Relationship Between Caves and Landforms in the Mammoth Cave National Park Area: A Preliminary Report," 69 pp., 58 figs., 1 map, printed in West Germany, 1972

Mohr, Charles E. and Thomas L. Poulson, "The Life of the Cave," McGraw-Hill, Inc., 1966, 232 pp., profusely illustrated

Poulson, Thomas L. and William B. White, "The Cave Environment," in *Science,* September 5, 1969, Vol. 165, pp. 971-981, 3 figs., publ. by American Association for the Advancement of Science

Quinlan, J.F., "Central Kentucky Karst," Reunion Internationale Languedoc-Provence, 1968, Actes: in *Mediteranee,* Etudes et Travaux; No. 7, pp. 232-253; 1970, 5 figs.

Schmidt, Victor A., "Problems of Cave Conservation in the U.S.A.," in *Studies in Speleology,* Vol. 1, parts 2-3, December 1965, pp. 82-88, 3 plates

Schwartz, Douglas W., "Prehistoric Man in Mammoth Cave," publ. by Eastern National Park and Monument Association, 1965, 24 pp. profusely illustrated

Sloan, Tacoma G. and Douglas W. Schwartz, "Archeological Survey of Mammoth Cave National Park, Kentucky," 1960, ms. in park files

Smith, P. M., "The Flint Ridge Cave System: A Wilderness Opportunity," A Cave Research Foundation Study, May 1961, 15 pp.

------, "Regional Economic Development and Wilderness at Mammoth Cave," in *News and Notes,* Vol. III (1970), Nos. 1 and 2, publ. by Cumberland Chapter, Sierra Club

Watson, Patty Jo, "Prehistoric Miners of Salts Cave, Kentucky," in *Archeology,* Vol. 19, No. 4, 1966, pp. 237-243, 2 figs., 10 plates

Watson, Patty Jo and Richard A. Yarnell, "Archeological and Paleoethnobotanical Investigations in Salts Cave, Mammoth Cave National Park, Kentucky," in *American Antiquity,* Vol. 31, No. 6, October 1966, pp. 842-849

Watson, R. A., "Central Kentucky Karst Hydrology," in *National Speleological Society Bulletin,* Vol. 28, No. 3, 1966, pp. 159-166

Watson, Richard A., "The Preservation of Wilderness Karst in Central Kentucky, U.S.A.," 1967, 13 pp., 1 map, publ. by Cave Research Foundation

------, "Mammoth Cave: A Model Plan," in *National Parks & Conservation Magazine – the Environmental Journal,* Vol. 46, No. 12, December 1972, pp. 13-18, 6 plates, 1 map

Weller, James Marvin, "The Geology of Edmonson County," publ. by The Kentucky Geological Survey, 1927, 56 photographs, maps, and diagrams

White, William B., Richard A. Watson, E. R. Pohl, and Roger Brucker, "The Central Kentucky Karst," in *The Geographical Review,* Vol. LX, No. 1, January 1970, pp. 88-115, 12 figs., publ. by American Geographical Society

Wilson, Gordon, "Folkways of the Mammoth Cave Region," 1962, 64 pp., 17 figs., privately printed

------, "Birds and Their Habitats in Mammoth Cave National Park," publ. by Eastern National Park and Monument Association, 1968, 39 pp., 6 figs., 3 tables

The following publications are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402:

Anonymous, "Compilation of the Administrative Policies for the National Parks and Monuments of Scientific Significance (Natural Area Category)," Revised 1970, 147 pp., price 75 cents

------, "Park Road Standards," May 1968, 18 pp., 14 plates, price 15 cents

------, "Outdoor Recreation for America," January 1962, Outdoor Recreation Resources Review Commission (ORRRC) Report to the President and to the Congress, 246 pp., 67 plates, 30 graphs and charts, 41 tables, 5 maps, price $2.00

------, "Wilderness and Recreation – A Report on Resources, Values and Problems," Appendix B, Cave Resources, pp. 322-324, ORRRC Study Report 3, 1962, $1.75

Brown, Richmond F., "Hydrology of the Cavernous Limestones of the Mammoth Cave Area, Kentucky," Geological Survey Water-Supply Paper 1837, 1966, 64 pp., 24 figs., 4 tables, price 35 cents

Cushman, R. V., R. A. Krieger, and John A. McCabe, "Present and Future Water Supply for Mammoth Cave National Park, Kentucky," Geological Survey Water-Supply Paper 1475-Q, 1965, pp. 601-647, Figs. 71-81, 9 tables, price 25 cents

APPENDIX

United States Department of the Interior
BUREAU OF OUTDOOR RECREATION
SOUTHEAST REGIONAL OFFICE
148 Cain Street
Atlanta, Georgia 30303

IN REPLY REFER TO:
E3035

JUN 17 1974

Memorandum

To: Regional Director, Southeast Region, National Park Se
Atlanta, Georgia

From: Regional Director, Southeast Region, Bureau of Outdoo
Recreation, Atlanta, Georgia

Subject: Review of the Draft Environmental Statement for the Master Plan including Wilderness Area Proposal for Mammoth Cave National Park

We have reviewed the subject draft statement as requested in the letter from Acting Regional Director Bainbridge dated May 6, 1974.

Generally, we have found the draft statement to be informative with a clear and factual examination of environmental impacts and alternatives. The maps and diagrams are of good quality and a useful addition to the text. However, the photographs were too dark to be of much value.

We note the greatly increasing demand which has been put on Mammoth Cave Park. In view of this, we believe the National Park Service should be commended for devising plans that would significantly increase the number of cave trips and the quality of visits while protecting the unique character of the resource.

We are encouraged by the plans for facilities to expand sightseeing, fishing, picnicking, and primitive camping in the River Valley Section and primitive camping and hiking in the Hilly Country Section. In view of these recreation proposals, the fact that the land within the park has received considerable modification by man, and the fact that the area will be managed primarily as wildland, we agree that the wilderness designation may not be appropriate for portions of the park at this time.

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

Thank you for the opportunity to review and comment on the draft environmental statement.

Hugh L. Watson

FOR Robert M. Baker

United States Department of the Interior
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
17 EXECUTIVE PARK DRIVE, N. E.
ATLANTA, GEORGIA 30329

L7617-SER-PE June 11, 1974

Memorandum

To: Regional Director, NPS, Atlanta, Georgia

From: ACTING Regional Director, Atlanta, Georgia

Subject: Review of Draft Environmental Statement for the Master Plan, Mammoth Cave National Park, Kentucky

We have reviewed the master plan and draft environmental statement for Mammoth Cave National Park and offer the following comments for inclusion in the final statement.

General Comments

The discussion of effects of various actions on surface and subterranean fish and wildlife resources is inadequate.

Detailed Comments

Description of Environment

A more detailed description of habitat types and fish and wildlife populations should be included.

Environmental Impact

Impacts of proposed actions and alternates on fish and wildlife should be more fully discussed.

Alternatives

The effects of allowing vegetational succession to proceed to the climax forest stage should be discussed in full for all wildlife species found on the area. This discussion should be included in the section on short-term uses vs. long-term productivity.

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

In the discussion on white-tailed deer, it should be pointed out that deer populations will decline from habitat loss from current management practices or from future practices associated with wilderness designation.

The no-project alternate, which would be a continuation of current practices, should be discussed in more detail, particularly for impact on fish and wildlife.

Summary Comments

We would like to suggest that consideration be given to modifying vegetative management practices in various unspecified areas to maintain vegetation in various stages of plant succession, thereby increasing available ecological niches and consequently increasing visitor enjoyment through more opportunity to observe larger numbers and kinds of wildlife. Onsite technical assistance would be available from the U.S. Fish and Wildlife Service to advise park managers in implementing such management techniques. Such areas could be as limited in size or location as major management objectives required but could easily enhance visitation enjoyment.

We appreciate the opportunity for this review.

Robert T. Webb

OFFICE OF THE DIRECTOR

United States Department of the Interior

BUREAU OF MINES
WASHINGTON, D.C. 20240

June 10, 1974

DES 74-43

Memorandum

To: Acting Regional Director, Southeast Region, National Park Service, Atlanta, Georgia

Through: Assistant Secretary--Energy and Minerals

From: Director, Bureau of Mines

Subject: Draft environmental statement, National Park Service, proposed master plan and wilderness study for Mammoth Cave National Park, Kentucky

Our Eastern Field Operation Center, Pittsburgh, has reviewed the draft environmental statement for the proposed master plan and wilderness study for Mammoth Cave National Park prepared by the Denver Service Center of the National Park Service. The 51,384 acres of the park is located predominantly in Edmonson County with small portions in Barren and Hart Counties, Kentucky. This plan proposes a procedure to relieve automobile and visitor congestion, diversify park use, and to provide an improved visitor experience over a 10-to 20-year period. A wilderness study of four roadless areas within the park concluded that none of these areas were suitable for wilderness classification.

None of the mineral resources of coal, stone, petroleum, rock asphalt, and sand and gravel that are mined in the three-county area, are known to be present within the park area except stone. Saltpeter was mined during the Civil War from Mammoth Cave System.

On page 62, 5th paragraph, the following statement is made: "Moreover, atmospheric contamination from combustion (emissions from vehicles and heating plants) may enter the caves in winter when dry outside air is inhaled. Caves exhale in summer." In order to let the reader know that this particular respiration cycle is not unique and that contamination can occur in all seasons, it should be explained that caves inhale and exhale continuously in all seasons. Both convection and through-flow air patterns are induced by differential barometric and temperature changes especially when the intake and exhaust points are at different elevations. In the summer warm air entering from topographicially lower or hotter areas moves upward to be expelled at a topographically higher point. In the winter the opposite occurs. Caves cannot exhale without simultaneously inhaling.

Memo. to Acting Regional Director, Southeast Region, National Park Service, Atlanta, Georgia, Subj: Mammoth Cave National Park, Kentucky

The geology of Mammoth Cave National Park is discussed in the statement, and while minerals are not specifically discussed, the environmental statement is adequate with regard to mineral resources since mining is prohibited within the park.

