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FINAL  
ENVIRONMENTAL IMPACT STATEMENT

AD-A161 934

OPERATION & MAINTENANCE OF CLARKS HILL LAKE,  
SAVANNAH RIVER, GEORGIA & SOUTH CAROLINA

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A161934	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Final Environmental Impact Statement, Operation and Maintenance of Clarks Hill Lake, Savannah River, Georgia, and South Carolina		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Charles W. Belin, Jr., Ph.D.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, Savannah P. O. Box 889 Savannah, Georgia 31402-0889		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE October 1981
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Environmental impact statements    Flood control Clarks Hill Lake                      Vegetation Georgia South Carolina Savannah River		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) -The operation and maintenance activities at Clarks Hill consist of reservoir regulation, flood control hydroelectric power generation, management of land resources and facilities, management of leases, easements, and other outgrants and project management and maintenance activities. The action addressed is a continuance of the operation and maintenance program for the project.		

The overall environmental impact of the operation and maintenance program is that of environmental improvement and maintenance of project lands through the protection and management of available resources in the best interest of the human environment. Specific impacts may be either beneficial or detrimental but mitigable as described within the text of this statement. Significant lake fluctuations change the environment along the lakeshore with respect to fish spawning and the survival of vegetation. The heavy recreational use of the lake and perimeter lands results in changes in the local environment. The flood control operations preserve and stabilize the downstream environment. The operation of the project for hydroelectric power generation results in the production of power without any resulting air pollution or consumption of fossil fuels.

Adverse environmental effects associated with the operation of Clarks Hill Lake are: soil erosion and/or compaction due to (1) heavy recreational use, (2) traffic (pedestrian and vehicular) in unauthorized areas, and (3) effects of wave action and pool fluctuation on the shoreline; damage to and/or loss of vegetation (trees, shrubs, and grass) due to pool fluctuation, mowing damage or construction activity; and alterations of the natural environment through recreational development and other construction activities. Hypolimnetic power generation releases during periods of stratification contain waters with depressed dissolved oxygen concentrations.

Alternatives are discussed for each activity as described in paragraph 2 above.

**FINAL ENVIRONMENTAL STATEMENT  
OPERATION AND MAINTENANCE OF CLARKS HILL LAKE,  
SAVANNAH RIVER, GEORGIA AND SOUTH CAROLINA**

The responsible lead agency is U.S. Army Engineer District, Savannah.

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FINAL ENVIRONMENTAL STATEMENT  
 OPERATION AND MAINTENANCE OF CLARKS HILL LAKE,  
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## 1.00 SUMMARY:

1.01 Major Conclusions and Findings. The alternative of continuing the present operation and maintenance of the Clarks Hill Lake (Plan A) has been selected as the most economically and environmentally effective method providing recreational benefits, energy, and management of the surrounding natural area. This alternative is considered the National Economic Development (NED) Plan.

1.02 The Environmental Quality (EQ) Plan is that plan which maximizes the net EQ impacts of management, conservation, preservation, creation, and restoration or improvement of the quality of the natural and cultural resources affected by the project. Several alternatives have been considered to the present operation and maintenance activities. These include to continue with present operation and maintenance activities (Plan A), operation as a dry lake (Plan B), removal of some of the project facilities and restoring the area to the pre-existing environment (Plan C), and operation of Clarks Hill Lake solely for power generation without regard to flood control, recreation, navigation, and other uses (Plan D). Any beneficial effects gained by operating Clarks Hill Lake solely for one project purpose without regard for the other authorized project purposes would be far outweighed by the tremendous adverse affects this action would have on the other authorized project purposes. Therefore, Alternatives B, C, and D are not considered viable. Plan A is considered the Environmental Quality Plan.

1.03 Areas of Controversy: No issues of major disagreement have been found to date.

1.04 Unresolved Issues: There are no known unresolved issues among study area interests.

1.05 Relationship to Environmental Requirements: Table 1 on page 2 provides a list of applicable laws and the relationship of each of these to the separate plans.

## 2.00 NEEDS FOR AND OBJECTIVES OF ACTION:

2.01 Study Authority: The Clarks Hill project was authorized by the Flood Control Act approved 22 December 1944 (Public Law No. 534, 78th Congress, 2nd Session). It was recommended in the project document as the initial development of a group of 11 projects in the Savannah River Basin proposed and recommended for flood control, navigation, hydroelectric power, and other purposes. Authority for the development of public recreational use at power, flood control and navigation projects is contained in Section 4 of the Flood Control Act approved 22 December 1944, and as amended by Section 4 of the Flood Control Act of 1946, Section 209 of the Flood Control Act of 1954 and Section 207 of the Flood Control Act of 1962. Basic legislation is further amended by Section 2 of the Land and Water Conservation Fund Act of 1965 (Public Law 89-72). General considerations, covering lake management and public use, are contained in EM 1130-2-302 - Project Operations, Planning and Administration of Project Lands and Waters; ER 1130-2-312 - Criteria for Design and Construction, Civil Works Projects; ER 1130- 2-406 - Lakeshore Management, ER 1165-2-104 - Fish and Wildlife Conservation, Corps

TABLE 1

## RELATIONSHIP OF DETAILED PLANS TO ENVIRONMENTAL REQUIREMENTS

Federal Policies	Plan A Continued Status Quo	Plan B Operation as Dry Lake	Plan C Restore to Pre- Existing Conditions	Plan D Operation Solely as Power Source
Fish and wildlife Coordination Act	All plans in compliance, however, U.S. Fish and Wildlife Service must review EIS.			
Water Resources Planning Act of 1965	All plans in full compliance.			
National Historic Preservation Act of 1966	All plans in compliance.			
Wild & Scenic Rivers Act	Not applicable to any of the plans.			
National Environ- mental Policy Act of 1966	All plans in compliance.			
Section 404 of Clean Water Act of 1977	Plan B in partial compliance. Disposal sites specified through section 404(b)(1) Guidelines in EIS, however, Congress must exempt the discharge from regulation under Sections 301, 402 and 404 of the Clean Water Act. Not applicable to all other plans.			
Endangered Species Act of 1973	All plans in full compliance. No threatened or endangered species would be affected by the project.			
Flood plain Manage- ment (E.O. 11988)	All plans in compliance.			
Protection of wet- lands (E.O. 11990)	All plans in compliance.			
Marine Protection, Research and Sanc- tuaries Act of 1972.	Not applicable to any of the plans.			
Analysis of Impacts Prime and Unique Farmlands.	None of the plans would affect unique or prime farmland.			
Coastal Zone Manage- ment Act of 1972.	Not applicable to any of the plans.			

of Engineers Projects; ER 1130-2-400, Project Operations, Recreation-Resource Management of Civil Works Water Resource Projects; and ER 405-2-835 - Real Estate, Management and Utilization of Civil Works Lands; supplemented by letters from the Office of Chief of Engineers, and Division Office letters and memoranda. The District Engineer is responsible for administration of leases, licenses, permits, and easements, including collection of any rentals.

2.02 The operation, maintenance and management activities include hydroelectric power, flood control, navigation, maintenance of the project with related structures and facilities, land resources management and recreation management.

2.03 A tabular description of the structures and capabilities of Clarks Hill Lake are listed in table 2 following.

2.04 Public Concerns: Public involvement was necessary in order to properly evaluate and determine the needs of the public. Two public meetings were held by the Corp of Engineers on 23 and 24 October 1978 as well as numerous workshops in February, March, and April 1979. The following summary lists the pertinent comments received during the public meetings and workshops.

- a. Excess land on Clarks Hill for private development.
- b. Allow current lease holders to purchase leased land.
- c. Honor past commitments to lessees.
- d. Implement the citizen advisory board.
- e. Insure water quality standards.
- f. Implement erosion control measures.
- g. Allow leases for longer periods than 5 years.
- h. Maintain minimum lease rental fees.
- i. Construct more facilities for the handicapped.
- j. Improve and expand public access to the lake.
- k. Continue the fish and wildlife management programs.
- l. Control water level fluctuations.
- m. Provide financial assistance to counties for loss of tax base by land acquisition.
- n. Control the use of off-road vehicles.
- o. Allow all lease holders to develop land in a fashion similar to the Fort Gordon recreation area site.
- p. Increase lakeshore management zoning to permit more private docks on the lake.
- q. Zone the lake to resolve boating conflicts.
- r. Lease land to private interests for long periods of time.
- s. Do not excess any land on Clarks Hill Lake.
- t. Prohibit private development on public land.
- u. Formulate a water use and withdrawal policy.
- v. Protect fragile environments from development.
- w. Further restrict private docks from the lake.
- x. Provide "amenities" in recreation areas.

