FLATTENED MUSK TURTLE

RECOVERY PLAN

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(*Sternotherus depressus*)

RECOVERY PLAN

Prepared by

John J. Pulliam, III
and
Robert G. Bowker
U.S. Fish and Wildlife Service
Jackson, Mississippi

for

Southeast Region
U.S. Fish and Wildlife Service
Atlanta, Georgia

Approved: _____
Regional Director, U.S. Fish and Wildlife Service

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Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be obtained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies, other than the U.S. Fish and Wildlife Service, involved in the plan formulation. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1990. Flattened Musk Turtle Recovery Plan. Jackson, Mississippi. 15 pp.

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EXECUTIVE SUMMARY

Current Status: The major apparent threats are water pollution, collecting, disease, and an altered pattern of genetic exchange due to habitat modification.

Goal: The goal of the recovery plan is to delist the flattened musk turtle.

Recovery Criteria: Recovery criteria are evidence of a viable population over a 10-year period in at least 12 streams.

Actions Needed:

1. Establish a work group to address the water quality problem;
2. monitor the flattened musk turtle populations to determine the significance of these threats, appropriate protective actions, and the effectiveness of those actions as implemented; and
3. implement any protective measures that are warranted.

Date of Recovery: The time required for meeting the flattened musk turtle recovery goal is primarily a function of:

the diligence with which development, regulatory, and enforcement interests are able to effectively stop degradation of the turtle's aquatic habitat;

the time required for the aquatic habitat to recover from that degradation; and

the time required for the population to respond to more favorable habitat quality and other restoration actions given the turtle's low reproductive rate.

Accordingly, achievement of the recovery goal will be a lengthy, complicated, and potentially controversial process. All that can be reasonably stated now relative to time required for recovery is that, under the best of circumstances, it will take more than 3 decades.

Cost of Recovery: No basis for determining recovery costs at this time.

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I. INTRODUCTION

Background

On June 11, 1987, the U.S. Fish and Wildlife Service published in the Federal Register a final rule indicating its determination that the flattened musk turtle (Sternotherus depressus) was a threatened species under the Endangered Species Act of 1973, as amended.

The flattened musk turtle was described by Tinkle and Webb (1955) as Sternotherus depressus. Tinkle (1958) continued to give it full species rank in another systematic study. Iverson (1977a,b) also considered S. depressus a full species. Seidel and Lucchino (1981) considered S. depressus a full species on the basis of morphometric and electrophoretic analysis. Ernst, et al. (1988) considered S. depressus a distinct species on the basis of shell morphology. Other herpetologists, e.g. Wermuth and Mertens (1961) and Mount (1975, 1981), have treated it as a subspecies of Sternotherus minor.

Description

The flattened musk turtle is a small aquatic turtle having a distinctly flattened carapace up to 12 centimeters or 4.7 inches long, with keels virtually, if not altogether, lacking (Mount 1981). The carapace varies from very dark brown to orange with dark bordered seams and is slightly serrated behind (Ernst and Barbour 1972). The plastron is pink to yellowish. The head is greenish with a dark reticulum that often breaks up to form spots on the top of the snout (Mount 1981). Stripes on the top and sides of the neck, if present, are narrow. There are two barbels on the chin, all four feet are webbed, and males have thick, long, spine-tipped tails (Ernst and Barbour 1972).

Population Status and Distribution

The flattened musk turtle is found only in Alabama, in the upper Black Warrior River system (Figure 1). Within its geographic range, the flattened musk turtle occurs only in a portion of apparent suitable habitat. In addition, local distribution appears fragmented. Two major distributional surveys found flattened musk turtles at fewer than one-half of the approximately 125 sites sampled. Mount's estimate of the number of stream miles where this turtle has probably been extirpated amounts to 2? percent of its range (Mount 1981). Ernst caught no S. depressus at 46 percent of the locations that he sampled (Ernst et al. 1983). An evaluation of U.S. Geological Survey water quality records and Mount's collections, field observations, and habitat characterizations, suggests that only 15 percent of the Black Warrior system (142 out of 947 stream miles, including impoundments) supports viable flattened musk turtle populations. Assuming that relative population vigor is characterized by trapping success rates and evidence of annual recruitment; and that the reported sample sites throughout the basin represent a statistically valid distribution; then Ernst's field data suggests that only 10 to 20 percent