Director

OFFICE OF THE DIRECTOR

United States Department of the Interior

BUREAU OF MINES
WASHINGTON, D.C. 20240

In Reply Refer To:
EBM-MRED-MS
D-2712

June 12, 1974

Mr. David D. Thompson, Jr.
Regional Director, Southeast Region
National Park Service
Southeast Regional Office
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Thompson:

Thank you for the information on the proposed master plan and preliminary wilderness study for Mammoth Cave National Park. We have reviewed the plan and study.

Since mineral activity is not permitted under the current park status there will be no change relative to mineral development. We concur with your appraisal that the areas studied for wilderness designation do not meet the criteria for the National Wilderness Preservation System.

Thank you for the opportunity to review the master plan and wilderness study.

Sincerely yours,

Thomas V. Falkie

Director

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR
DES 74-43

JUN 13 1974

Memorandum

To: Regional Director, National Park Service, Southeast Region, Atlanta, Georgia

Through: Deputy Assistant Secretary--Energy and Minerals

From: Director, Geological Survey

Subject: Review of draft environmental statement for the master plan, including consideration of wilderness area establishment, Mammoth Cave National Park

We have reviewed the subject draft environmental statement as you requested.

We believe the draft statement is well done in regard to the park itself, but that it could be strengthened by including more definite steps to be taken to mitigate adverse impacts, especially related to waste disposal, that would result from the probable increasing development of neighboring areas.

Discussions of plans for improved sewage disposal (p. 9 and 80) fail to specify whether wastes only from Park Service facilities or also from peripheral commercial developments will be treated. If not adequately treated, the latter could cause serious deterioration of the subterranean environment.

Phasing out the use of "Spring Water" (p. 23) should be done gradually to avoid problems resulting from any unrecognized changes that have occurred in ground-water hydrology, such as blocked passages.

It would be more appropriate in the list of cities in Kentucky and nearby States (p. 53) to give populations of metropolitan areas rather than just the incorporated cities.

The traditional term for the kind of terrain in the photograph opposite page 90 is "cedar glade" rather than "cedar karren."

Consideration might be given to burial of electrical cables (p. 96)

Henry W. Coulter

Acting Director

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
333 Waller Avenue, Lexington, KY 40504

June 10, 1974

Mr. James L. Bainbridge
Acting Regional Director
Southeast Region
National Park Service
U. S. Department of the Interior
3401 Whipple Avenue
Atlanta, GA 30344

Dear Mr. Bainbridge:

The draft environmental impact statement for the proposed Mammoth Cave National Park Master Plan and Wilderness Study that was addressed to the U. S. Department of Agriculture on May 1, 1974, was referred to the Soil Conservation Service for review and comment.

The statement should describe the effect upon the deer and other wildlife with the establishment and use of the trail system in the hilly country. Large numbers of people visiting the area may disrupt the daily and seasonal movements of deer. Human activity during late May and June, when the deer are having fawns, could be particularly adverse. Human use will, at least to some extent, preempt the use of the area by deer and other wildlife creating more pressure on the surrounding habitat. This human intrusion could cause much more damage than the physical loss of habitat described in the draft environmental impact statement.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely,

Glen E. Murray
State Conservationist

cc:
Kenneth E. Grant, Administrator, SCS, Washington, D. C.
Coordinator, Environmental Quality Activities, Office of the Secretary, USDA, Washington, D. C.
Council on Environmental Quality, Washington, D. C. (5 copies)

DEPARTMENT OF THE ARMY
LOUISVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 59
LOUISVILLE, KENTUCKY 40201

ORLPD-R

18 June 1974

Mr. James L. Bainbridge
Acting Regional Director
National Park Service
Southeast Regional Office
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Bainbridge:

This is in response to your letter of 30 April 1974 requesting comments on the draft environmental statement for the Mammoth Cave National Park Master Plan, including consideration of wilderness area establishment.

1. If the proposed Master Plan is adopted, there would be a critical need for phasing the various redevelopmental elements in order that the local economy be able to absorb the changes without suffering economic imbalances.

2. The Master Plan's objective to protect the Park resources from overuse could be enhanced by encouraging park users to utilize Nolin Lake as a resource for overnight use and active day uses such as boating, fishing, and swimming. This concept, however, would have to promote not only Mammoth Cave National Park but all of the recreation resources of the region.

3. Extending the length of the activity day should be given consideration as an alternative to total Park redevelopment as proposed by the Master Plan. Extending the length of the activity day would stimulate the local economy by creating more demand for overnight facilities and related services while lessening the demand for increased parking and accommodating an increasing number of visitors.

4. Page xii of the environmental impact statement states that sightseeing accounts for over one half of the Park's annual visitation. If the Park is redeveloped as proposed in the Master Plan the Park visitation gained through sightseers use of internal roads would no longer exist. Was this absence of over one half of the annual visitation considered when future visitation was projected for the redeveloped Park?

ORLPD-R 18 June 1974
Mr. James L. Bainbridge

5. The proposed Master Plan limits all access to the Park to a mass transit system. This single method of visitor access would seem to have a dehumanizing effect on the visitors. Perhaps this "herding" method of management would be more appropriately used in the Park areas which are heavily used or in areas which are most environmentally sensitive and controlled use is absolutely necessary.

6. The last paragraph on page 35 of the environmental impact statement states that some abandoned roads will be available for use by horseback riders. This proposal does not seem consistent with the Master Plan concept of management. Also, the Master Plan makes no provisions for stable facilities or delineation of roads which will be used.

7. The Master Plan fails to clearly explain the relationship that possible wilderness designation has to the proposed redevelopment.

We regret the delay in transmitting our comments and offer our appreciation for the opportunity to review and comment on the draft environmental statement for the Mammoth Cave National Park Master Plan including consideration of wilderness area establishment.

Sincerely yours,

JOHN E. MOORE
LTC, Corps of Engineers
Deputy District Engineer

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
1421 PEACHTREE ST., N. E.
ATLANTA, GEORGIA 30309

May 31, 1974

Mr. James L. Bainbridge
Acting Regional Director
National Park Service, Southeast Region
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Bainbridge:

We have reviewed the Draft Environmental Impact Statement for the management of Mammoth Cave National Park in Kentucky and find that, while we have no objection to the action described, we believe firther consideration should be given to several areas of concern, especially the treatment systems for handling wastewater.

It is stated (page 81, line 11) that "All these systems are approved by Federal and Commonwealth water pollution control officials, though there have been some operational problems which have been corrected." We realize that the lagoon system at the Great Onyx Civilian Conservation Center and the trickling filter system near Green River serving the Historic Entrance Area were originally designed to meet State and Federal standards. We must point out, however, that Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) established a permit system, and subsequently effluent standards, which probably cannot be met on a continuous basis by the present lagoon system and the trickling system.

The maximum standards which discharges to the Green River must meet are those complying with secondary treatment requirements published in the Federal Register of August 17, 1973 (Volume 38, Number 159, Part II, Water Programs). These criteria require a minimum of 85 percent BOD_5 and suspended solids removal with effluent standards not to exceed the following:

Pollutant	Unit of Measurement	Monthly Average	Weekly Average
BOD_5	mg/l	30	45
SS	mg/l	30	45
Fecal Coliform Bacteria	MPM/100 ml	200	400

Pollutant	Unit of Measurement	Monthly Average	Weekly Average
pH	units	within limits of 6.0 to 9.0	

Records for trickling filter systems show that they have difficulty in meeting BOD_5 and suspended solids removals on a consistent basis. Records also show that the lagoon system will have difficulty in meeting the suspended solids removal requirements at the time of maximum algae growth and during spring turnover, and BOD_5 removals during colder weather when bacterial action is at a minimum.

In reference tp the first sentence on top of page 100, we recommend that if the trickling filter system is to be used as a central plant, it should be modernized. The Imhoff tank which is used for primary settling and sludge digestion does not have efficient skimming devices and its digestion is anaerobic and not compatible with the aerobic conditions which must be maintained in the trickling filter and in the final settling tank. We recommend that the Imhoff tank be discarded or used as an aerobic digester and replaced with a modern primary settling tank with good skimming devices. Even with this revision, however, a multimedia filter will probably have to be furnished to meet the required BOD_5 reductions in winter months when bacterial action is at a minimum.

The possibility of converting the plant into an activated sludge plant or an extended aeration plant should also be investigated.

We further suggest that upgrading the main wastewater treatment plant at the Historic Entrance should improve water quality in the River.

Finally, due to the magnitude of the proposed project, data should be supplied to the Kentucky Air Pollution Control Commisstion to conduct an "indirect source review" as stipulated by 40 CFR 52 (Federal Register 2-25-74).

We would like to have five copies of the final environmental impact statement when it is available. If we can be of further assistance in any way, please let us know.

Sincerely,

for Frank T. Rudmel

David R. Hopkins
Chief, EIS Branch

COMMONWEALTH OF KENTUCKY
Kentucky Heritage Commission
CORNER IN CELEBRITIES
FRANKFORT, KENTUCKY 40601
MRS. SIMEON WILLIS
STATE LIAISON OFFICER

Mr. David D. Thompson, Jr., Regional Director
Southeast Regional Office - National Park Service
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Thompson:

Thank you for sending copies of the preliminary Draft Master Plan and preliminary Draft Environmental Impact Statement for Mammoth Cave National Park, Kentucky. We have reviewed both documents and we are glad to see that consideration has been given to historic sites located within the boundaries of the Park, which might qualify for nomination to the National Register of Historic Places. We trust that the Park Service will proceed to nominate those sites determined to be eligible.

With regard to your statement about the joint Memorandum of Agreement, it is our understanding based on information directly from the Advisory Council, that the Advisory Council itself is responsible for initiating the joint Memorandum. With this in mind, we would not want to take action in contradiction to the procedures of the Advisory Council. However, should we receive copy of a joint Memorandum of Agreement initiated by the Advisory Council, we will be glad to review it.