2.05 Planning Objectives. Discussions with local officials have indicated a strong desire for some method to reduce flooding and associated damage in the Clarks Hill Lake watershed. Several residents and property owners in the flood plain have also expressed a strong concern over the hazards and

TABLE 2  
CLARKS HILL LAKE  
PERTINENT DATA

LOCATION OF DAMSITE

Savannah River, Georgia and South Carolina, 21.7 miles upstream from Fifth Street Bridge, Augusta, Georgia.

DRAINAGE AREA (sq. mi.)

At damsite	6,144
At Augusta, Georgia, Fifth Street Bridge	7,240

FLOW DATA AT AUGUSTA

<u>Discharge, cubic feet per second</u>	
Average	10,180
Maximum (1929 flood)	350,000
Maximum (1796 flood)	360,000
Minimum daily (regulated by Clark Hill 1954-1956 low water period)	3,580

Channel capacities:

Augusta, Fifth Street Bridge	35,000
Butler Creek	27,000
Clyo	12,800

Gage height, feet: (Fifth Street gage)

1929 flood	46.3
1796 flood (historic)	40.0

PEAK FLOWS AT DAMSITE (cubic feet per second)

September 1929 (estimated)	277,000
April 8, 1936	217,000
August 14, 1940	196,000
March 23, 1942	99,300
January 20, 1943	111,000
March 5, 1952	127,000
March 12, 1952	102,000
March 24, 1952	110,000

SPILLWAY DESIGN FLOOD

Total volume of rainfall, inches	21.8
Initial loss, inches	0.9
Average infiltration rate, inches per hour	0.083
Total volume of storm runoff, inches	14.7
Total volume of storm runoff, acre-feet	4,790,365
Peak rate, natural flow at damsite, cubic feet per second	1,140,000
Peak rate, inflow to full reservoir without Hartwell, cubic feet per second	1,280,000
Peak rate, reservoir outflow without Hartwell, cubic feet per second	1,055,000

TABLE 2 (CONT'D)  
CLARKS HILL LAKE  
PERTINENT DATA

SPILLWAY DESIGN FLOOD (Cont'd)

Peak rate, reservoir inflow with Hartwell, cubic feet per second	1,176,500
Peak rate, reservoir outflow with Hartwell, cubic feet per second	1,015,000
Duration of flood, days	7

LAKE

Elevations, msl:	
Spillway crest	300
Minimum design pool, with Hartwell	312
Static full pool	330
Top of gates, (top of flood control pool)	335
Maximum design surcharge	346

Storage capacities, acre-feet:

Spillway crest	1,000,000
Spillway crest to top of gates	1,900,000
Power and incidental flood control storage, elevation 312 to 330	1,045,000
Flood control storage, elevation 330 to 335	390,000
Total to top of gates	2,900,000
Maximum design surcharge, 11 feet	950,000

Areas, acres:

Minimum design pool, elevation 312	45,000
Static full pool, elevation 330	71,100
Top of gates, elevation 335	78,500
Maximum design surcharge, elevation 346	97,500

TAILWATER ELEVATIONS (msl)

Maximum design flood (1,055,000 cubic feet per second)	255
Powerhouse design flood (645,000 cubic feet per second)	240
Maximum flood of record (277,000 cubic feet per second)	220.5
Normal (Stevens Creek Dam, top of flashboards)	187
Average operating tailwater	191
One unit at maximum discharge:	
Stevens Creek flashboards down	185
Stevens Creek flashboards up	188
Seven units at maximum efficiency-136' head	193

DAM

Concrete gravity type with earth embankments at either end, and gate-controlled spillway:	
Maximum height, concrete section, foundation to roadway, feet	200
Length, concrete section, feet	2,282
Total length, feet	5,680

TABLE 2 (CONT'D)  
CLARKS HILL LAKE  
PERTINENT DATA

DAM (CONT'd)

Elevations, msl:	
Roadway, top of dam	351
Top of gates	335
Spillway crest	300
Flood plain, average	200
Freeboard, above maximum surcharge, feet	5

APPROXIMATE QUANTITIES

Concrete, cu. yd.	1,050,000
Earth fill, cu. yd.	3,500,000

SPILLWAY

Concrete-gravity type, ogee spillway with bucket-type stilling basin and highway bridge:	
Total length, feet	1,096
Net length, feet	920
Crest gates	
Number	23
Type	Tainter
Width, feet	40
Height, feet	35
Head on crest (spillway design flood), feet	46

OUTLET SLUICES

Number	8
Size, feet	4 x 9
Type of gate, slide, hydraulically operated	
Total discharge capacity, reservoir at spillway crest (elevation 300), cubic feet per second	18,700
Total discharge capacity, reservoir at top of crest gates (elevation 335), cubic feet per second	21,300

POWER DATA

Streamflow at site, 49-year period (1925-1973) cubic feet per second:	
Minimum monthly, cubic feet per second (October 1954)	1,100
Maximum monthly, cubic feet per second (April 1936)	49,800
Average, total period, cubic feet per second	8,600
Maximum drawdown, feet	18
Regulated flow, cubic feet per second (to provide minimum navigation flow below New Savannah Bluff)	6,000
Penstocks (main units):	
Number	7
Diameter, feet	20
Spacing, feet	62
Maximum velocity, feet per second	15.5
Gates, type	Tractor

TABLE 2 (CONT'D)  
CLARKS HILL LAKE  
PERTINENT DATA

POWER DATA (CONT'd)

Penstocks (service units):

Number	2
Diameter, feet	4.5
Maximum velocity, feet per second	8.2

Generating units:

Gross static head, feet	152
Average head, feet	134
Minimum head, feet	118

Installation, kilowatts each

7 units, 40,000 kilowatts each	280,000
2 service units, 1,000 kilowatts each	2,000
Total	282,000

hardships associated with repeated flooding. They, too, desire some form of relief from this recurring problem.

2.06 Based on the evaluation and needs of the study area, the objectives of the project are reducing flooding and associated damage in the drainage basin; protecting life and property from flooding; enhancing the quality of the environment in the study area; and enhancing land use in the study area through the reduction of flooding and damage to existing development.

### 3.00 ALTERNATIVES INCLUDING THE PROPOSED ACTION:

#### 3.01 Those Within the Capability and Jurisdiction of the Corps of Engineers.

At the present time, the most feasible alternative would be to continue the operation of the project for flood control, power generation, navigation and other project purposes including recreation, wildlife and fisheries management (Plan A) since the present method of regulation appears to meet both downstream and lake commitments and hydropower requirements.

#### 3.02 Alternatives to Reservoir Regulation, Flood Control, and Hydroelectric Power Generation. There are several alternatives which may be considered.

3.03 Operation of the project as a dry lake (Plan B) would forego the authorized water supply benefits and the recreation benefits which have been added. The rapid filling and emptying of the lake would tend to degrade the area environmentally because of the repeated destruction of flora in the lake area. Considering the losses of project benefits and the environmental losses, this cannot be considered a viable alternative.

3.04 The alternative of removing some of the project facilities (Plan C) would restore somewhat the pre-existing environment. The environment cannot be restored exactly as it existed. The pre-existing environment was not so unique or valuable as to justify the expenditure of sufficient funds to achieve this objective. Further, economic losses to the nation and the area of the project from its abandonment make this an undesirable alternative. In addition, cessation of power generation would adversely affect the segment of the regional population dependent upon this service for fulfilling needs during peak power requirement periods. In view of the tremendous problems and monetary and intangible losses which would be associated with the discontinuance of flood control, power production, and navigation, this alternative is not viable.

3.05 In addition to the above listed alternatives, Clarks Hill Lake could be operated solely for power generation without regard to flood control, recreation, navigation and other uses (Plan D). The project could be operated solely for recreation or solely for navigation without regard for the other authorized project purposes. However, in order to operate the project solely for one project purpose without regard for other authorized purposes would be contrary to the laws that authorized the project. Also, it is quite obvious that any beneficial effects gained by operating Clarks Hill Lake solely for one project purpose without regard for the other authorized project purposes would be far outweighed by the tremendous adverse affects this action would have on the other authorized project purposes.

3.06 Within each of these plans, there are a number of categories in which alternatives are available. These are alternatives to:

- Management of land resources and facilities.
- Enforcement of regulations.
- Development and expansion of recreation areas.
- Forest Mangement.
- Fish and wildlife management.
- Cultural resource management.
- Management of leases, easements, and the outgrants.
- General outgrants and leases.
- Project management and maintenance activities.
- Alternatives to lake zoning.
- Alternatives to sewage disposal.
- Solid waste disposal.
- Control of undesirable vegetation.
- Control of terrestrial vegetation.
- Control of insects.
- Construction and maintenance of project roads.