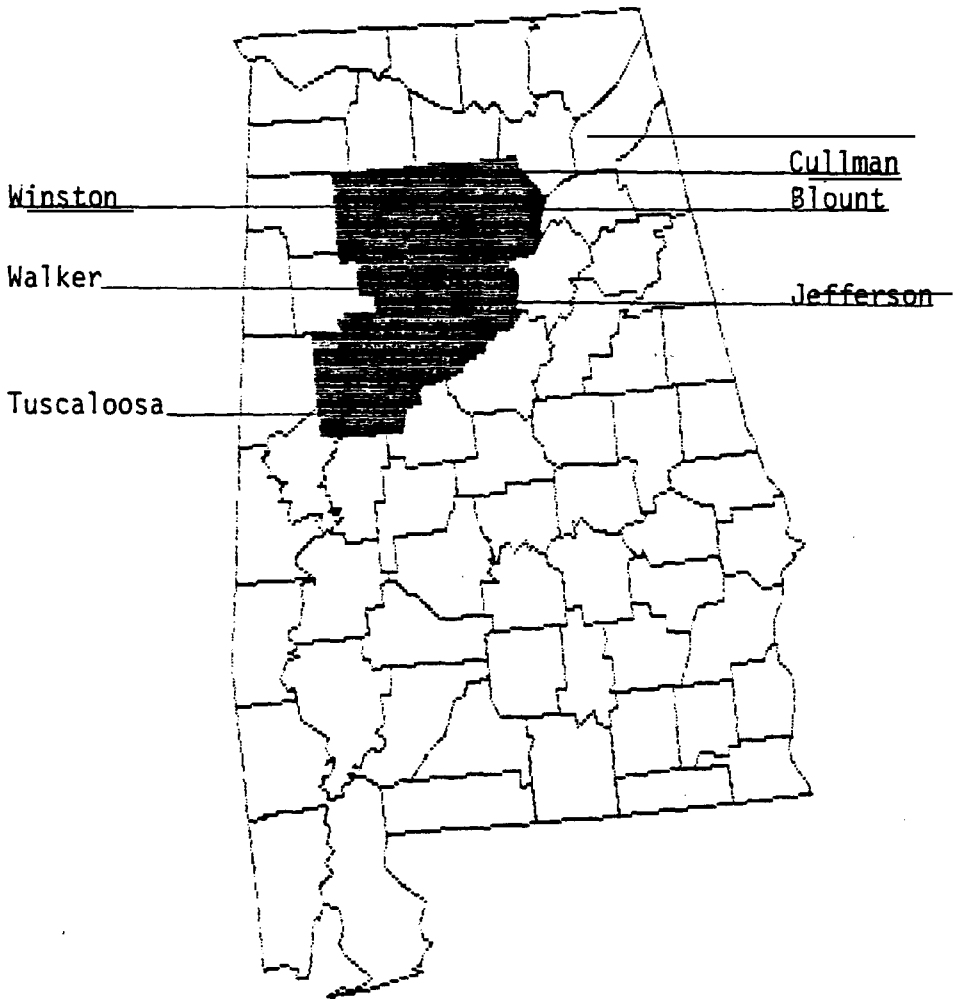

Figure 1 - Range of the Flattened Musk Turtle

of the Black Warrior system supports viable flattened musk turtle populations.

Description of the Habitat

The flattened musk turtle is found in a variety of streams and in the headwaters and around the margins of some impounded lakes. However, its optimum habitat appears to be free-flowing large creeks or small rivers having vegetated shallows from a few centimeters to about 0.6 meters (2 feet) deep, alternating with pools 1.1 to 1.5 meters (3.6 to 5 feet) deep. These pools have a detectable current and an abundance of crevices and submerged rocks, overlapping flat rocks, or accumulations of boulders. Other factors contributing to habitat quality for this turtle include abundant molluscan fauna, low silt load and deposits, low nutrient content and bacterial count, moderate temperature, and minimal pollution (Estridge 1970, Mount 1981). Ernst, et al. (1983) reported that S. depressus also inhabits stream stretches with sandy bottoms, alternating with suitable cover sites.