With kind regards, I remain

Sincerely,
Ida Lee Willis
Mrs. Simeon Willis
State Historic Preservation Officer

December 18, 1973

Advisory Council
On Historic Preservation
1522 K Street N.W. Suite 430
Washington D.C. 20005

May 7, 1974

Mr. David D. Thompson, Jr.
Regional Director
National Park Service
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Thompson:

The Advisory Council on Historic Preservation has reviewed the preliminary Draft Master Plan and preliminary Draft Environmental Impact Statement for Mammoth Cave National Park, Kentucky. Additionally, we have received and reviewed the comments of the Kentucky Historic Preservation Officer following her review of the same material.

The Council has found the attention given to historic and cultural resources in this preliminary draft to be procedurally adequate for this early stage of the Environmental Impact Statement preparation. Subsequent versions of the Impact Statement and the Master Plan should reflect the contact that has been made with the Kentucky Historic Preservation Officer and incorporate her recommendation pertaining to the early nomination of historic places within the park that might qualify for listing in the National Register of Historic Places.

The Council is pleased to note that a full survey of historic, cultural, and archeological sites and objects is being made and that any proposed action affecting a resource that has qualified or that appears to qualify for listing in the National Register will be submitted for review and comment to the Advisory Council in accordance with Council procedures.

The Council appreciates your cooperation and looks forward to reviewing proposed actions that might affect historic resources within Mammoth Cave National Park.

Sincerely yours,

Ann Webster Smith
Director, Office of Compliance

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

NATIONAL SPELEOLOGICAL SOCIETY, INC.

affiliated with the American Association for the Advancement of Science

Dedicated to the exploration, study, and conservation of caves

Draft Environmental Impact Statement

Proposed Master Plan and Wilderness Study

Mammoth Cave National Park, Kentucky

Comments by the National Speleological Society

The National Speleological Society is the world's largest organization dedicated to the exploration, study, and conservation of caves and related features. Our interest in Mammoth Cave National Park extends over many years, since the park contains some of the world's most significant karst features, including the world's longest cave. We have followed with interest all developments which might affect the speleological values of the area, and have from time to time ourselves suggested management plans for the park. Therefore we welcome this opportunity to comment on the Draft Environmental Impact Statement for the Proposed Master Plan and Wilderness Study for Mammoth Cave National Park, and request that this statement be included in the final Environmental Impact Statement.

Before beginning a detailed discussion of this environmental impact statement (EIS) and its features, it might be well to mention some of the characteristics of an effective environmental impact statement. Such an EIS should cover adequately all of the environmental impacts of the proposed action in a manner understandable to both the lay person and the technical expert. This may require both the presentation of clearly written prose text and the voluminous technical data upon which the analysis and conclusions were based. If data is unavailable, or beyond the state of knowledge, the EIS should clearly identify such information and set forth any unanswered environmental questions. A good impact statement is one that makes provision for feedback from those affected by the action continually during the course of the action; it also makes provision for continuing research and revision of the proposals for action based upon that research.

Viewed in this light, the Mammoth Cave National Park Master Plan and Wilderness Study EIS is a mixed presentation. Certainly most of the impacts are discussed in a manner understandable to all--but the data upon which such discussion are based are often not presented. Nowhere does the EIS identify those areas where further study is necessary, in spite of the fact that very little is known about the environmental factors affecting caves. Feedback from the public and those affected most by the plan, the concessionaires, is only included through the normal commenting process. While research proposals are included in the Master Plan, there is no provision for incorporating that research into the environmental evaluation process.

The solution to the above problems is probably not to massively rewrite the Master Plan and its EIS, although as will be shown below there is a need for considerable revision to strenghten the EIS. The presentation of additional data in an appendix might be a first step towards resolving the problem. The EIS should identify the areas of critical environmental concern and those questions needing more research. In order to incorporate future data into the Impact Study process, separate EIS's should be prepared on those portions of the plan involving construction or other major projects with a significant effect upon the environment, and then

Cave Avenue *Huntsville, Alabama 35810* *AC 205 852-1300*

subjected to the review process. The research on environmental factors in the caves should be given first priority, and research results should be incorporated into later impact statements.

In general, the Park Service and its planners are to be congratulated on preparing a reasonably strong EIS which identifies most of the environmental impacts of the Master Plan, although the Wilderness Study section of the EIS has serious deficiencies. The discussion and analysis that follow are not intended to denigrate the Master Plan, but merely to provide a basis for improvement of the EIS. It is a difficult process to prepare a complete and comprehensive EIS; in fact, a perfect one has probably never been prepared and never will be. Part of the process of preparation is a comprehensive review by the public and interested parties. It is hoped that the discussion to follow makes a positive and beneficial contribution to the overall improvement of the environmental impact statement.

The following analysis of the EIS is based upon many hours of study by the NSS Committee on Conservation and the NSS Mammoth Cave National Park Conservation Task Force. It has been organized differently than the original EIS in order to provide a more orderly and coherent forum for discussion of the environmental impact. The organization method used in the EIS is confusing and leads to much unnecessary repetition of points.

DESCRIPTION OF THE ENVIRONMENT

The description of the environment is in general complete and well presented. There are some errors, however. On p. 62 the statement that "caves exhale in summer" is an oversimplification of the actual situation which may lead to misunderstandings. On p. 65, it should be noted that the Mammoth Cave Shrimp, Palemonias ganteri, has been recommended for inclusion on the official list of endangered species. In the discussion of roads on pp. 70ff, it might be helpful to point out some of the environmental problems encountered with roads in karst areas, and specifically to mention the sinkhole which formed in May 1974 near Sloans Crossing in the park. The discussion of utilities on pp. 78ff is excellent, but should point out the dangers to human life and cave visitors from a gasoline leak occurring above a developed section of the cave. The statement at the bottom of p. 81 regarding the toxicity of sewage effluent is questionable, since chlorine treated water could be toxic to some forms of life.

The discussion of park travel data on pp. 74ff should be updated to the present. It should provide a better breakdown of the vehicle and travel information, to better define how many vehicles merely pass through on Highway 70 and never visit the cave and development area proper. A fuller discussion of the effects of peak and average loading factors on the parking lots and facilities would also be helpful. In addition, it is not clear how many people took particular cave trips because they were offered and available, and how many took the trip of their own choice. The establishment of a peripheral staging area might have a significant effect upon such choices.

On p. 83, perhaps it should be noted that the presence of the Job Corps in the park produces certain undesirable effects including an increase in cave vandalism potential and increased possibility of pollution due to the presence of the sewage facilities. On p. 90, it should be stated that there are caves forth of the Green River, but that it is not expected that cave systems rivalling those south of the river will be found. On p. 93 it should be noted that the

low recreational use of the Hilly Country is probably due to inadequate public knowledge of the resources.

The discussion of visitor increases found on pp. 93-4 as well as several other places in the EIS seems to be based upon the blind assumption that visitation will continue to grow in a linear fashion. Demographers have recently had to revise population growth estimates because of changes in the underlying factors affecting growth, and it is probable that such changes will eventually be reflected in travel estimates. In addition, other constraints may operate to vary the extrapolations made. These factors, including the energy crisis and changing work/school patterns, should be examined in the EIS to the greatest extent possible, especially since they have begun to show up in the visitation figures for the last few years.

The discussion that follows will be devoted to a detailed consideration of each of the major actions included in the Master Plan, Wilderness Study, and EIS.

1. EXPAND CAVE TRIPS

Description--The data presented should be updated to 1974. Presentation of a time distribution graph and peak and average data would be helpful. The discussion fails to mention the Wild Cave Tours, and the increasing popularity of the wilderness-type caving experience. It is difficult to see how a capacity of 100 per day in Great Onyx can be expected to replace the 120 per day now taking the Violet City tour. In fact, the increasing popularity of wilderness-type caving and the probability that many people would be attracted to that tour in order to see a new cave would suggest that more tour capacity might be necessary.

Since the plans for action are not specific at this point, when detailed engineering studies have been performed a separate EIS should be prepared for each entry or trail expansion project.

Environmental Impact--Past damage levels should not be used as a base level for determining impact. It should be the goal of management to minimize completely the future impact, and if possible to return the environment to a natural condition. In fact, the statement that no damage to the cave is known to have occurred with the prior tunnel entries is highly questionable, since there was no environmental monitoring at the time. A preliminary study of the historical evidience suggests that there have been major environmental changes in the cave since it was opened, and that some of them may have been caused by the opening of new entrances. In a related case at Carlsbad Caverns the elevator shaft and the lighting system were found to be major contributors to the drying out of the cave. In the absence of a detailed study at Mammoth such as that performed at Carlsbad, no adequate and valid statement can be made regarding the water balance of the cave. All statements in the EIS regarding this would seem highly questionable.

The effectiveness of protection against vandalism on the semi-self-guiding tours is also questionable. Since any vandalism represents an irretrievable commitment of the cave resources, careful consideration must be given to this point, and it should be discussed in detail in the EIS.

The statement on p. 96 that there will be no change in cave values with the lighting of the Violet City tour is questionable. Changing from a semi-wilderness-type experience to a developed-type experience will certainly change the value of

the trip for many. In addition, the installation of elevators at Star Chamber could affect the type of highly esthetic experience which many visitors had there during the last century, and that still could be had in an unlighted chamber if the elevators were not present.

The environmental impact of lantern tours upon Great Onyx cave should be discussed in more detail.

Mitigating Measures--The measurement of environmental parameters is to be applauded, and should be given the highest priority. However, air quality measurements should include particulate concentration, especially to monitor the effects of smoking upon the cave. Airlocks on elevators are probably needed at one end only. A complete study should be made to determine the best way to restore the natural environment of the cave to the greatestextent possible through airlocks and other features. Hiding new lighting should be done in a natural fashion, and it is an excellent idea to bring in consultants to help with this work.

On p. 132 opening of Colossal and Crystal Caves to lantern tours is mentioned for the first time. If this is to be done, it should be included as part of the proposal and the environmental impact should be discussed. Otherwise, why mention it here? This discussion also over-simplifies the problems that may be encountered in opening up old trails in the cave, since upgrading them to modern safety standards may require much work in some cases, because there has been deterioration of many trails.