Each of these categories is considered in detail below.

3.07 Enforcement of regulations. The following alternatives are primarily those presently possible with the existing authority of the Corps of Engineers, since with present experience and knowledge, these are the most reasonable alternatives. It should be noted that these alternatives are for enforcement of the applicable provisions of Chapter III, Title 36, Code of Federal Regulations and not other Federal and State laws.

3.08 A no enforcement alternative is not realistic. The regulations were designed so that maximum desirable public use (recreation, etc.,) can be made without one individual imposing upon the rights of another. It is obvious that the impact of this alternative is of such a significant adverse magnitude that it would outweigh any desirable impact.

3.09 Prior to June 1972, a requesting compliance method was used. The policy under which this method was implemented is Violation of Rules and Regulations. Persons who violated the rules and regulations were courteously informed that they were acting in violation thereof and were requested to desist from the violation. The admonition was accompanied by an explanation of the reasons for the regulation and the need for conformance in order that others having equal rights could enjoy the lake and project area. If it were a matter of applying for a permit or similar action, assistance was offered. When, in the opinion of the Resource Manager, action on the part of enforcement agencies was required, a report was made to the Resident Engineer to send a written warning to the violator and if this was disregarded, obtain assistance from appropriate law enforcement officers.

3.10 The advantages with this method were that most people would comply when requested to do so and few problems with actual enforcement were encountered. Many of the provisions of Chapter III, Title 36, Code of Federal Regulations, are not State or local statutes, thus they can only be enforced by Federal law enforcement officers. The FBI, U.S. Marshals, etc., have a heavy workload and little time for the minor cases on the project; unfortunately,

this is also true of many local and State law enforcement officers. Therefore, there was often nothing that could be done except to request compliance. Due to these factors a Citation Authority program was implemented in June 1972 with good results.

3.11 The basic advantage of the Citation Authority Program is that it gives a tool which can be used to ensure compliance with the regulations. With this alternative, there is a method whereby persistent violators may be dealt with. The disadvantages with this alternative are as follows: (1) Officers could become involved in situations where their authority is not adequate; and (2) Officers implementing the program may, at times, be subject to considerable danger.

3.12 If the need arose, Congress could authorize the development of a complete law enforcement program, granting the Corps representatives the right of arrest and power to enforce all laws and regulations. Because of the expense and the problems with overlapping jurisdiction, this is not desirable at all times.

3.13 Development and Expansion of Recreation Areas. The first alternative to development or expansion of recreation areas would be no new recreational development. This course of action, while eliminating the need for recreation development funding, would greatly reduce the existing recreational potential of the lake and public lands. If the trends in visitation continue to rise, with no further development of public lands suitable for outdoor recreation activities, there would be an increase in usage of existing public use areas. The result would be a decrease in the aesthetic quality of the site due to overutilization and degradation of the site through soil compaction, erosion, loss of vegetation, vandalism, etc.

3.14 A second and more feasible alternative would be to develop new recreation areas with the emphasis on minimum alteration of the site. All facilities would be placed in such a manner as to blend into the natural surroundings. This alternative is the present policy for the development or expansion of recreation areas. This type of development also involves related forest and wildlife management considerations, thus providing for human visitor enjoyment as well as wildlife habitat requirements.

3.15 A third alternative would be to limit the number of visitors to a recreation site on a "reservation" or "first-come first-served" basis. Should present visitation trends continue, this type of program may be necessary to ensure preservation of the environmental quality of the project facilities.

3.16 Forest Management. The most apparent alternative to having a forest management program on Corps of Engineers projects is to have no forest management program.

3.17 The alternative of having no forest management program or in some cases, not to plan for forest management, would be contrary to sound land management practices. Therefore, a policy of no forest management would not be in the best public interest. The most feasible alternative, and the present course of action, is to prepare a forest management plan and implement the program.

3.18 There are varying degrees of forest management, from mere maintenance of existing stands to intensive management of the total forest community. Alternatives involving forest management and the intensity would depend upon the type of activity, i.e., recreation, wilderness area (no management), commercial harvesting, etc., for which the area is most suitable, and the extent of man's influence.

3.19 Guidelines have been established at Clarks Hill in accordance with the detailed requirements furnished in appendix B to the Master Plan-Forest Management Plan for Clarks Hill Lake Project, Georgia and South Carolina.

3.20 This forest management plan places the emphasis on wildlife, low density recreation, erosion control, watershed protection, aesthetics, and improvement of overall vigor of residential stand. Silvicultural practices are carried out to achieve these goals without regard to monetary gain. Protection of the environment, regardless of economic gain, is of prime importance.

3.21 Fish and Wildlife Management. At the Clarks Hill project, thousands of acres of valuable wildlife habitat are owned by the U.S. Government. Therefore, land management techniques practiced on this project will have significant impact upon wildlife in the area.

3.22 The first alternative to the proposed actions for fish and wildlife management is a complete lack of management and a continuation of the outleasing program as in the past. The effect of "no management" actions on fish and wildlife populations may be either beneficial or detrimental to wildlife, depending upon both the type of land-use patterns established by lessees on project lands and the type of land management activities carried out by landowners on adjacent private lands.

3.23 Under "no management" combined with an agricultural and grazing lease program, all of the land use practices on the project would be manipulated for the purpose of providing a profitable monetary return for lessees and not for the purpose of managing the environment for wildlife. However, as a result of lessee operations, valuable game habitat may be provided on Corps of Engineers land as a by-product of farming or grazing practices. For example, the cultivation of various agricultural crops may provide food sources for a variety of game birds, nongame birds, mammals, and proper animal unit density on grazing tracts will leave valuable cover in the areas for concealment and nesting activities. Similarly, negative habitat conditions could very easily occur on areas leased by private citizens if crops that are unpalatable to wildlife are cultivated or if adverse agricultural methods are used by the lessee.

3.24 Another alternative is the "no management and no leasing" which would let the land lie fallow. This would have both beneficial and adverse effects. A complete absence of game fish management would be detrimental to the sport fishery at these projects. Rough fish would overpopulate the available habitat and game fish progeny, faced with the task of competing for necessary food and space, would be drastically reduced. Therefore, an absence of fisheries management would be detrimental to the sport fishery.

3.25 A third alternative would be to have a management system controlled to some degree by the Corps of Engineers. The design could be a comprehensive wildlife management program in which the Corps was the primary agency responsible for its operation, or the plan could call for varying degrees of management between the Corps of Engineers and various professional wildlife agencies.

3.26 Cultural Resource Management Program. The most apparent alternative to having a Cultural Resource Management Program on Corps of Engineers projects is to have no Cultural Resource Management Program. The alternative of having no cultural resource management would be inconsistent with the Reservoir Salvage Act of 1960 (Public Law 86-523) (74 STAT 220), as amended, National Historic Preservation Act of 1966 (Public Law 89-665) (80 STAT 915), as amended, National Environmental Policy Act of 1969 (Public Law 91-190) (83 STAT 852) and Executive Order 11593, Protection and Enhancement of the Cultural Environment (36 F.R. 8291, 15 May 1971). Therefore, a policy of no cultural resource management would not be feasible or in the best public interest.

3.27 The chosen alternative is to have a Cultural Resource Management Program. By having a Cultural Resource Management Program and strictly adhering to its objectives, it will insure the best possible protection for the cultural environment, provide a means to reach the Corps of Engineers' total environmental goals, and be in the best public interest by preserving these resources for future generations.

3.28 Alternative to Management of Leases, Easements and Other Outgrants.

3.29 General Outgrants and Leases. The first alternative concerning general outgrants and leases would be to cancel all outgrants which specifically exclude some uses of the area by the general public. Such action would result in the cessation of water withdrawal, the abolishment of powerlines presently crossing Federal Lands, and the closing of any existing gravel pits. This could adversely affect that segment of the regional population receiving electric and water services, and could increase the cost involved in county road construction and maintenance.

3.30 The best proposal is to require all entities seeking outgrants to restrict their alteration of the environment to a minimum, i.e., place powerlines underground and seed grass and/or plant trees after burying lines and to provide vegetative screens to obscure aesthetically displeasing structures or alterations. At the present time, this course of action, with some modifications, is being implemented.