Factors Affecting the Species

Habitat Alteration

Dodd, et al. (1988) concluded, after an intensive study, that siltation appears to have seriously impacted the flattened musk turtle. Possible adverse effects of silt include: (1) extirpation or reduction in populations of mollusks and other invertebrates on which the turtles feed; (2) physical alteration of the rocky habitats where the turtles seek food and cover; and (3) development of a substrate in which chemicals toxic to the turtles or their food sources may accumulate and persist. Activities and sources that have historically contributed to the siltation problem include agriculture, forestry, mining, and industrial and residential development. Recent passage of laws provide the means to regulate the amounts of silt that these activities can contribute to streams. Even if such regulation proves effective in stopping future flattened musk turtle habitat degradation, stream recovery is a slow process. That and the turtle's low reproductive rate will insure that meaningful improvement in its p[illegible]etion status will require a long time.

Pollu[illegible]y organic and inorganic chemicals degrades water quality in the fla[illegible] musk turtle habitat and may affect its survival. Shell erosion an[illegible] of invertebrate food organisms are possible adverse effects of s[illegible] pollution (Mount 1981).

Finally, hydrologic changes associated with mining (including declines in water level, creation of spoil aquifers, and changes in streamflow characteristics); and various navigation and flood control projects may have adverse effects on the habitat of the flattened musk turtle. These activities cause range fragmentation which, according to Dodd et al. (1988), is a serious problem to the flattened musk turtle.

Overutilization

The flattened musk turtle has been listed for sale on several dealer price lists at more than $80 each. Most of the formerly good populations have been considerably reduced through commercial collecting in recent years. "Collecting that permanently removes individuals from a population represents additional 'mortality' to the population which must be offset with higher than normal recruitment in order to maintain stable populations; however, recruitment appears low in flattened musk turtles" (Congdon, et al. 1987). A State law prohibiting the taking of flattened musk turtles was passed on May 21, 1984. This law and the Endangered Species Act provide a mechanism to control collecting.

Disease and Parasites

Estridge (1970) found three of seven specimens parasitized by a protozoan agent of turtle malaria. Ernst, et al. (1983) found some specimens heavily parasitized by a leech that carries the protozoan. A disease characterized by a mixed gram-negative septicemia has been noted in populations of the flattened musk turtle (Dodd 1988). Almost one-fourth of the turtles caught by Dodd, et al. (1988) in the last trap sample at one site were diseased; and more than one-half of all turtles of this species observed basking in the Dodd study were considered sick.

Altered Pattern of Genetic Exchange

Historically, the flattened musk turtle was found in the upper Black Warrior River system of Alabama upstream from the fall line, the break between interior provinces and the coastal plain (Tinkle 1959; Estridge 1970; Mount 1976, 1981; Ernst, et al. 1983). Beginning about 1930, several dams were built on the Black Warrior River below and near the fall line. The impoundments created behind those dams extend from well below to well above the steep gradient in streams as they cross the fall line. It has been hypothesized that creation of the impoundments allowed the range of S. m. peltifer (previously limited to below the fall line) to be functionally connected for the first time to the river above the fall line, and to have contact with the range of S. depressus (Iverson 1977a,b; Seidel and Lucchino 1981). This linkage eliminated a natural, environmental barrier to interbreeding between S. depressus and S. m. peltifer (Iverson 1977a,b). Bankhead Dam, which was constructed in 1915 and prior to the impoundments near the fall line, is further upstream and now constitutes the primary physical barrier between the ranges of S. depressus and S. m. peltifer. As a result of these habitat modifications, the Black Warrior River system below Bankhead Dam but above the fall line may now contain hybrid populations of Sternotherus turtles (Iverson 1977a,b; Mount 1981). Another interpretation is that the area from the fall line to where Bankhead Dam is now located was an area of natural intergradation between distinct taxon (Mount 1981). If hybridization or an altered pattern of natural intergradation is occurring due to habitat modification, the process may threaten the flattened musk turtle as a taxon if that modification continues.

Biological Characteristics

Several biological characteristics of the flattened musk turtle increase its vulnerability to the threats discussed previously. This turtle does not mature sexually until 4-8 years of age, and normally deposits only 1 to 2 clutches of eggs per year with 1 to 3 eggs per clutch (Close 1982). This low reproductive rate reduces the ability of the species to recover rapidly from anything that decimates the population or to respond rapidly to recovery activities. Since the flattened musk turtle occurs only in the upper Black Warrior River basin, it evidently has rather specific habitat requirements. This factor increases the likelihood of adverse impact from habitat modifications. Flattened musk turtles feed primarily on mollusks (Marion, et al. 1986), which are particularly susceptible to water pollution. The turtles also feed and spend virtually all of their time at the stream bottom and thus are in almost constant contact with any toxic sediments that may be present.