Adverse Effects--This discussion fails to consider with adequate perspective the vandalism which will result from expansion of tours and self-guiding tours. Also, it is possible, with care, to "naturally" hide cave lighting, and although this still has an unavoidable adverse effect, that effect can be minimized.

Short-term Uses v. Long-term Productivity--This discussion fails totally to take the proper perspective in considering this question. In dealing with cave systems, which are essentially a renewable resource only in geologic time spans, if at all, any public use, even though it may last for many years, must be considered short term compared to the long-term productivity of the geological and speleological features. Such use, even continuing use of facilities and improvements, should be evaluated in relation to new uses and the effect of both existing and new uses upon the enhancement of the long-term productivity should be considered. Long-term productivity, in this case, must be considered over the geological time span as well as the shorter human time span.

The projected public use will lead to a gradual deterioration of the resource--as is produced in fact by any use of cave resources. The Park Service, and the Plan, must balance this deterioration against the expected long-term usage, attempt to minimize it, and come up with a reasonable proposal for public use based upon such minimization of damage. This section of the EIS should discuss these problems in detail.

Although the overall prior deterioration must be taken into account, it should not be used as a justification for allowing deterioration of the resource to continue.

Irreversible/Irretrievable Commitment of Resources--This discussion fails to mention the irreversible effects of vandalism caused by increased visitor use and

the re-use of old trails. Any use of a cave is an irreversible and irretrievable commitment of the cave resources, and this should be noted and discussed.

Alternatives--The discussion of alternatives is inadequate. Various combinations of expansion should be specifically delineated and discussed, including the different trips within Mammoth Cave, and as suggested by local residents the trips to other caves in the park. It has not been made clear that alternative b. represents a half-way step at implementation of the Plan. Since it appears from the discussion that the alternative will be implemented, its inclusion here seems irrelevant. However, if that step is considered as the only action to be taken, then it is a valid alternative.

General--The coverage of expanding the cave trips in the EIS is probably, with the exceptions noted above, as complete as can be expected considering the vagueness of the Master Plan regarding the exact ways in which such expansion will be carried out. However, it would appear that inadequate consideration has been given to the impact of the visitors upon the cave and to the carrying capacity of the cave resources. Little study has been done in this area, and most development has been predicated upon a "seat of the pants" approach to planning. It is clear that with increasing visitation the magnitude of the impact will increase, and may approach the point where deterioration is critical. Planning should begin now for environmental monitoring and the establishment of control areas within the cave system to help determine when environmental loading approaches the danger point, so that action can be taken while there is still time.

Although fiscal restraints imposed by Congress may affect the ability of the NPS to carry out expansion of cave tours when needed, planning should begin now to improve the quality of the visitor experience, as outlined in the Master Plan. As each project is implemented, individual EIS's should be prepared defining the precise effects of construction projects, visitation patterns, and use upon the cave environment. The Master Plan and its EIS are the framework upon which those detailed EIS's can be hung.

2. RELOCATE STAGING AREA

Description--The data presented here (as throughout the text) in footnotes should be integrated into the text and updated to the present. A fuller description of the pristine cave passages underlying Union City should be given.

Environmental Impact--This discussion should be expanded to consider the immediate effects of construction, and then the long-term effects of the presence of the staging area and its associated water and sewage lines. Special consideration should be given to the problems of pipelines across Doyel Valley. The Secondary effects of the location chosen upon the surrounding regional environmental and socio-economic picture should be discussed in more detail--especially the impact upon the surrounding economy of a peripheral site.

Mitigation--Cave loading limits should not be used as a justification for cutting off the parking lot size at 1,600. If the cave can stand only the load of 1,600 cars, then it cannot stand the additional ones whether or not the is paved. The use of stabilized turf for overload parking would not seem to solve any problems, but merely to relocate them from the Historic Entrance area to the new staging area site. However, if this is planned for, then the adverse effects can be taken into account and minimized.

Since the lands of the park are to be treated primarily as natural lands, according to the Land Classification System, then water of agricultural runoff quality would seem to be inadequate. Especially in view of the delicacy of the cave environment and the mandate to preserve the "natural" qualities of the park, better water quality must be achieved.

If limestone is to be obtained from outside the park, care must be taken to assure that caves are not destroyed by the quarrying process.

Alleviateion of the dangerous sewage problems on Mammoth Cave Ridge at Snowball Dining Room and Mt. McKinley could be done by tying those facilities directly back into the existing sewage treatment plant immediately, without waiting for the construction of the staging area. Because of the natural features of the park which would be subjected to potential pollution danger, the extension of the pipeline across Doyel Valley is not justified, even with the presence of a check valve to limit flow in case of breakage.

Union City itself represents a potential historical site which should be carefully excavated before construction proceeds.

Adverse Effects--Plugging of sinkholes due to siltation is probably a by-product of improper agricultural methods of years past, and would be greatly reduced in a natural situation. The implications of changing the hydrological cycle for the cave fauna should be given more consideration. The statement that it should be beneficial is questionable if the fauna are adjusted to a five month drought cycle. Unseasonal flooding in 1967 greatly reduced the number of Mammoth Cave Shrimp in Roaring River passage, which may be in the runoff zone of the staging area. The danger of a sewage or water line spill needs to be more carefully evaluated, including its effects upon both the local and overall cave ecology.

Short-term Uses v. Long-term Effects--This discussion should be expanded. The statement that park values are less important in this area is questionable. Since the staging area will be located over a pristine wilderness, short-term uses have greater relative degrading power than they might have at a site overlying a non-wilderness cave.

Irreversible and Irretrievable Commitments of Resources--This discussion overlooks the potential loss of wilderness cave resources, and the possible loss of an endangered species, the Mammoth Cave Shrimp.

Alternatives--The discussion of alternatives is acceptable, although the choice of those selected for consideration seems arbitrary. An alternative site outside the park near Chaumont should have been considered. The discussion of the Frozen Niagara site seems to suggest that it is superior to the Union City site; if that is the case, perhaps it should have been chosen instead of Union City. Since the caves at that site are already of a non-wilderness character, it might be a better location, since it would not degrade the wilderness values of the Joppa Ridge caves or contribute as much to the pollution of the cave system.

General--Because of the many questions not answered by the EIS regarding the proposed Union City site for the staging area, and because other sites seem to offer more advantage towards protecting the cave systems and the fauna of the park, we believe that the choice of a site for the staging area should be carefully re-evaluated.

Factors that should be taken into account in this evaluation include the possible affects upon the Mammoth Cave Shrimp and the pristine Joppa Ridge Wilderness, as well as the possiblity that the sewage and water plans for the area are inadequate and might present a threat to the park resources. Whatever site is ultimately selected, provision must be made for environmental monitoring of the subsurface areas of the park potentially affected by the construction and operation of the site to assure that adverse environmental effects are minimized, if not eliminated.

It is probable that cave passages underly all of the park south of the Green River on the Mammoth Cave Plateau. If it is not possible to find a site for a staging area outside of the park, off the Mammoth Cave Plateau, then it becomes a matter of choosing the site within the park which presents the least environmental danger to the park resources. Almost all factors appear to be equal in balancing the Union City site against the Frozen Niagara site save two: Union City is underlain by pristine wilderness caves while Frozen Niagara is underlain by an already disturbed cave system; and a Frozen Niagara site would require the construction of additional access roads from outside the park with corresponding uncontrolled development, while a Union City site would be adjacent to existing access roads, but would require construction of a transit system and sewage lines across Doyel Valley which might threaten the Mammoth Cave Shrimp and other cave fauna. This is a difficult dilemma to resolve, and therefore we are asking for a re-evaluation of the problem, taking the newly developed information into account.

3. EXTEND TRANSIT SYSTEM

In general, this discussion seems adequate, although less time was devoted by us to its evaluation. However, it might be good to point out the problems with road construction and maintenance peculiar to karst areas, such as sinkhole formation, and to mention past occurances in the park. In the section on adverse effects, it is questionable whether money costs can be directly offset by pleasure. Some of the things mentioned in that section seem irrelevant to the discussion. The irretrievable commitment of energy resources should be balanced against the commitment if private automobiles are allowed to continue to visit the park; it will then be seen that the net effect is an improvement in the energy availability situation.

4. PHASE OUT EXISTING FACILITIES

It would improve the description to show known cave passages in color on the maps of the surface areas. It would thus become evident that there are passages underlying the employee's housing area, and that these facilities should be removed from the park as part of the Plan.

The specific benefits of removing the Job Corps Center should be noted, including a reduction in pollution potential and the removal of a cave vandalism threat. In fact, a greater coverage of the beneficial effects of removing all facilities would be helpful.

The discussion of alternatives should be expanded to present a complete discussion of the relocation of the Job Corps Center outside the park. Also, alternatives for each set of facilities should be considered separately.

5. MODIFY INTRAPARK CIRCULATION

The statement on p. 21 that all roads in the park existed prior to the park's establishment is incorrect, since Ky. 70 was built at a later time, and some of the roads were certainly improved and paved subsequent to the establishment of the park. The discussion in impacts should include a better estimate of the magnitude of the effect road paving will have on surface runoff. A mitigating measure is that of keeping the roads open to local people for cemetary access; however, this might mean that the full mitigation effect of preventing vandalism might not be realized, since there would still be some public vehicular access. No mention is made of the cost of providing guard personnel to assure that the roads are not used by non-local people. The adverse impacts listed would not seem to be present if local people are allowed access to the park to visit the cemetaries.

6. UTILIZE NEW SOURCES OF DOMESTIC WATER

The statement on p. 22 that water from the perched aquifer is of high quality because all of Flint Ridge is in the park would seem to contradict later statements (p. 171, for example) that wilderness would have no effect upon water quality because of the danger of pollution from outside sources. It should also be made clear what criteria were used to determine projected water use in the park.

The discussion of environmental impact should include the primary effects of supplying water from an outside source as well as the secondary: how removal of water from sources outside the park would affect the regional water balance and economic situation as well as the water supply to caves within the park.

On p. 143, Nolin River Lake is not on the Green River as is stated.