3.31 Alternatives to Project Management and Maintenance Activities.

3.32 Alternatives to Lake Zoning. The first alternative to lake zoning is to leave the project lands unzoned. The disadvantage of this alternative is that each individual action must be evaluated in depth. This involves repeating the same type of evaluation over and over. Also, with no zoning, it is more difficult to systematically evaluate and coordinate activities, such as granting boat dock permits, duck blinds, etc.

3.33 The advantage of this system is that the cost and effort of designing the zoning plan is eliminated.

3.34 The chosen alternative is to continue designing and implementing zoning plans where they are applicable in accordance with the Clarks Hill Lakeshore Management Plan. The disadvantage of the alternative is that it requires detailed in-depth planning which is time-consuming and expensive. The advantages of this alternative are of two types as follows: (1) it provides a systematic way to evaluate and coordinate activities with the overall O&M Program; and (2) it is a good means to control and/or provide for an activity. An example of this would be providing special accommodations for handicapped individuals, zoned parking areas, etc.

3.35 Sewage Disposal. The first alternative would be to make no provisions for sewage disposal. If this alternative were implemented, it would result in serious health and sanitation problems as well as aesthetically displeasing conditions.

3.36 The second alternative is the one presently being used. This basically consists of periodically pumping the sewage holding vaults and septic tanks and depositing the waste in surrounding municipal treatment facilities where it receives secondary treatment. The advantage of this alternative is that the sewage is dealt with in such a manner that it does not create a pollution problem.

3.37 A third alternative would be construct and operate a facility for the treatment of all the sewage generated on the project. The advantage of this alternative is that it definitely would ensure the proper treatment of the sewage. The disadvantage with this system is that the quality of the treatment would probably not be improved and the treatment cost would be increased.

3.38 Solid Waste Disposal. The problems associated with the disposal of refuse in recreational areas are, under the best of circumstances, often difficult. The method to be used for disposal should be governed by the characteristics of the development and determined by careful study and analysis of the problems involved. The present method of solid waste disposal in a State approved sanitary landfill appears to be the best solution to the solid waste problem at this time. However, other alternatives, while not as feasible or desirable, are described below.

3.39 An alternative to the cleanup practices used by the Corps would be to leave the trash in the area; however, this creates health hazards and eyesores and is neither acceptable to the general public nor capable of meeting State Health Department regulations. Other possible alternatives to the present cleanup method implemented at Clarks Hill are as follows: (1) reclamation of old borrow areas for sanitary landfills; (2) utilization of existing landfills of nearby communities; (3) use of high temperature incinerators; (4) use of a compaction system; or (5) composting.

3.40 High temperature incinerators may be utilized for solid waste disposal in the future; however, the expense of operating incinerator units is very high.

3.41 Compaction systems designed to reduce the volume of solid waste could be utilized in conjunction with one of the above-mentioned techniques; however, the cost of this method of disposal is also very high, and still leaves the task of disposing of the material.

3.42 The composting of solid wastes may be an acceptable solution to the solid waste problem; however, this is also an expensive method of disposal.

### 3.43 Control of Undesirable Organisms.

3.44 Aquatic Vegetation Control. Aquatic vegetation has not been a problem at Clarks Hill because of a relatively small surface area of shallow water, paucity of certain nutrients and fluctuating water.

3.45 Terrestrial Vegetation Control. No control would be an alternative. The disadvantage would be that undesirable vegetation would soon become tall and dense, thereby reducing the aesthetic value of areas where mowing could not control vegetation. Such areas would include recreation sites, guardrails, roadside slopes, structures, and other project lands. Objectionable insects and other pests would utilize such vegetation for breeding areas, and fire hazards would develop.

3.46 A second alternative would be to use methods such as grazing, brushhogging, grass whips, lawnmowers, etc. The advantage with this alternative is that no chemicals are used. The primary disadvantage is that many areas cannot be reached with mechanical devices and some areas are not suitable for the use of grazing. Fire is used for thinning large stands of timber and is the only practical means of controlling the understory vegetation in large forested areas.

3.47 The third alternative is chemical control of undesirable vegetation. The advantages of this alternative are that it is cheap, fast and effective. The disadvantages are potential pollution hazards through misuse and the possible side effects of the chemicals on desirable plant and animal life.

3.48 The preferred alternative is to use a combination of mechanical and chemical control measures. With this alternative each case may be considered individually, and the method of control with the fewest undesirable effects selected.

3.49 Insect Control. The first alternative is to have no insect control program. The disadvantage is that, without controls, insect and other health related pests pose a serious nuisance and health hazard to the visiting public. Furthermore, the responsibility for mosquito control was delegated to the Corps by both Georgia and South Carolina prior to construction of this project. Advantages would generally stem from decreased expenditures.

3.50 The second alternative would be to develop an insect control program with emphasis on biological pest management (encouragement or stocking of insect predators, diseases, and parasites), with supplementary usage of pesticides for heavy infestation. This is a desirable alternative, but biological insect control is a relatively new field, and the techniques of management have not been developed to the point that biological control can

be depended upon. If, in the future, biological control is developed to the extent that it is feasible, it will be considered.

3.51 The third alternative is the control measures now being used and is the system described in paragraph 5.42 of this statement. The advantage of this system is that the insects are dealt with in such a manner that they do not become a major problem.

3.52 Construction and Maintenance of Project Roads. The first alternative is not to construct or maintain any roads on the project. This alternative would eliminate the possibility of new or expanded public use areas. Also, the elimination of maintenance on existing roads would create safety hazards as well as decrease visitor pleasure.

3.53 A second alternative would be to continue with the present system. With this system, the main roads are bituminous-surfaced with superelevated curves, while the secondary roads are hard-surfaced without superelevated curves. In addition to the hard-surfaced roads, there are assorted dirt and gravel roads. There are several advantages with this alternative. High-quality roads are provided for the public. Dust levels are reduced and access to the public land is available with greater ease to larger numbers of the public. There are several disadvantages to this alternative. High-quality (highway type) roads are very expensive to construct and maintain. The design of the primary roads encourages higher rates of speed, thus creating visitor safety hazards. Also, they may adversely affect the "natural character" which is desired in most public use areas.

3.54 The preferred alternative is to blend roads in with the surroundings by constructing them with more curves, and keeping them on the contour as much as possible. Narrow roads (22 feet), as compared to wider (24 feet) roads, disturb less terrain and are more aesthetically pleasing. Roads should be designed so that they meet the need, but do not exceed requirements. The advantages of this alternative are: (1) funds would be better utilized, i.e., lower costs to accomplish desired objectives; and (2) the "natural character" of public use areas would be preserved. The disadvantage of this alternative is that it would require specialized studies to determine the types of roads required. Also, construction methods and specifications for the varying types of roads would need to be determined as well as increased maintenance of secondary roads.

3.55 Plans Considered in Detail: Each of the four major plans considered is discussed below. It should be remembered that each of the subalternatives, listed in paragraph 3.06 above, can be attached to the separate plans. This provides for a total of 93 separate plans available.

3.56 Plan A - Continuing with the Present Operation and Maintenance Of Clarks Hill Lake Project. This alternative is considered to be not only the best choice from the environmental point of view, but also the most economically advantageous for the area. The estimated annual benefits, including both the consumptive and nonconsumptive recreational benefits, using 1970-1972 average attendance amounted to \$159,500. The estimated average annual costs for a similar period including personal wages, equipment, subimpoundments, fishing piers, maintenance, creel census and temperature data, was approximately \$81,000. A benefit/ cost ratio becomes 1.97.

3.57 In the present plan, Clarks Hill Lake provides flood control, hydroelectric power, navigation, opportunity for land resources management, recreation, low water control, insect control and flottage removal.

3.58 Flood Control. Operation of the project for flood control is in accordance with the Reservoir Regulation Manual for Savannah District and as directed by the District Engineer. Although floods may occur in any season, they are most likely to occur in February and March and in connection with hurricanes during August, September, and October.

3.59 Water releases from the lake during flood periods will normally be limited to releases required to meet contract power commitments. When the lake level is above maximum power pool, water will be stored and released from the flood control pool in accordance with the Reservoir Regulation Manual. Storage and release of water impounded above elevation 300 feet may be controlled by tainter gate operations alone, if necessary. Ordinarily, releases will be through generation of firm power commitments and/or secondary energy, with tainter gate operation being reserved as an emergency measure.

3.60 Clarks Hill provides flood protection for the towns and lands along the Savannah River below the dam. The maximum discharge that can occur through the outlet works without downstream flooding is approximately 30,000 cubic feet per second (c.f.s.). The flood control storage of the lake (390,000 acre-feet) can be expected to be utilized once every 5 years (taken from pool elevation probability curve for Clarks Hill Lake).