II. RECOVERY

A. Objective

The objective of this plan is to remove the flattened musk turtle from the list of threatened species. The species can be delisted when there is a viable population over a 10-year period in at least 12 streams. Evidence will include age/sex ratios, numbers in age classes, and turtles per night captured using comparable survey techniques. There are approximately 24 streams in the upper Black Warrior River basin, including the three major forks. The minimum of 12 streams to be recovered shall include at least eight of the streams with the best habitat; the others shall be streams with the next best habitat, according to Guthrie's study (1986).

The time required for meeting this flattened musk turtle recovery objective is primarily a function of:

the diligence with which development, regulatory, and enforcement interests are able to effectively stop degradation of habitat quality and any other of man's actions adversely effecting the turtle population;

the time required for the degraded habitat to recover; and

the low reproductive rate of the turtle.

B. Narrative Outline for Recovery Actions Addressing Threats

1. Improve habitat quality.

Probably the most significant factor adversely affecting the flattened musk turtle is degradation of its aquatic habitat. Therefore, measures should be taken to improve the habitat.

1.1 Develop a habitat restoration plan. Develop a habitat restoration plan in consultation with scientists familiar with the turtle's biology and representatives from appropriate Federal and State agencies. The plan should comprehensively identify restoration parameters (e.g., water quality requirements of the turtle) and a strategy for implementation of each. Areas that may need special attention include abandoned mines adjacent to streams containing flattened musk turtles and the Sipsey Fork, Brushy Creek, Blackburn Fork, and Blackwater Creek which constitute the best remaining habitat for this species.

1.2 Implement actions to restore habitat. After specific habitat restoration measures have been identified, each agency should use the authorities and expertise available to contribute to habitat restoration.

2. Assess threats to the turtle population and monitor its status.

A plan is needed to determine the nature and magnitude of the threats and the effectiveness of protective actions implemented.

2.1 Develop study plan. A study plan should be developed that includes monitoring of the turtle's population status including size classes and evidence of reproduction. The scope of the plan should also include a qualitative and quantitative assessment of the presence of toxic materials and the incidence of disease. The current pattern of genetic exchange within the historical range of the flattened musk turtle should be further investigated. Guthrie (1986) and Dodd, et al. (1988) submitted ideas regarding future monitoring of flattened musk turtles, including determining the extent of lake utilization.

2.2 Conduct studies. Once the study plan is developed, the studies should be conducted as funds are available. This could be done by contract, by each agency sharing part of the effort, or some combination of these options.

2.3 Reduce on-going adverse actions. Information gathered should be used to guide human activities and projects so that appropriate protective measures can be included in those actions (e.g., water quality standards within the turtle's habitat may have to be upgraded). Emphasis on protection from adverse impacts should be focused on Sipsey Fork, Brushy Creek, Blackwater Creek, and Blackburn Fork because they are crucial to attaining recovery.

3. Reduce isolation of individual populations.

A currently common situation within the entire Warrior Basin is that portions of habitat once occupied by the flattened musk turtle have been made unsuitable by habitat alteration (Dodd, et al. 1988). The resultant fragmentation has caused isolation of individual populations with little possibility of genetic interchange from one population to the other. Corrective action should emphasize restoring altered habitat areas to reestablish natural corridors. Isolated populations would then have the opportunity for reproductive contact again.

4. Decrease incidence of disease, if significant.

If study results indicate that the magnitude of disease is significant, efforts should be made to identify the causative agent and to take corrective action.

5. Reduce adverse genetic exchange above Bankhead Dam, if significant.

Hybridization of S. depressus with S. m. peltifer may have occurred below Bankhead Dam due to the construction of impoundments above and below the fall line, a former natural barrier. Altering this barrier with impoundments created a situation that may have allowed the two taxon to interbreed. If study results indicate the current pattern of genetic exchange poses a threat to the listed population of the flattened musk turtle, the causative factor should be determined and corrective action taken.