In the discussion of alternatives, it should be noted that cave fauna and flora would suffer in times of water shortage if there were no action taken.

7. PROVIDE ADDITIONAL SITES FOR PICNICKING AND PRIMITIVE CAMPING

This section seems to be mixed up and poorly organized. Part of the description of the proposal is included under impacts. The section on mitigation mentions no mitigation. The effects of motorboats upon the wilderness values of the park are not mentioned. The discussion of short-term uses v. long-term productivity seems to dwell unduly on the present without showing any relationship to the future. The alternatives discussion seems to imply that one of the alternatives is being selected as the choice of action. Inadequate consideration overall is given to ways to help retain the wild and scenic character of the river. Such consideration should include making it wilderness, as well as limited development to channelize use.

8. TRANSPARK ROAD AND BRIDGE

The discussion of the road and bridge seems based upon some ill-considered assumptions regarding regional development and the park. Since the bridge would be located in the western section of the park, well away from the resources that people come to see, it would probably not produce new visitors to the park, but instead would serve as a major transit arterial between the two reservoirs to the

north and south, similarly to the way that Ky. 70 serves as a major arterial. While it is likely that the bridge would increase the total number or park users, many of them (if not most) would in reality be park road users, and would probably not visit the caves, or even stop in the park or in the nearby communities. The existing ferrys and low-grade roads provide a different experience for the park visitor than one receives on an interstate highway. The dust which is common in summer reduces visibility, but it also keeps animals away from the road and reduces animal fatalities. It is highly questionable how use of the road would be limited to recreational traffic, as is stated on p. 126, since at other places in the EIS it is stated that much use will be by commuters. The effect of the road upon the surrounding wilderness resources is not mentioned.

The discussion of alternatives seems to ignore potential benefits of the alternatives, and instead seems aimed at justifying the case for a bridge. If it is decided to go ahead with plans for the bridge, a complete EIS on that project alone should be prepared before the final decision is made.

9. ESTABLISH TRAIL SYSTEM

There is no consideration made of the effects of a trail system upon the cave resources of the northern section of the park. Opening up the back country to increased use will subject caves in that area to vandalism and increased usage unless precautions are taken to protect the resouce. An increase in illegal cave exploration is probable. This will depend upon the relative locations of the trails and the caves, the general public knowledge of the existence of the cave resources, and the amount of usage the area receives. In general, since much of the area is eligible for inclusion in the National Wilderness Preservation System (or will be at a later date), the trails should be designed to wilderness trail standards. There seems to be some contradiction with respect to the use of wagon roads as a base for the trail system. On p. 29, for example, it is stated that wherever possible these roads will be incorporated into the system. On p. 164, however, it is argued that use of these old roadbeds would not be desirable. This point should be clarified.

10. DEVELOP PRIMITIVE CAMPSITES

Tent sites, already ditched, could be provided as an interim step before shelters were constructed. Such sites, although not as primitive as some campers might like, would reduce the impact of tent use, while still allowing it. The provision of permanent shelters will not stop many persons from pitching their tents anyway, especially under crowded conditions, or in the hottest parts of the summer. The shelters, in order to be useful, would have to be insect proof, which might add considerable to their expense. Furthermore, such shelters are not compatible with the type of wilderness experience which is enjoyed and desired by many backpackers. If such shelters are provided, however, they should be built with natural-type materials brought in from outside the park to minimize impact upon the local natural wilderness environment.

The discussion of alternatives is completely inadequate, since it does not include any.

SUMMARY OF CUMULATIVE ENVIRONMENTAL IMPACTS OF THE MAJOR PROPOSALS ON SIGNIFICANT RESOURCES

This summary is an excellent idea, since it presents the reader with the overall picture at a glance. However, there are several points which are omitted:

It should be pointed out that water quality will be improved by dilution after the water flow from springs is restored to the cave systems. More data should be provided (probably elsewhere in the EIS) documenting the relationship between sewage pollution outside the park and possible contamination of the park cave passages. Vegetation loss data should be compared in some way to the total vegetation of that type in the park. A more precise word than "infinitesimal" should be used to describe the reduction in numbers of cave fauna. A compete study (as noted above) of the effects of longer lighting time on the water balance of the Frozen Niagara section should be made, and data included in the EIS (Reference to a similar study made at Carlsbad might be helpful. See John S. McLean, Microclimate at Carlsbad Caverns, U.S.G.S. Open File Report, Available from Carlsbad Supt. of S.W. Regional Office, NPS.) The impact upon the wild cave resources of lantern tours in Flint Ridge should be considered.

The section on recreational use should give more consideration to the problems of peak period congestion. Flexible use concepts should be able to eliminate many peak congestion problems without undue expense. Since it is not really known whether increased visitation to Mammoth Cave will result in unacceptable deleterious effects (no adequate environmental studies have been made), more caution should be excercised in the EIS in describing this situation. There is a need for studies to determine the carrying capacity of the cave resources.

The discussion of the effects upon nearby communities and parks should be expanded to include a complete discussion of the economic and environmental benefits which will accrue to the surrounding community if the master plan is implemented and orderly development occurs outside the park. Without such an analysis and discussion, it will be extremely hard to convince the local residents of the benefits of the Master Plan.

SUMMARY OF MEASURES TO MITIGATE ADVERSE EFFECTS OF THE PLAN

Water quality should be improved to natural runoff quality, and not agricultural runoff quality. Odor and smoke pollution within the cave should be monitored, also. The Mammoth Cave Shrimp is rare and endangered, and many other species are probably rare enough so that special precautions should be taken for their protection. Surfacing of trails is not mentioned elsewhere in the plan, so should not be here. The statement that Mammoth Cave's wildlands are tiny is only partly true. Compared to the large wilderness areas of the west, they are not substantial. But for the east they are quite large. If usage becomes so great that the resources are threatened, then limitation of use should be considered instead of reducing the quality of the experience by paving trails. There should be more discussion of the effects of the Plan upon adjacent communities.

LAND AND CAVE CLASSIFICATION SYSTEMS

Inclusion of a discussion of the land and cave classification systems in the

EIS is to be lauded--however, these sections are completely inadequate as they relate to wilderness. Apparently this section was added as an afterthought, since land classification is not mentioned in many of the sections of the EIS, specifically the sections on the mitigating measures, the adverse effects, the short term uses v. long term productivity, and the irreversible commitments. The contention in the EIS that consideration of these factors is not necessary because the land classification system is intimately tied to the Plan itself is only partially true. Since the land classification scheme exists in much of the park independently of the developments which are usually concentrated in particular locations, and is the only planning mechanism available for much of the park, its impact must be considered.

In addition to a more complete discussion of the impacts of a classification system, the EIS should consider alternative classification systems and their impacts. For example, in 1971 the Cave Research Foundation proposed a cave passage classification system based upon the physical characteristics of the caves in the park. The use of such a system, based upon the permanent physical characteristics of the land, would have a different impact upon the cave resources and the planning process that the ORRRC-type system proposed for use by the Park Service. A third alternative would be the use of a dual system of classification--with each cave passage classified both by its physical characteristics and its usage.

Of course, any land classification system or zoning plan can only function effectively if it is based upon adequate research. At this point in time there is not enough known about cave resource carrying capacities and the effects of visitation to adequately predict the impacts upon the cave environment of the classification of a particular cave passage by usage. On the other hand, speleological knowledge of the cave has advanced to the point where it would be possible to implement the CRF classification system. The EIS and Master Plan should make provision for conducting the research on cave management and usage necessary to produce adequate classification of the cave passages.

WILDERNESS

The EIS purports to cover both the Master Plan and the Wilderness Study, but wilderness has been given short shrift, apparently because of the no-wilderness recommendation of the Wilderness Study. However, even the no-wilderness recommendation does not excuse the inadequate discussion of the impacts of this recommendation, not to mention the omission of wilderness discussion in many of the sections of the EIS.

The non-wilderness recommendation is based upon an arbitrary analysis of the data available. Fortunately the EIS contains a better description of the wilderness characteristics of the park than did the so-called "Wilderness Study" which was supplied with the Master Plan. The same data presented in the EIS can be interpreted to show that the works of man are substantially unnoticeable, and that the area does qualify for wilderness protection. Knowledgable observers may be able to notice subtle indications of man's presence, but to the ordinary wilderness user, the non-expert "reasonable man," the park's roadless areas appear to a large degree to be of wilderness character.

Some of the interpretations in the description section as to the eligibility for wilderness are directly contradicted by Secretary Reed's letter of June 24,

1972. Based upon that letter, the impoundment of the Green River by Lock 6 should not disqualify the Green River from wilderness as is stated at least twice in the EIS (p. 45, p. 47). In fact, the broadened interpretation of wilderness requirements and management procedures made in that letter makes the Park Service's no-wilderness recommendation seem almost a travesty of the spirit of the Wilderness Act.

It would appear that many of the developments being planned for potential wilderness areas are being proposed as greater than those actually needed, when in fact wilderness-compatible developments would suffice. An example of this is the trails and campsites planned for north of the Green River. Since these are only planned at present, and in fact are probably unneccessary for the forseeable future regardless of the classification of the land, they should not affect the wilderness eligibility of the park lands. It might in fact affect the type of development actually installed if the lands were declared as wilderness, but since the EIS does not anticipate an immediate need for the developments proposed, lesser, wilderness-compatible developments will probably be adequate.

In fact, much of the usage anticipated for the northern section of the park will only be realized if the area is declared a wilderness. If it is not made a wilderness, it is probable that the present low level of use will continue for many years to come. While this might actually be beneficial for the wilderness resources, it would have an adverse affect upon the regional economy and the wilderness users, who might have to travel further from home to reach a wilderness.