3.61 Hydroelectric Power. The present total installed capacity of the dam is 280,000 kilowatts. The power operation is subject to such regulations concerning the maximum and minimum release of water from the lake for flood control and stream regulation as may be established from time to time by the Corps of Engineers. Estimates of energy available, based on stream flow and storage, are furnished the marketing agency, the Southeastern Power Administration, at weekly intervals.

3.62 When the inflow is such that firm commitment generation only would result in the lake rising above rule curve elevations, secondary energy will be generated in the amounts up to the limit of the nominal installed capacity to bring the pool elevation down to the rule curve. When the lake is below rule curve operating levels, power generation releases, supplemented by the incremental flow between Clarks Hill and New Savannah Bluff will be such as to provide a minimum flow of 5,300 c.f.s. at Butler Creek for navigation. Usually generation for firm contract commitments will provide adequate releases but supplemental secondary power may be generated if necessary to provide the minimum flow. This operation will be followed unless critical drawdown conditions exist and it is determined that lake releases should be limited to those which will provide a minimum of 3,250 c.f.s. at the water intake of the Atomic Energy Commission's Savannah River Plant. This situation will be extremely rare, but it may occur and during such periods the marketing agencies will be so advised in order that they may make arrangements for meeting firm contract commitments by purchase from an alternate source.

3.63 Navigation. A minimum flow of 5,800 c.f.s. is required below New Savannah Bluff Lock and Dam for navigation. The Clarks Hill discharges are regulated to meet this minimum with reregulation provided at Stevens Creek Dam. A discharge of 6,300 c.f.s. is normally provided 80 percent of the time.

3.64 Maintenance of the Project with Related Structures and Facilities. Maintenance of Clarks Hill project with related structures and facilities is performed in accordance with the Operations and Maintenance Manual, Clarks Hill and Hartwell projects, Corps of Engineers, March 1969. The manual provides for the inspection and maintenance of the earth embankment, spillway, control works, cranes and hoists, buildings, grounds, water supply and sewage disposal systems, electrical system, radio communication system, and various types of vehicles and equipment for administration and maintenance of the project. The manual also provides an inspection checklist which includes maintenance to be performed and supplemental information concerning principles relative to maintenance practices and methods of repairing and maintaining a clean, orderly condition both from an operational and aesthetic standpoint.

3.65 Land Resource Management. The project lands are to be allocated to provide for sound development and resource management practices consistent with the authorized project purpose and the intent of the National Environmental Policy Act of 1969. The Master Plan for Clarks Hill Lake presents the layout and plans of the existing and future planned developments for the project lands. The Savannah District is currently in the process of updating the Master Plan to include consideration of current and future recreational demands.

3.66 The project lands are zoned so that they may be better utilized to fulfill the present and foreseeable future public demands and to assure the maximum sustained benefits for the greatest number of people.

3.67 Project land is allocated on its highest and best use. Lands may be allocated for both interim and ultimate use or in some cases of nearly equal resource values, dual allocations may be required. The project land has been subdivided into one or more of the following allocations: Project Operations; Recreation-Intensive Use; Recreation-Low Density Use; Sensitive Areas; and, Wildlife Management. In general, those lands not required for the operation and administration of the project structures are zoned upon the basis of their potential to be utilized for outdoor recreation by the public.

3.68 Recreation. The overall Recreation Management Program attempts to provide the visitor with a safe and wholesome outdoor recreational environment. The basis of this program is the enforcement of regulations of Chapter III, Title 36, Code of Federal Regulations; zoning of project lands and water to provide an optimum mix of recreation and fish and wildlife benefits; and the operation and maintenance of recreation areas.

3.69 The operation and maintenance of the recreation areas involves the removal and disposal of solid waste and sewage from park facilities; control of undesirable vegetation; insect control through the elimination of pest breeding habitat and judicious applications of pesticides; construction and

maintenance of project roads; and the maintenance and expansion of recreation areas and facilities.

3.70 Low Water Control. An average weekly flow of about 6,000 c.f.s. is required from Clarks Hill for the navigation project on the Savannah River below Augusta. This flow, supplemented by daily low flow releases from station service units, leakage, seepage, and runoff from the area between Clarks Hill and New Savannah Bluff Lock and Dam, will provide about 6,300 c.f.s. at the latter location, as measured at the nearby Butler Creek gage. During extremely dry periods, outflow from Clarks Hill may be reduced to the extent necessary to maintain a flow of only 5,800 c.f.s. at Butler Creek gage. These curves, which are based on a study of the 1925-1927 critical dry period, show the limiting values of pool elevations at Clark Hill and Hartwell below which this flow reduction may be initiated and above which it may be terminated. During the 56-hour weekend period, the navigation flow is maintained by releases from available storage from the Stevens Creek pool of the South Carolina Electric and Gas Company supplemented by off-peak releases from Clarks Hill. During normal periods, releases from storage at Stevens Creek between maximum power pool (elevation 187) and minimum power pool (elevation 183.2) which amounts to 5,170 c.f.s., are supplemented by 8,820 c.f.s. from the main units at Clarks Hill. The minimum Clarks Hill releases on either Saturday or Sunday will be 3,000 c.f.s. in which event the remainder of 5,820 c.f.s. will be released on the alternate day.

3.71 Malaria Mosquito Control and Flotage Removal Operations. Mosquito breeding is almost entirely limited to waters containing submergent and emergent vegetation and flotage. In order to minimize the mosquito breeding potential, measures such as marginal drainage, regrowth control and removal in shallow areas and drift removal will be employed as needed. Mosquito control operations also consist of larviciding areas of the lake within flight range of population centers and areas having a high mosquito potential. During summer floods it may be necessary to employ emergency larviciding to prevent heavy mosquito production in vegetated areas. Delineation of all areas to be larvicided is based on entomological data. Larviciding practices, as approved by the respective State Departments of Public Health, are employed where larviciding is required. Contract aircraft is utilized for the distribution of larvicides.

3.72 Operation and Maintenance Expenditures. The average annual expenditures of the operation and maintenance between 1976 and 1980 at Clarks Hill have been \$3,196,439.

3.73 Plan A includes the following subalternatives:

- a. Recreation management.
- b. Enforcement of regulations.
- c. Development of new recreation sites with the emphasis on minimal site alteration.
- d. Continuation of a forest management plan emphasizing wildlife, low density recreation, erosion control, watershed protection, aesthetics, and sound silvicultural techniques, incorporating the best management practices.
- e. Fish and wildlife management including techniques designed to increase fish and wildlife production.

f. Cultural Resources management for the preservation of historic and archaeological artifacts.

g. Wise management of leases, easements, and other outgrants consistent with the Master Plan for the Clarks Hill project.

h. Continuation in designing and implementing zoning plans in accordance with the Clarks Hill Lakeshore Management Plan.

i. Control of sewage disposal by periodically pumping holding vaults and transporting to nearby municipal treatment facilities.

j. Disposal of solid waste in a State-approved sanitary landfill.

k. Monitoring of aquatic vegetation to forecast when problems may occur.

l. Control of terrestrial vegetation by both mechanical and chemical measures.

m. An insect control program specifically designed towards control of mosquitos including marginal drainage, regrowth control, flotage removal. These measures as well as the judicious use of larvicides will help to prevent heavy mosquito production.

n. The planning and construction of roads to blend with the surroundings in an aesthetically pleasing and environmentally favorable manner.

3.74 Plan B - Operation of the Project as a Dry Lake: The advantages of this plan are that, over time, the directly impacted area would revert to its natural successional sequence. This could take decades to naturally occur.

3.75 The disadvantages to this plan are the loss of the authorized water supply benefits and recreation areas. The flood control benefits of the structure would not be utilized. In addition, the seasonal filling and emptying of the area would have a cyclic effect on the aquatic organisms present. The full potential of the area, including the dam, would not be realized as it has been in the past.

3.76 Plan C - Removal of Some of the Project Facilities: The loss of the benefits provided by the lake, including energy, recreation and flood control, is not offset by the gains made to the surrounding area. Due to the large expenditure of funds to accomplish this plan, this alternative is not considered viable.

3.77 Plan D - Operation of the Project Solely for one Commodity.

Clarks Hill Lake could be operated solely for power generation without regard to flood control, recreation, navigation and other uses. The project could be operated solely for recreation or solely for navigation without regard for the other authorized project purposes. However, to operate the project solely for one project purpose without regard for other authorized purposes would be contrary to the laws that authorized the project. Also, it is quite obvious that any beneficial effects gained by operating Clarks Hill Lake solely for one project purpose without regard for the other authorized project purposes would be far outweighed by the tremendous adverse affects this action would have on the other authorized project purposes. Therefore, these alternatives are not considered viable.