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III. IMPLEMENTATION SCHEDULE

The following Implementation Schedule outlines actions and costs for the Sternotherus depressus recovery program. It is a guide for meeting the objectives elaborated in Part II of this plan. This schedule indicates the general category for implementations, recovery plan tasks, corresponding outline numbers, task priorities, duration of tasks, (continuous denotes a task that should continue on an annual basis), which agencies are responsible to perform these tasks, and lastly, estimated costs for U.S. Fish and Wildlife Service tasks. These actions, when accomplished, should bring about the recovery of Sternotherus depressus and protect its habitat. The following key is for the Implementation Schedule, columns 1 and 4.

General Category (Column 1):

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Recovery Action Priorities (Column 4):

1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

2 - An action that must be taken to prevent a significant decline in the species' population/habitat quality or some other significant negative impact short of extinction.

3 - All other actions necessary for full recovery of the species.

IMPLEMENTATION SCHEDULE

General Category	Plan Task	Task Number	Priority	Task Duration	Region	Division	Other	FY 1	FY 2	FY 3	Comments/ Notes
M3	Develop habitat restoration plan	1.1	2	1 year	4	FWE	All[1]/	Normal	operat-ing	costs	
M3	Implement habitat restoration plan	1.2	2	Continuous	4	FWE	All[1]/	Normal	operat-ing	costs	
I1	Develop study plan	2.1	2	1 year	4	FWE	All[1]/	Normal	operat-ing	costs	
I1	Conduct studies	2.2	2	Continuous	4	FWE	All[1]/				Costs To be determined.
O2	Reduce on-going adverse actions	2.3	2	Continuous	4	FWE LE	All[1]/	Normal	operat-ing	costs	
M7	Minimize isolation	3.0	3	Continuous	4	FWE	All[1]/				As determined by 2.2.
M6	Decrease incidence of disease	4.0	3	Continuous	4	FWE	All[1]/				As determined by 2.2.
M7	Reduce adverse genetic exchange above Bankhead Dam	5.0	3	Continuous	4	FWE	All[1]/				As determined by 2.2.

1/ Alabama Departmentof Conservation and Natural Resources
Soil Conservation Service
Environmental Protection Agency
Bureau of Land Management
Office of Surface Mining
U.S. Forest Service
U.S. Army Corps of Engineers
U.S. Geological Survey
Alabama Geological Survey
Alabama Surface Mining Commission
Alabama Dept. of Industrial Relations
Alabama Dept. of Environmental Management

PART IV: APPENDIX

List of Reviewers

Dr. Clarence Abercrombie
FL Game & Freshwater Fish Comm
4005 South Main
Gainesville, FL 32601

Dr. W. Auffenberg
Dept. of Natural Sciences
Florida State Museum
Gainesville, FL 32611

Dr. James Dobie
Dept. of Zoology-Entomology
Auburn University
Auburn, AL 36849

Dr. George Folkerts
Dept. Zoology-Entomology
Auburn University
Auburn, AL 36849

Dr. Richard L. Franz
Dept. of Natural Sciences
Florida State Museum
Gainesville, FL 32611

Mr. Robert W. Guthrie
2820 Surrey Road
Birmingham, AL 35223

Dr. John Iverson
Biology Department
Earlham College
Richmond, IN 47374

Dr. F. Wayne King
Florida State Museum
Gainesville, FL 32611

Dr. Dan W. Speake
Coop. Wildlife Research Unit
Auburn University
Auburn, AL 36849

Dr. Robert Thomas
LA Nature Center, Inc.
New Orleans, LA 71201

Dr. Ken Marion
Biology Department
University of Alabama
Birmingham, AL 35294

Dr. C.J. McCoy
Amphibians & Reptiles Section
Carnegie Museum/Nat. History
Pittsburgh, PA 15213

Dr. Don Moll
Dept. of Life Services
SW MO State University
Springfield, MO 65802

Dr. Robert H. Mount
Dept. Zoology-Entomology
Auburn University
Auburn, AL 36849

Dr. Peter Pritchard
FL Audubon Society
1101 Audubon Way
Maitland, FL 32751

Dr. Michael E. Seidel
Dept. of Biological Sciences
Marshall University
Huntington, WV 25701