A word at this point about underground wilderness is necessary, since the Park Service has chosen to use the EIS as a vehicle for setting forth its legal (or quasi-legal) interpretation of the eligibility of the caves for wilderness protection. In fact, the NPS appears to recognize that caves are of wilderness quality, but bases its entire case against underground wilderness upon its interpretation of the Wilderness Act, and utilizes a dictionary to prove the contention that since the Wilderness Act refers only to land it cannot include caves. Unfortunately for the Park Service and its definition, in interpreting laws the courts are more prone to use legal definitions than dictionary definitions--especially where there is a long-standing body of law involved in such a definition. Black's Law Dictionary states that "land, in the most general sense, comprehends any ground, soil, or earth whatsoever." It goes on to quote a specific legal case which held that "land is or includes the solid material of the earth, whatever may be the ingredients of which it is composed, whether soil, rock, or other substance." Thus it can be seen that to the courts, land in fact comprises the subsurface soil as well as the surface. A fuller discussion of this point, with appropriate legal citations, will be submitted by the NSS for inclusion in the wilderness hearing record.

Clearly, in view of the fact that caves and cave systems are part of the land, and that Mammoth Cave National Park was established for the protection of the cave systems, it is incumbent upon the Park Service to review the underground "roadless areas" of the park for their wilderness suitability, and to discuss such review and its impacts in an EIS. Since the Park Service has admitted that such lands are eligible for the National Wilderness Preservation System, there should be a wilderness recommendation and a separate environmental impact statement to support it.

On p. 110, the Park Service has discussed some of the impacts of its decision to recommend no wilderness. This is a good beginning, but is hardly adequate as an EIS on the Wilderness Study. The discussion overlooks many impacts, including the continued potential for cave pollution, the pressures for cave and surface development in the park, and the irretrievable commitment of the wilderness resource represented by the developments which might occur. Positive benefits of wilderness which should have been discussed include the statutory assurance of proper, environmentally sound management, the availability of surface wilderness for recreational purposes, and the protection of the surface and cave resources from pollution, development pressures, etc.

A complete discussion of these and other relevant factors should be included in the EIS. Other parks (such as Carlsbad) have produced 50 page EIS's on a wilderness proposal alone. Surely a more substantial consideration of wilderness would be appropriate here.

The only other discussion of wilderness in the EIS is in the section on alternatives, where the wilderness proposals of various conservation groups are set forth and compared to the Park Service proposal for eventual wilderness designation of selected lands. This discussion is reasonably complete, but because of misinterpretations of the various citizen's proposals it is really an examination of a series of false alternatives, and an attempt to justify the course of action already selected by the Park Service.

The discussion of impacts of wilderness, beginning on p. 169, seems to be based to a large part upon assumptions which are not warrented by the facts. The argument that wilderness designation would preclude management of the forest is negated by Secretary Reed's letter, which allows the use of the "minimum tool" for wilderness management, as well as the fact that no plans for forest management have been presented--and in fact the existing and prior trend has been to move towards the re-establishment of the pre-Columbian ecological conditions through natural succession. Wilderness designation would have no effect upon this policy other than to give it statutory acknowledgement.

The argument that the proposed underground wilderness designation would not provide adequate protection because major potential sources of pollution lie outside the park is questionable. There is no extensive research data to support this, and, in fact the EIS itself on p. 22 states that water "is of high quality because almost all of Flint Ridge is in the park and pollution sources are virtually non-existant." Admittedly there is a potential for pollution from outside the park, and development on the Sinkhole Plain must proceed carefully to assure that such potential is not realized. But the presence of such a potential does not relieve the Park Service from the responsibility to adequately protect the cave resources from pollution sources over which it has control.

The statement on p. 171 that "polluted groundwater from sources outside the park could disrupt the active growth of flowstone in passages within the phreatic zone" seems based upon an inadequate knowledge of speleogenesis, since flowstone does not in general grow in passages in the phreatic zone. Ground water pollution could affect the rate of solution in water filled passages.

Whether underground wilderness would unduly restrict development in the Park depends upon the actual need for developed-type cave tours, and the actual amount of underground wilderness designated. The NPCA proposal, which would omit Mammoth

Cave Ridge from the wilderness, should provide adequate room for expansion well beyond the year 2000. The Park Service itself admits that it will not be necessary to develop any new trails beyond the 9.5 miles presently or formerly used before that date. Estimates of the required capacity are based upon a linear projection of the 1960's trends, and there is considerable evidience to suggest that such growth will not continue indefinitely. In addition, there will be a growing popularity of wilderness-type cave vistiation, including wild cave tours and lantern tours, and the need for these can be satisfied in a designated wilderness environment.

The impacts on access and circulation listed on p. 172 are completely without basis, since the NPCA wilderness proposal would not close all of the roads as suggested by the Park Service. Ky. 70 would remain open. Other roads which might be closed would also be closed by the Master Plan proposals, and thus the same impacts would be involved.

The mention of development of interpretive facilities at Flint Ridge caves being foreclosed as an option by the surface wilderness is absurd, since no such facilities are proposed in the Master Plan or by anyone else. In like manner the limiting effect of underground wilderness upon development is greatly exagerated, since no developments incompatible with wilderness are planned for the areas proposed for that classification. Furthermore, Secretary Reed's letter quite clearly allows some modification of the wilderness environment to allow for human safety. With proper precautions, it is possible to enable large numbers of people to view wilderness cave through lantern tours.

The theme that designation of underground wilderness would unduly limit the ability to expand developments continues throughout the discussion of wilderness alternatives, in spite of the fact that no forseeable need for such development outside of Mammoth Cave Ridge has been demonstrated. In fact, if such arguments were allowed to prevail, there would be no wilderness left by now. Congress established the National Wilderness Preservation System specifically to protect wilderness from such development pressures, and by failing to study and recommend eligible lands, the NPS is at odds with the intent of the Wilderness Act.

Park Service misinterpretation of wilderness proposals also continues throughout the discussion. On p. 177, in discussing the Wilderness Society proposal, it is stated that "all lands between Mammoth Cave Ridge and the Green River are excluded from wilderness." In fact the proposals only excludes the surface of Flint Ridge from wilderness, and the subsurface areas are very much included. Apparently the Park Service is playing a semantic game with the word "land," for the usage throughout the EIS is consistent with its interpretation that land refers only to the surface, in spite of legal definitions which make it clear that land includes the subsurface.

The discussion of the wilderness alternatives in general seems designed to to convince the reader that wilderness is undesireable for the park, instead of presenting a balanced discussion of the alternatives and their impacts. This is supported by the gross distortions of the various wilderness proposals which occur in their presentations, and the setting up of "straw men" which have undesirable impacts. Many more of these could be detailed here, but it would serve no useful purpose, since it is obvious that the entire section on wilderness in

the EIS will have to be rewritten in order to be adequate and satisfy the requirements of NEPA. The Park Service must be aware of these distortions and should be able to remove them to present a balanced discussion in its final EIS.

CONCLUSIONS

In conclusion we would like to reiterate the fact that we find the wilderness portion of this EIS completely inadequate to meet even the minimal requirements of NEPA, and request that it be completely rewritten. In addition, the parts of the EIS pertaining to the Master Plan comtain many errors and omit many impacts, and that section should be revised to make it a stronger document which will present fairly and firmly the environmental aspects of what we believe to be an excellent Master Plan.

NATIONAL SPELEOLOGICAL SOCIETY, INC.

affiliated with the American Association for the Advancement of Science
Dedicated to the exploration, study, and conservation of caves

COMMITTEE ON CONSERVATION
922 Park Ave.
Albany, NY 12208

June 12, 1974

James L Bainbridge
Acting Regional Director
Southeast Region
National Park Service
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Bainbridge:

The National Speleological Society appreciates very much the opportunity to comment upon the Draft Environmental Impact Statement for the Proposed Master Plan and Wilderness Study for Mammoth Cave National Park, Kentucky. A copy of our detailed comments is attached. We request that it be included in the final EIS when it is prepared. The following is a summary of those comments:

Overall this represents a reasonably good EIS, except for its inadequate coverage of the Wilderness Study impacts, and many minor points that need strengthening. The major defects are as follows:

1. It needs a better discussion of park visitation and its effects, especially the economic impact of the Master Plan proposals upon the surrounding region.

2. A better analysis of the effects of visitation upon the cave should include a determination of carrying capacities for the cave resources, a better understanding of the effects of short-term uses on the long-term productivity, and a consideration of the irretrievable nature of vandalism.

3. The staging area discussion should give better consideration to sewage and parking lot runoff problems and to the effects of the proposed staging area upon the endangered Mammoth Cave Shrimp and the pristine wilderness cave systems under Joppa Ridge.

4. The road and bridge discussion is based upon a misunderstanding of the probable use of the road by non-park users.

5. There is an inadequate discussion of environmental problems within the caves themselves, especially relating to water balance and air quality.

6. The wilderness discussion is completely inadequate as an environmental impact statement. It contains an arbitrary analysis of the data and a misinterpretation of the legal definition of wilderness; it completely ignores Secretary Reed's letter of June 1972; it proposes overdevelopment of potential wilderness without justification; it contains a completely inadequate discussion of wilderness and non-wilderness impacts; and its discussion of alternatives consistently misinterprets the conservationists's wilderness proposals and argues against "straw men."

Cave Avenue *Huntsville, Alabama 35810* *AC 205 852-1300*

We recommend that the Master Plan part of the EIS be strengthened by revising it to take into account the points mentioned in our detailed analysis attached, and that the Wilderness Study section be separated from the Master Plan section and completely rewritten to reflect an adequate consideration of the wilderness resources of the park and the environmental impacts of the wilderness recommendations.

Sincerely,

Robert R. Stitt
Conservation Chairman

enclosure

cc: J. Kulesza, Park Superintendent
R. Walker
N. Reed
Rogers C.B. Morton
Drew Chick
Environmental Protection Agency, Region IV
Council on Environmental Quality (5)
Wilderness Hearing Record
Master Plan Meeting Record
R. Nichols
R. Curl
E. Dickerman
R. Watson

THOMAS O. HARRIS
SECRETARY

WENDELL H. FORD
GOVERNOR

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
OFFICE OF THE SECRETARY
FRANKFORT, KENTUCKY 40601
TELEPHONE (502) 564-3350

June 13, 1974

Mr. James L. Bainbridge
Acting Regional Director
United States Department
of the Interior
National Park Service
Southeast Regional Office
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Bainbridge:

The draft environmental impact statement entitled "Mammoth Cave National Park, Kentucky" has been reviewed by the Kentucky environmental review agencies. The impact statement was found to contain no inadequacies in its coverage of the environmental impact expected to occur as a result of the project. However, I would like to take this opportunity to inform you that before construction the Department of the Interior must submit to the Division of Air Pollution, Department for Natural Resources and Environmental Protection, an application for a permit to construct an indirect air contaminant source. I am referring to the planned construction of the 2,320 vehicle parking lot.