#### 4.00 AFFECTED ENVIRONMENT:

4.01 Savannah River Basin. The Savannah River Basin is a long, relatively narrow basin, with the long axis lying in a northwest-southeast direction. The length of the basin is about 250 miles and the maximum width is about 70 miles. The total area of the basin is 10,579 square miles, of which 179 square miles are in North Carolina, 4,530 square miles in South Carolina, and 5,870 square miles in Georgia. The Savannah River is formed by the confluence of the Seneca and Tugaloo Rivers which have their headwaters on the southern slope of the Blue Ridge Mountains in North Carolina just north of the boundary with South Carolina and Georgia. The river meanders in a southeasterly direction through the Piedmont Plateau and Coastal Plain and with certain of its tributaries forms the boundary between Georgia and South Carolina from the North Carolina State line to the Atlantic Ocean.

4.02 The lake is contiguous to Columbia, McDuffie, Wilkes, Lincoln, Warren, and Elbert Counties in Georgia and McCormick and Abbeville Counties in South Carolina. The estimated acreages for each county are included in table 3. The major tributary streams of the lake are presented in table 4.

4.03 General Topography and Geology of Area. The Clarks Hill Dam is on the Savannah River near the southeastern margin of the Piedmont Plateau region of Georgia and South Carolina, about 20 miles above the "fall line." Topography of the lake area is typical of the eastern Piedmont. The drainage pattern is dendritic and streams have reached a mature stage in the erosion cycle. Summits of the broad, rather flat-topped ridges between stream valleys are remnants of the old peneplain surface into which the valleys have been incised. The plane defined by these erosional remnants has a general elevation of about 500 feet above sea level near the damsite and slopes gently to the southeast. Stream gradients are rather steep with shoals and rapids common. Flood plains are developed only along the main trunk streams and are very narrow, except along the left bank of the Savannah below the mouth of Little River, Georgia, where there is a flood plain 1,500 feet wide.

4.04 Water Characteristics. The main stem of the Savannah River carries a considerable amount of sediment at practically all stages; however, the concentration of silt is much heavier during the rainy seasons and periods of high flows. During periods of very low flow the water is relatively clear. The Georgia and South Carolina Little River arms of the lake are much less silt-laden, both streams running reasonably clear during the dry seasons. The turbidity of the Georgia Broad River is somewhat similar to that of the Savannah River. Many of the smaller streams feeding the lake are reasonably clear under all conditions of flow.

4.05 Climate. The climate of the project area is temperate. Summer is quite warm and relatively humid. About 60 percent of the days in June, July, and August have maximum temperatures of 90°F, or above, and for about 6 days the temperature may reach 100°F. Minimum temperatures average in the upper sixties in June, July, and August. Fall is somewhat drier and cooler with days that are pleasantly warm and sunny and cool nights. Winters are mild with about one-half of the days in December, January, and February having freezing temperatures. The winter temperature seldom drops below 10°F

TABLE 3  
ESTIMATED LAKE ACREAGES BY COUNTY

	<u>Water Acreage at Elev. 330</u>	<u>Fee Acreage Above Elev. 330</u>	<u>Easement &amp; Use Permit Acreage Within Proj Bound</u>
<u>GEORGIA</u>			
Lincoln County	29,335	23,665	177
Columbia County	9,967	9,598	24
McDuffie County	3,901	10,394	4
Wilkes County	1,451	6,664	0
Elbert County	1,824	3,068	8
Madison County	0	0	1
Warren County	0	128	0

SOUTH CAROLINA

Abbeville County	56	902	1
McCormick County	21,049	27,765	1,866

Approximately 3,950 acres of riverbed not included in the above tabulation were inundated.

TABLE 4  
MAJOR TRIBUTARY STREAMS ENTERING CLARKS HILL LAKE

Savannah River, GA	Soap Creek, GA
Georgia Little River, GA	Lloyds Creek, GA
South Carolina Little River, SC	Murray Creek, GA
Georgia Broad River, GA	Fishing Creek, GA
Long Cane Creek, SC	Newford Creek, GA
Keg Creek, GA	Pistol Creek, GA
Clatt Creek, GA	Benningsfield Creek, SC
Big Creek, GA	Hawe Creek, SC
Hart Creek, GA	Baker Creek, SC
Cherokee Creek, GA	Buffalo Creek, SC
Grays Creek, GA	

and temperatures in the high seventies have occurred in every winter month. Spring is the most variable season of the year. Average temperatures increase around 25°F from March 1 to May 31. The average April has one morning with a freezing temperature. The cold fronts and squall lines of March and April initiate the severe weather of spring. This is the period having the greatest tornado frequency. The mean annual temperature is 64.4°F with a mean maximum of 75.2°F and mean minimum of 53.8°F. The average length of the growing season is 241 days with the mean date of the first fall freeze November 12 and last spring freeze March 16.

4.06 The mean annual precipitation is 48.10 inches. The driest period of the year is in October and November when there is little cyclonic storm activity. Less than 20 percent of the annual rain comes in the fall. Occasionally, a tropical storm passing along the coastal region will add to the sparse rainfall of this season. Rainfall increases gradually during the winter and reaches a peak in March when cyclone and cold front activity is at a maximum. There is a general decrease again to a dry period from late April through early June. From late June through early September, there is a wet period due primarily to thunderstorm activity which reaches a peak in July. The normal monthly rainfall between the Hartwell and Clarks Hill Dams is shown in table 5. This table is based on the arithmetical mean of the normals at 13 stations spaced uniformly over the area. The maximum, minimum, and mean annual precipitation and the period of record for three of these stations are shown in table 6. Snowfall, though occasional and light, is usually heaviest during the month of February. There is no record of an important flood occurring where melting snow appears to have contributed materially to the runoff. Snow seldom falls in the coastal regions of the basin. The prevailing wind of the summer months is from the south with an average velocity of 5.5 miles an hour. Northwest winds occur mostly during the colder months of the year in October, November, December, January, February, March, and April.

4.07 Evaporation. During warm weather, evaporation from the lake surface may amount to as much as 0.20 inch per day, which is equivalent to over 550 cubic feet per second when the pool is full or nearly full. An estimate of the evaporation from the lake is obtained by multiplying the land pan evaporation at the dam by 0.70.

4.08 Air Quality. The guidelines governing the control of air pollution in the project area are set forth in the Rules and Regulations for Air Quality Control, which is administered by the Air Quality Control Branch of the Department of Natural Resources for the Georgia portion of the project and by the Bureau of Air Quality Control, South Carolina Department of Health and Environmental Control for the South Carolina portion of the project. Presently, there is no permanent monitoring of air quality performed in the project area. Air quality sampling stations within a 50-mile radius indicate that the air quality meets the national secondary ambient air quality standards as set forth by the Environmental Protection Agency pursuant to the Clean Air Act, as amended. Standards are set for six pollutants: sulfur oxides, particulate matter, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen dioxide. The standards for the secondary ambient air quality are the highest standards and represent air quality requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants.

4.09 Noise Pollution. Noise pollution is not a serious problem within the project area and is no greater than that which would normally be expected in a recreational lake type area. Disturbances occur at infrequent intervals and originate from sources such as tourist traffic, timber harvesting operations, machinery operations for maintaining the project's facilities and power boats.

4.10 SIGNIFICANT NATURAL RESOURCES:

4.11 Water Quality. The States of Georgia and South Carolina have adopted Federally approved water quality classifications and standards in compliance with the Federal Water Quality Acts of 1964, 1965, and 1972. The Georgia Environmental Protection Division (EPD) of the Department of Natural Resources has classified Clarks Hill Lake as recreational waters and has classified the Savannah River from Clarks Hill Dam to the 13th Street Bridge in Augusta, Georgia, as drinking waters. The South Carolina Department of

TABLE 5  
NORMAL MONTHLY AND PERCENT OF ANNUAL  
RAINFALL, SAVANNAH RIVER BASIN BETWEEN  
THE HARTWELL AND CLARKS HILL DAMS

Month	Inches	Percent of Normal Annual
January	4.39	9.13
February	4.59	9.54
March	5.02	10.44
April	3.95	8.21
May	3.34	6.94
June	3.84	7.98
July	4.93	10.25
August	4.48	9.32
September	3.31	6.88
October	2.82	5.86
November	2.80	5.82
December	4.63	9.63
Annual	48.10	100.00

TABLE 6

MAXIMUM, MINIMUM, AND MEAN ANNUAL  
PRECIPITATION FOR THREE REPRESENTATIVE STATIONS  
BETWEEN THE HARTWELL AND CLARKS HILL DAMS

	Period or record (years)	ANNUAL PRECIPITATION				
		Mean (inches)	Maximum (inches)	(year)	Minimum (inches)	(year)
Calhoun Falls, Sc	75	45.84	79.72	1929	28.60	1954
Washington, GA	90	46.16	87.24	1929	31.81	1954
Hartwell, GA	53	50.15	68.50	1929	3.41	1925

Health and Environmental Control has designated the waters of Clarks Hill Lake as Class A and the waters of Savannah River below Clarks Hill as Class B. Appendix C provides a comparative listing of the criteria set for recreational and Class A waters, and a comparative listing of the criteria set for drinking and Class B waters.