Dr. Richard C. Vogt
University of Wisconsin
Dept. of Zoology, Birge Hall
Madison, WI 53706

Mr. John L. Behler
Curator, Dept. of Herpetology
N.Y. Zoological Society
Bronx, NY 10460

Ms. Karen Bjorndal
Dept. of Zoology, Univ. FL
223 Bartram Hall
Gainesville, FL 32611

David Close
Department of Biology
University of AL, Birmingham
Birmingham, AL 35294

Dr. Harold A. Dundee
Tulane University
Dept. of Biology
New Orleans, LA 70118

Mr. Ronald E. Estridge
Director of Federal Programs
Alexander City State Jr. College
Alexander City, AL 35010

Dr. Richard Highton
Department of Zoology
University of Maryland
College Park, MO 20742

Mark Schaffer
Office of International Affairs
(IA, Mail Stop 2058 MIB)
U.S. Fish & Wildlife Service
Washington, D.C. 20240

U.S. Fish & Wildlife Service
Office of Public Affairs
(PA, 3240 MIB)
Washington, D.C. 20240

U.S. Fish & Wildlife Service
Office of Research Support
(RD-8/ORS, 527 Matomic)
Washington, D.C. 20240

Environmental Protection Agency
Hazard Evaluation Division
EEB (TS769C)
401 M Street, S.W.
Washington, D.C. 20460

Dr. R. Bruce Bury
U.S. Fish & Wildlife Service
1300 Blue Spruce Dr.
Ft. Collins, CO 80524

Dr. Ken Dodd
U.S. FIsh & Wildlife Service
412 NE 16th Ave., Rm 250
Gainesville, FL 32609

Dr. Carl H. Ernst
Department of Biology
George Mason University
Fairfax, VA 22030

Dr. J. Whitfield Gibbons
Savannah River Ecology Lab.
Drawer E
Aiken, SC 29801

U.S. Geological Survey
Water Resources Division
520 19th Ave.
Tuscaloosa, AL 35401

U.S. Fish & Wildlife Service
Division of Endangered Species &
Habitat Conservation
(EHC, 500 Broyhill)
Washington, D.C. 20240

U.S. Fish & Wildlife Service
Division of Refuges
(RF, 2343 MIB)
Washington, D.C. 20240

U.S. Fish & Wildlife Service
Division of Fish Hatcheries
(FH, 637 Matomic)
Washington, D.C. 20240

Water Quality Programs
1751 Federal Dr.
Montgomery, AL 36130

AL Forestry Commission
513 Madison Ave.
Montgomery, AL 36130

AL Highway Dept.
Environmental Technical Section
1409 Coliseum Blvd.
Montgomery, AL 36130

AL Surface Mining Commission
P.O. Box 2390
Jasper, AL 35502

Mr. Charles Kelley, Director
Division of Game & Fish
64 N. Union St.
Montgomery, AL 36104

Geological Survey of AL
State Geologist/Oil & Gas Supvr.
P.O. Box 0
Tuscaloosa, AL 35486-9780

State Programs Administrator
Room 279
649 Monroe St.
Montgomery, AL 36130

Bureau of Land Management
411 Briarwood Dr., Suite 404
Jackson, MS 39206

District engineer (ATTN:SAMPD-ES)
U.S. Army COE
P.O. Box 2288
Mobile, AL 36628

Division Administrator
Federal Highway Administration
441 High St.
Montgomery, AL 30308

Office of Surface Mining
1951 Constitution Ave., NW
Washington, DC 20240

Regional Administrator
EPA
345 Courtland St., NE
Atlanta, GA 30308

Regional Forester
U.S. Forest Service
1720 Peachtree Rd., NW
Atlanta, GA 30309

Steve Jones GSC #8
AL Power Company
P.O. Box 2641
Birmingham, AL 35291

Regional Office
Federal Energy Regulatory Comm.
730 Peachtree Bldg., Room 500
Atlanta, GA 30308

State Conservationist
Soil Conservation Service
P.O. Box 33
Auburn AL 36930

State Director
Office of Surface Mining
Homewood, AL 35200

State Executive Director
Agric. Stab. & Conserv. Service
474 S. Court St.
Montgomery, AL 36192

AL Natural Heritage Program
Dept. of Conservation & Natural Resources
State Lands Division
64 North Union St., Room 752
Montgomery, AL 36130