Sincerely,

Thomas O. Harris

Thomas O. Harris
SECRETARY

TOH:NNH:dch

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401

June 14, 1974

Mr. James L. Bainbridge
Acting Regional Director, Southeast Region
U. S. Department of the Interior
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Bainbridge:

This is in response to your letter of May 1, 1974, enclosing the draft environmental statement for the proposed Mammoth Cave National Park Master Plan and Wilderness Study.

The proposed project is outside the Tennessee Valley and the TVA power service area. We have reviewed the project with interest; however, we have no comments.

Sincerely yours,

Peter A. Krenkel, Ph.D., P.E.
Director of Environmental
Planning

An Equal Opportunity Employer

June 5, 1974

Superintendent, Mammoth Cave National Park
Mammoth Cave National Park, Kentucky

Dear Sir,

I have just finished reading the proposed Mammoth Cave National Park Master Plan, Environmental Impact Statement(EIS), and associated wilderness literture, and wish to commend you and the Park Service on the exceptionally fine job you did in preparing the report. I generally concur with the recommendations made in the report, but there are what seem to me to be blatant errors which should be changed in the final preparation of the Master Plan.

The first concerns water quality and regional planning for the Park and the surrounding area. Water Quality, I believe, is of paramount importance in perserving and protecting the unique natural resource that is Mammoth Cave. Mammoth Cave was formed and nurtured by water, and some of the delicate and unique animals which have adapted to the cave system are found no where else. These animals, as we both know, are quite sensitive to changes in their environment, and their environment is wholly influenced by the nature of the waters entering the caves. In addition, the geomophological assests of the Park are also affected by the relative water quality influencing them ranging from discoloration of formations to destruction of formations. The EIS recognizes the fact that subsurface streams do not have the natural purification ability which surface streams possess, nor do they have the healing properties that surface streams possess.

In view of the above considerations, it was with shock that I read on page 49 of the EIS that there are no water quality standards established for underground streams. The next sentence recognizes the need for subsurface stream water quality monitoring and control to protect the cave environment, but there is no mention of formulating underground streams water quality standards.

I feel that the Master Plan should call for the diverting of all wastewaters generated in the drainage basin(both surface and subsurface drainage basins) tributary to MCNP, to the adjacent drainage basins after sufficient treatment to render the pollutants harmless to the recieving basin(s). This drastic action would prevent a possible overloading of the underground streams natural purification ability, and would prevent the possible entrance to the cave of noxious pollutants. There is precedence for this action, Lake Tahoe in Nevada pumps treated wastewaters into Califorinia to perserve Lake Tahoe, itself a unique natural water resource. Although I do not anticipate Mammoth Cave to ever approach the sorry condition of Hidden River Cave near the town of Horse Cave, I do feel that the above action is warranted since we do not presently know the assimulative capacity for pollution of underground streams, nor do we want to upset the cave environment by the introduction of potentially harmful substances which may become a possibility in the future as the local region grows to accomodate the tourist influx.

In order to protect water quality, and incidently, protect the area surrounding the Park from "strip" development mentioned several times in the EIS, a comprehensive land use plan and regional sewerage district should be established,(page 52 of the EIS states that there are presently no local sewerage districts). This would not only protect the Park and cave environments, but it would be in keeping with the Federal Environmental Protection Agency directives which promotes regional evaluation and planning for both land use and sewerage planning as opposed to piecemeal action. This would also be consistent with State water quality goals. A side benefit would be to prevent erratic development characterized by other national parks such as Gatlinburg outside of the Smokies. The local populous could be enlisted to such a plan once it is explained as protecting local aesthetics for they too desire to perserve the natural appearance of the region. Planned development can then satisfy the needed and inevitable expansion of visitor facilities without having a detrimental effect on the surrounding area.

The Park Master Plan, without a Regional Master Plan to compliment it, would lose its intended effect as the EIS points out.

In addition to this regional planning, water quality standards for underground streams should be formulated. The exact nature of these standards will of course be subject to a wide variety of parameters, and will entail an effort simuliar to the one devoted to the Master Plan since the effect of each pollutant, and relative concentrations of that pollutant, must be seperately analyzed in relation to the cave environment. However, the future results from the implementation of such standards would make such an effort worth while.

A second addition to the Master Plan must be the appropriation of the remaining 20,000 acres authorized for the Park. This is important for two reasons, connected cave systems and intensive park use. It would also be in keeping with the intent of Congress when it authorized the park. The first reason is commonsense in "Cave Country". Even today, the Cave Research Foundation is mapping the growing cave system and integrating what use to be seperate caves into "cave systems". It would be difficult to manage the Mammoth Cave System(now the Flint-Mammoth), when parts of it are not under Park Service auspicious. The second reason, intensive Park use, is somewhat more subtle for not only will more surface park lands be needed to adequately serve the projected increases of visitors forecasted by the Master Plan, but adjacent lands to the park will be subject to development as the private sector provides new facilities for the increased visitation. This will raise the price of land to such a level as to prevent it ever being added to the park. Page 51 of the EIS states that few of the farms surrounding the Park are self sustaining. This would make this area prime for development should utility service become extended, and this would eventually happen. Of course, the master land use plan for the regional area mentioned earilier in this letter would preclude such development.

My last objection to the Master Plan was the proposed bridge over the Green River and the cross park road. It is my personal estimation that such a corridor, especially the bridge over the senic Green River, would be not only a serious environmental mistake, but an intrusion upon the natural appearance of the Park resources. The EIS admits that the road will result in increased Park vandalism, increased poaching of

animals, and increased animal-vehicle collisions. In addition, the EIS projects possible damage to the natural drainage patterns, and significant cut and fill operations in several locations.

Mention was made of why a road to the east of the park could not be built as a replacement to this cross-park road, but no where did I find a simuliar evaluation of a westernly route. Prehaps an improved road to the west of the Park encircling the Park could be built. This road could be placed and designed as to encourage its use over the ferry by the local traffic.

I hope you find favor with my suggestions and incorporate them into the "final" Master Plan for Mammoth Cave National Park. I would be pleased to hear your comments on these suggestions.

Yours Truly,

Kip Duchon
97 Peachtree Park Drive, Apt W-8
Atlanta Georgia, 30309

THE NSS BULLETIN

Quarterly Journal of The National Speleological Society

MANAGING EDITOR
JAMES HEDGES
8218 Sherrill
Landover, Md. 20785

BOARD OF EDITORS
EARTH SCIENCES
WILLIAM B. WHITE
Materials Research Laboratory
The Pennsylvania State University
University Park, Pa. 16802

PSEUDOKARST
EBERHARD WERNER
Dept. of Geology and Geography
West Virginia University
Morgantown, W. Va. 26506

LIFE SCIENCES
DAVID C. CULVER
Biology Department
Northwestern University
Evanston, Ill. 60201

CONSERVATION
DAVID IRVING
Science Applications, Inc.
Box 2351
La Jolla, Calif. 92037

HISTORY
ERNST KASTNING
5810 Fondren Rd., Apt. 86
Houston, Texas 77036

EXPLORATION
JEANNE GURNEE
231 Irving Ave.
Closter, N. J. 07624

6 June 1974

Hearing Officer
Mammoth Cave National Park
Mammoth Cave, Ky. 42259

Sir:

I appreciate receiving a copy of the Draft EIS. Park Service officials at this and other units of the National Park System always are considerate of my requests for information! What follows is my personal evaluation of the Draft EIS:

The Draft EIS recognizes most of the urgent problems at the park, notably the Job Corps camp and the need for a remote staging area to replace the present conglomeration of facilities at the Historic Entrance. I might note that there is, probably, NO location south of the river and reasonably near the park which is not cavernous. The new staging area will compromise known or to-be-known caves regardless of its location, unless it is located north of the river. That would not be feasible. The proposed location near Union City probably is as good as any.

About surface wilderness areas: I will return to these in regard to roads in a moment. The basic approach, of designating class 3A and 4A lands as "wilderness" goal" lands, is a good one. I really cannot endorse the view that these abandoned farmlands and woodlots are truly "wilderness" at present, although they surely will be so in a few decades and should be managed with that in mind. I would like to see all of the areas suggested as "wilderness" by the Wilderness Society included in the NPS master plan as "wilderness goal". These areas are somewhat larger than the 3A and 4A areas mapped in the master plan.

The most serious defect in the master plan and draft EIS is the matter of the paved road crossing the park. On p.128 it is stated that this road would be open only to recreational traffic. Elsewhere, several times, however, the EIS states that ferry traffic consists largely of local residents on business or commuting. This data invalidates the argument in favor of the transpark highway. While heavy trucks could be kept off the road, it seems unlikely that even the primary, much less the sole, use of the road would be for recreation.

It would be much better for the park and for park visitors, and probably also for local residents, to build the "alternative e" road outside the park.

Intertwined withe road problem is that of the ferries. Why cannot Houchins Ferry be kept as a living history type of exhibit (or the Mammoth Cave ferry -- which ever is more convenient)? This still provides a river crossing for local residents and park personnel, and for emergency and police vehicles. Crossing a ferry provides a much greater sense of isolation, a greater enhancement of the wilderness experience, than does driving across a concrete bridge. I don't think that this aspect of the ferries was given consideration, at least not adequate consideration.