4.12 A water quality monitoring program for Clarks Hill Lake was initiated by the Savannah District Corps of Engineers in 1969 and continued through 1974. The program involved monthly grab samples at locations on various streams flowing into the lake, within the lake proper, and locations below the dam. These investigations included measurements of water temperature, dissolved oxygen, pH, conductivity, turbidity, and total iron and manganese concentrations. The monitoring was not continuous at each location throughout the entire period; however, the data are sufficiently representative to be used for study purposes. In addition, an automatic water quality monitor for sampling temperature, dissolved oxygen, pH, and conductivity of releases was installed downstream of the dam in August 1971. The data obtained from these studies has been published in "Savannah River Basin Water Quality Investigations Data Report," March 1969 and its four supplements.

4.13 The water quality of Clarks Hill Lake generally exceeds the established criteria. No excessive concentrations of dissolved minerals have been observed in the release waters, nor have the criteria set for pH, temperature, bacteria, and solids been violated. However, during the late summer and early fall months, the dissolved oxygen levels of power generations releases may be as low as 1 to 2 ppm due to stratification.

4.14 As part of the National Eutrophication Survey, Clarks Hill Lake along with 14 other lakes in Georgia were analyzed to determine their trophic condition by the Environmental Protection Agency. The resultant data was published in Report on Clarks Hill Reservoir, Working Paper No. 287, September 1976. The overall data indicate Clarks Hill Lake can be generally classified meso-eutrophic. However, because of the size of the lake, there are several trophic degrees exhibited. Mesotrophy is indicated in the lower portion near the dam, meso-eutrophy is evident in the midreaches, and eutrophy is indicated in the extreme upper reaches and in the distal portions of some tributary arms of the lake.

4.15 Using six parameters as a basis of comparison, Clarks Hill Lake ranked sixth in overall trophic quality of the 14 Georgia lakes which were sampled. Of the 14 sampled, 7 had greater mean total phosphorous, 6 had greater median dissolved ortho-phosphorous, 8 had greater mean Secchi disc transparency. The respective values for Clarks Hill Lake were as follows: median total phosphorous 0.025 mg/l; median dissolved ortho-phosphorous 0.007 mg/l; median inorganic nitrogen 0.150 mg/l; mean chlorophyll a 6.715 ug/l; and mean Secchi disc depth 1.5 m. Although blue green algae are normally prominent in September, the survey limnologists did not observe surface concentrations of algae at that time or nuisance conditions during any of the sampling visits.

4.16 Similar to other deep impoundments in the southeast, Clarks Hill Lake undergoes a yearly cycle of stratification and destratification. From November to April, the water temperature is virtually uniform resulting in little variance in density. The winds that blow on the surface are thus able to circulate all of the water within the impoundment to the surface to contact the atmosphere and facilitate oxygen absorption. As a result, uniformly high oxygen levels are maintained throughout the entire lake during these months. With the onset of warmer weather, surface waters begin to warm up. Increased radiant heat is absorbed by the upper region of the lake, and inflowing waters also become warmer thus adding more heat to the surface water. At the same time, however, the lower layers of water remain cool because they are below the photic zone and removed from warming atmospheric temperature. Because cold water is more dense than warmer water, the warmer water "floats" on top of the cold layers. These two layers form a distinct stratification of the lake cross-section with the surface waters termed the epilimnion and the bottom waters termed the hypolimnion. The area between the epilimnion and the hypolimnion is the thermocline.

4.17 During the summer months the waters circulated by the surface winds are confined to the epilimnion. The hypolimnion is therefore effectively removed from an adequate source of reoxygenation, so therefore, as oxygen is depleted through decomposition of organic substances, the concentration of dissolved oxygen also drops. As summer progresses, dissolved oxygen concentrations may approach 0 ppm in August and September. As the atmosphere cools in the fall, the surface temperature also cools until a point is reached in late fall where densities become uniform and the waters of the lake "turnover" and completely destratify. After this fall turnover, the lake becomes isothermal with free circulation.

4.18 During stratification the water drawn into the penstocks comes from the oxygen deficient hypolimnion. Consequently, the releases from the dam are also low in dissolved oxygen. At Clarks Hill Lake, the periods of oxygen deficient releases normally lasts approximately 120 days. Although the lowest dissolved oxygen condition in the hypolimnion may reach 0 ppm, the lowest usually released is 1 to 2 ppm. The primary reason for this is that the dissolved oxygen profile of Clarks Hill Lake exhibits a "sandwich" layer flow phenomenon atypical of stratified impoundments with warm water influent.

4.19 This layer is apparently caused by the cold water release from Hartwell Dam located upstream. Upon entering Clarks Hill Lake, these waters, which have been aerated to near saturation levels, are cooler than the

epilimnion while slightly warmer than the deepest hypolimnion waters. They, therefore, move as a sandwich layer to the dam where they are discharged. The depth of the penstock withdrawal zone corresponds with the depth of the "sandwiched" layer during highly stratified periods. Consequently, the "sandwich" layer flow phenomena maintains a slightly higher dissolved oxygen level than that found in the hypolimnion waters immediately above and below it (Speece et. al., 1976).

4.20 Clarks Hill Fishery Resources. The portion of the Savannah River which was inundated by the formation of the lake was not important for fishing (U.S. Fish and Wildlife Service, 1946). The water was turbid during most of the year, and especially during summer. The type of fishing was limited for the most part to the use of live bait and the principal species taken were catfish, crappie, and sunfish.

4.21 The construction of Clarks Hill Dam subsequently altered the aquatic resources of the study area. Essentially, the impounded area above the dam was transformed into a lentic environment. The transformation from river to lake conditions and the change in aquatic habitats altered the fishery resources indigenous to the area. The most notable was the increase in game and sport fish populations such as largemouth bass, white bass, crappie, and sunfishes. Although various species of suckers and catfish also experienced population increases, the greatest increase was the preponderance of forage fisheries such gizzard shad. See appendix B for fish species of the project area. To further enhance the sport fishery resources of the lake and to utilize the abundance of forage species, the fishery departments of Georgia and South Carolina introduced striped bass, walleye, sauger, and yellow perch. Threadfin shad were introduced as forage fish to replace gizzard shad which grow too large for forage. Since the establishment of threadfin shad, hybrid bass (striped X white bass cross), brook and rainbow trout have been stocked in the lake.

4.22 The fisheries resource was also affected in the area downstream of the dam. The turbidity of this stretch of water was reduced and the quality of the fishery has increased. Recent creel studies indicate excellent fishing, at least seasonally, in the Clarks Hill tailrace; reported success rate is 2.4 fish harvested per angler hour (March-April). During this 2-month period in 1974, 8,400 hours were spent fishing in the immediate tailwaters. The fish species most commonly caught are bream, crappie, yellow perch, catfish, and hybrid bass. The presence of striped bass in apparent low numbers adds the prospect of catching a trophy fish.

4.23 Since the construction of the project, recreational sport fishing, has been significantly increased in fishing pressure and harvest both above and below the dam. The most recent census conducted in 1979 by the South Carolina Department of Wildlife and Marine Resources estimated that the Clarks Hill Lake proper received 513,680 fishing hours (7.34 hrs/acre) of pressure and 1,286,263 pounds (18.38 lbs/acre) of fish were harvested. In comparison to other man-made lakes, the quality of sport fishing at Clarks Hill Lake exceeds the mean catch rate of 0.85 fish/hour and 0.54 pounds/hour with an average weight of 0.66 reported by Jenkins and Morais (1971) for 103 reservoirs (table 7). Undoubtedly, one of the major reasons for the increased fishery resources at Clarks Hill Lake is the cooperative fishery management program with the Georgia and South Carolina fishery departments.