If the ferry approaches need rebuilding to provide separation of ferry traffic from other traffic, or if a new ferryboat is needed, do so. This would not depreciate the park experience nearly as much as would a paved road and bridge. Retaining the ferries, or one of them, would also discourage through traffic on park roads. It has been found repeatedly that when roads are rebuilt to higher standards, traffic on them increases rapidly. A relatively short, high-speed, paved road cutting across the park could not be expected to avoid drawing traffic from older roads at the periphery of the park. This matter is not faced in the EIS. A new, modern road would spoil the integrity of the park and introduce traffic noise and odors into adjacent wilderness areas.

A new road, along the "alternative e" corridor, should be built outside the 70,000 acre take lines, to avoid conflict with possible future enlargement of the park. This could be combined with a new visitor reception area at the north, near Lincoln School or Stockholm. It should be possible to emphasize surface wilderness/camping/hiking north of the river and the caves south of the river, thus separating park visitors according to interest and/or encouraging visitors to spend two days in the area instead of one.

A further argument against the transpark road is that it would, as the EIS admits, encourage development and land speculation around Nolin Lake. The road and bridge would just be a gift to the developpers. I would not wish to see any Park Service money spent on gifts for speculators.

Nothing in the deed reservations requires road access at a higher level of construction than was available when the deeds were drawn. The pre-1941 roads can be kept open as needed, and maintained at their original level, but no new construction is needed by deed restrictions.

In short, I regard the road proposal as contrary to the purposes of the park, an intrusion on park visitors, and a boon for land speculators and developpers. "Alternative e" plus the retention of Houchins Ferry as a living history site would satisfy all stated needs.

On the other hand, the proposal to substitute shuttle busses for private cars, and the planned changes in park roads to accomodate the busses, both appear to be exactly to the point.

My other major objection to the EIS concerns "underground wilderness". Cave zoning is a fine concept and should be quite useful. However, the arguments used against underground wilderness are semantic and an excessively strict interpretation of Congressional intent. The language of any feasible bill has to be general enough to cover all possible situations. The intent of Congress clearly was that the Wilderness Act should encompass all spaces capable of being occupied by Man. Remote, pristine underground areas qualify equally as well as remote, pristine areas on the land surface.

Cave zoning is a purely administrative device, subject to momentary alteration. Wilderness designation is relatively permanent and inflexible, which in the case of wilderness, especially economically valuable (for tourism) wilderness, is highly desirable. The environmental impact of zoning (only), without formal wilderness, is that the pristine passages can and therefore will be whittled away until attrition has cost us the whole piece. Moreoever, it would be legally more difficult to prosecute polluters upstream from national park caves if the caves are merely zoned than it would be if they were "wilderness" and the pollution was, thus, affecting not merely publicly owned caves but a formal "wilderness area". It would therefore be in the best interests of the park to declare all but the developed portions of the cave system "wilderness".

I noticed a few relatively minor points, also, in reading the draft EIS:

Why air-condition anything at the park? This is an unnecessary use of energy and resources.

Proposed restriction of development along approaches to park looks feasible, if either/both access to roads or access to water is closely regulated. Remember that the proposed transpark road would also attract strip development. If built, it would have to be closely regulated, also.

Why allow any power boats, even on the pool area of the river? The boat racing crowd and the water skiers already have two Corps of Engineers lakes nearby. Noise, bank erosion, and oil pollution are part of power boats.

There is too much concern about maintaining aesthetic diversity within the park ecosystems. Someone does need to maintain various "arrested" successional stages for educational or scientific uses. The USDA should do this, however, or the University, not NPS. The wilderness goal lands should be allowed to revert naturally to whatever they will. If that is hardwood forest, fine. If it is open glades in some areas, fine.

Again, may I say that I appreciate the opportunity to review your plans! Please keep me informed of developments.

Sincerely,

James Hedges

James Hedges

cc: Rob Stitt (NSS Conservation Committee)

224 South 7th Avenue
Sturgeon Bay, Wisconsin 54235
June 5, 1974

Mr. James L. Bainbridge,
Acting Regional Director
Southeast Regional Office
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Bainbridge:

As a member of "The National Speleological Society," the "Wisconsin Speleological Society," and a concerned citizen of the United States, I feel it is my duty to protest the lack of wilderness consideration for Mammoth Cave National Park. As far as underground wilderness goes, Mammoth Cave is a unique, natural underground feature that cannot be duplicated anywhere else on Earth. It is part of the fine history of the United States, and while I am in favor of opening new sections of Mammoth Cave to the public, this should be done only under controlled conditions, always trying to keep the consideration of the natural cave features upper-most in the mind.

As far as parking lots, we only need carefully look at how rapidly the recreation and tourism industry is increasing. What is unfortunate is that if we eventually go on a 4 day work week, the flood of cars and resulting problems such as oil and gasoline fumes will be with us four days out of every week unlike the present Saturday and Sunday flood. This is because some employeers will give their workers Friday off, and others will get Mondays off. It is clear that the volume of traffic and the crowds will increase, and since the job of a good National Park is to protect its features, all parking lots should be OUTSIDE of the park boundaries. An excellent spot for this would be below the Dripping Springs Escarpment, and outside of the park boundaries. We have to start asking ourselves if by designating an area a national park, that instead of protecting the area, we are in reality attracting more people to the area than before, and in effect, ruining the area?? Here is where good sound management comes into being.

I must compliment you on deciding to open some of the other caves in the park up under LIMITED conditions, as this not only allows us to enjoy the speleohistory of the area more, but it will help to remove the excess crowds from some of the caves that are too heavily visited. I would rather see many caves opened under moderate traffic conditions, with little noticeable effects, than just one main cave which would be ruined if it took too heavy a tourist load. Of course, all tours should have well trained guides.

In short, it is high time we got out of the politics and into the heart of the matter, namely the protecting of the world's largest cave! Certainly underground wilderness is possible, and in some states it is possible to buy underground rights. So why can't wilderness exist underground, especially when the surface in the area is already under Government ownership? The key to the future is the present, and to whom it may concern, I hope you will consider the very important aspect of wilderness, both above and underground wisely. True, you might not be able to use the land as much, but why should man utilize every square inch of the earth...surface or underground for his own greedy needs?

To the future of cave protection....

Gary K. Soule

Mr. Gary K. Soule NSS 11198

224 South 7th Avenue
Sturgeon Bay, Wisconsin 54235
June 5, 1974

Mr. James L. Bainbridge,
Acting Regional Director
Southeast Regional Office
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Bainbridge:

I am enclosing a letter concerning the Environmental Impact Statement Draft for MAMMOTH CAVE NATIONAL PARK in Kentucky. I understand that by sending this letter to your office, this letter WILL BE PRINTED IN ITS ENTIRETY IN THE FINAL ENVIRONMENTAL IMPACT STATEMENT ON MAMMOTH CAVE NATIONAL PARK. Since this is well within the 45 days following the April 30, 1974 publishing date as in the Federal Register, I expect to see this letter, IN PRINT, in this final statement.

I always feel that despite how many letters you get, they only have meaning if they are printed, instead of names listed. I am familiar with Environmental Impact Statements and your comment section, and also wish to be notified when the final environmental impact statement will be out, and its cost, if anything. Thanks, and I trust you will get this letter in the correct hands soon.

Yours truly,

Gary K. Soule

Mr. Gary K. Soule

Member: The National Speleological Society

P.S. I am sorry I cannot attend the hearing, so this will have to do as far as the hearing record and Final Environmental Impact Statement correspondence section is concerned.

Dept. of Botany
Univ. of Wisconsin
Madison 53706
June 1, 1974

Hearing Officer
c/o Superintendent
Mammoth Cave National Park
Mammoth Cave, KY 42259

Dear Friend:

As a separate comment, I would like to express my view that the Draft Environmental Impact Statement included with the Master Plan and wilderness documents is hopelessly inadequate, particularly in its discussion of wilderness alternatives.

I urge the reevaluation of the environmental impact and the drafting of a more comprehensive and realistic Environmental Impact Statement to be included with the Master Plan and associated wilderness documents.

Trusting that this will also become a part of the official record.

Sincerely,

Hearing Officer
c/o Superintendent
Mammoth Cave National Park
Mammoth Cave, KY 42259

Dear Friend:

As a separate comment, I would like to express my view that the Draft Environmental Impact Statement included with the Master Plan and wilderness documents is hopelessly inadequate, particularly in its discussion of wilderness alternatives.

I urge the reevaluation of the environmental impact and the drafting of a more comprehensive and realistic Environmental Impact Statement to be included with the Master Plan and associated wilderness documents.

Trusting that this will also become a part of the official record.

Sincerely,

Ronald F. Gietkowski

GIETKOWSKI
419 W. DOTY ST.
MADISON, WISCONSIN
53703

June 6, 1974
Madison, Wis

Hearing Officer
c/o Superintendent
Mammoth Cave National Park
Mammoth Cave, KY 42259

Dear Friend:

As a separate comment, I would like to express my view that the Draft Environmental Impact Statement included with the Master Plan and wilderness documents is hopelessly inadequate, particularly in its discussion of wilderness alternatives.

I urge the reevaluation of the environmental impact and the drafting of a more comprehensive and realistic Environmental Impact Statement to be included with the Master Plan and associated wilderness documents.

Trusting that this will also become a part of the official record.

Sincerely,

R J. Ehr

R.J. EHR
DEPT. OF PLANT PATHOLOGY
RUSSELL LABS U.W
MADISON, WISCONSIN 53706

2011 E. Washington
Madison, WI 53704
May 30, 1974

Hearing Officer
c/o Superintendent
Mammoth Cave National Park
Mammoth Cave, KY 42259

Dear Friend:

As a separate comment, I would like to express my view that the Draft Environmental Impact Statement included with the Master Plan and wilderness documents is hopelessly inadequate, particularly in its discussion of wilderness alternatives.

I urge the reevaluation of the environmental impact and the drafting of a more comprehensive and realistic Environmental Impact Statement to be included with the Master Plan and associated wilderness documents.

Trusting that this will also become a part of the official record.

Sincerely,

Cheri Casper
NSS #12329

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The Department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

Publication services were provided by the graphics and editorial staffs of the Denver Service Center. NPS 1017

☆U.S. GOVERNMENT PRINTING OFFICE: 1976—677-346/82