4.24 Past estimates of fish standing crops in Clarks Hill Lake have been obtained from cove rotenone sampling from 1954 through 1968. An evaluation of the samples over time shows that bass and bluegill, while fluctuating from year to year, did not reveal consistent increasing or decreasing trends in abundance over the 11-year period. Table 8 summarizes sampling in 1966, 1967, and the most recent sample taken in 1976. Data from 1976 samples reflect favorably in comparison with past data. A standing crop range of 100-150 lbs/acre is not as high as in some reservoirs; however, the ratio of game to nongame fishes is higher than in most and production is not tied up in nonutilizable resources.

TABLE 7  
CREEL SURVEY DATA SUMMARY

	1970 <u>2</u>	1971	1972 <u>3</u>	MEAN ON 103 <sup>4</sup> RESERVOIRS
<b>Effort</b>				
Total trips	--	--	--	--
Trips/ha (A)	--	--	--	--
Total hours	302,311	915,786	482,043	--
Hours/ha (A)	10.7 (4.3)	32.3 (13.1)	11.0 (6.9)	(30.4)
<b>Harvest</b>				
Total number	207,170	1,375,105	749,005	--
Number/ha (A)	7.3 (3.0)	48.5 (19.6)	26.4 (10.7)	25.1
Total kg	78,692	460,488	190,967	--
Total lbs	173,487	1,015,200	421,011	--
Kg/ha (lbs/A)	2.8 (2.5)	16.3 (14.5)	6.7 (6.0)	14.6
Average weight	.84 lbs	.74 lbs	.56 lbs	.66
<b>Success</b>				
Number/hr	0.69	1.50	1.55	.85
Kg/hr (lbs/hr)	0.57	1.11	0.87	.54

<sup>1</sup> Statistics recomputed for 28,329 ha (70,000 A) rather than 31,769 ha (78,500 A) as presented.

<sup>2</sup> Data represents only one-half of 1970 (1 July through 31 December).

<sup>3</sup> Data represents only first one-half of 1972 (1 January through 30 June).

<sup>4</sup> Jenkins, Robert M. and David I. Orais, 1971. Reservoir sport fishing and harvest in relationship to environmental variables. In. Reservoir Fisheries and Limnology, AFS Special Pub. No. 8, p. 371-384

TABLE 8  
CLARKS HILL COVE ROTENONE SAMPLING SUMMARY

LOCATION	1966	1967	1967
<u>Cliaatt's Creek</u>			
-- lbs/acre	103	115	141
-- % Game Fish	35	30	45
<u>Murry Creek</u>			
-- lbs/acre	107	85	97
-- % Game Fish	57	58	65

4.25 Commercial Fishing. Commercial fishing operations are permitted at Clarks Hill Lake by the State of Georgia. The most commonly caught and principal economic species include channel catfish, white catfish, flathead bullhead, brown bullhead, flathead catfish and carp. Additionally, large numbers of golden shiner, suckers, longnose gar, and gizzard shad are also taken. It is estimated that the commercial catch probably does not exceed 1,500 pounds annually.

4.26 Vegetation. The Clarks Hill Lake is located in the Oak-Pine Forest Region of the United States. The present vegetative cover is the result of an economic transition, the last phase of which was the abandonment of agricultural acreage and its subsequent conversion to grazing and timberland.

4.27 Since 1962, management has increased with the basic goal of establishment and maintenance of healthy vigorous stands of mixed species in order to provide improved wildlife habitat and enhancement of the recreational potential of the project as a whole. The major forest types present in order of ecological succession are pine, pine-hardwood and oak-hickory. The scientific names and other associated species are listed in appendix B.

4.28 The dominant forest type at Clarks Hill is the pine forest with loblolly pine and shortleaf pine existing either as pure stands or as a mixture. Slash pine, although not a native species, has been planted extensively on abandoned cropland along with loblolly pine under the reforestation programs sponsored by State and Federal Governments. Some isolated specimens of longleaf pine are found in the southern-most portion of the Clarks Hill project.

4.29 Wildlife. Prior to construction of Clarks Hill lake, populations of game and fur animals in the lake area were low to moderate. Deer and turkeys had limited stocking, but they were not present in harvestable numbers. The major species hunted included mourning dove, bobwhite quail, swamp and cottontail rabbits, and gray and fox squirrels. Other species of wildlife, while present in limited numbers, were not recreationally utilized. Generally, except on wildlife management lands, the overall wildlife potential was restricted by poor management.

4.30 Since initiation of management practices, wild turkey and whitetail deer have been steadily increasing in the area. Presently, deer, turkey, bobwhite quail, mourning dove, rabbit, squirrel, and a variety of nongame birds and animals are fairly common in the forest and fields around the lake. Several species of waterfowl also utilize the lake for resting and its coves and streams for feeding. These animals provide game for hunting and enjoyment to the sightseer and recreationist.

4.31 The Clarks Hill Management Program has been designed and developed to provide for long-range enhancement and sustained use of the aquatic and terrestrial resources. Of the total 80,610 acres of project lands, 35,965 acres have been zoned wildlife management with 20,258 acres being licensed to the Georgia Game and Fish Division and 12,812 acres licensed to the South Carolina Wildlife Resources Department as wildlife management area. The Corps' wildlife management responsibilities includes all those lands not outgranted to the states for wildlife management, regardless of their zoning designation. Working from the Fish and Wildlife Management Plan, Appendix D to the Clarks Hill Master Plan dated December 1973 and in cooperation with the South Carolina and Georgia Wildlife Departments, the Corps of Engineers has initiated several basic wildlife programs designed to improve wildlife habitat at Clarks Hill Lake.

4.32 The maintenance of approximately 160 permanent wildlife openings is one of the most beneficial projects. The foodplots, ranging in size from 1 to 40 acres, are planted in the fall and spring with a variety of quality wildlife foods to include browntop millet, dwarf sorghum, corn, chufas, winter wheat, winter rye, and clover.

4.33 Some of the larger wildlife openings are utilized as "seed management fields." These fields are planted and maintained for the production of seed to be used in planting annual wildlife foodplots the following season. The fields are usually cut just prior to the September dove season and then opened as public dove fields.

4.34 Waterfowl habitat improvement is another important project at Clarks Hill Lake. The Corps completed a 20-acre manmade subimpoundment near the headwaters of Fishing Creek, Georgia. The area can be drained and planted in the summer and then flooded in the winter to provide an abundant food supply for ducks. The same principle is used on six beaver ponds. The beaver ponds are drained in the summer and planted with Japanese millet. Once the millet matures, the beavers are allowed to reflood the area, thus providing another food supply for the ducks. The Corps has also installed 150 nesting boxes for wood ducks, to promote increases in local populations.

4.35 Two resident flocks of Canada geese have been established on Clarks Hill Lake. The South Carolina flock is composed of approximately 300 geese while the younger Georgia flock has 500 members. It is hoped that goslings hatched or reared by the original geese stocked from Lone Rock, Iowa, will accept Clarks Hill Lake as their new home and remain in the area year-round.

4.36 Bluebirds are also getting special treatment around Clarks Hill Lake. The Corps has installed 97 nesting boxes on public lands around the project. A survey conducted in May 1976, showed that 62 percent of these boxes were

being utilized by bluebirds. A wild turkey restoration project has been established at Bussey Point Nature and Wildlife Area on Clarks Hill Lake. It is a cooperative endeavor between the Corps of Engineers, Georgia State Department of Natural Resources, National Wild Turkey Federation, Georgia Wild Turkey Federation, and seven private landowners. This 2,386-acre peninsula in Lincoln county, Georgia, provided by the Corps of Engineers, is being managed to provide wild turkeys with suitable habitat. This area presently contains an abundance of mast-producing hardwoods and mature pines. In addition, the Corps has developed 19 foodplots to provide supplemental feeding areas. When the flock reaches desirable numbers, some birds may be trapped and transplanted to other sections of the State by Georgia Department of Natural Resources.

4.37 Threatened and Endangered Species. There are three different authorities to consider in evaluating threatened or endangered species which could be present within the Clarks Hill Lake project lands; Federal, State of Georgia, and State of South Carolina. Each of these maintains a list for wildlife with the Federal Government and Georgia maintains a plant list. South Carolina does not have legislation to establish plant lists. Current publications were reviewed to determine those species with likelihood of occurrence on the project lands.

4.38 In terms of wildlife, there are several species with likelihood of occurrence. The habitat of the red-cockaded woodpecker has been closely linked to overmature pine trees in excess of 50 years in age, especially those with the fungus infection known as red heart disease. There are stands of overmature pines found on project lands and two active colonies red-cockaded woodpeckers have been observed nesting in the Hawe Creek area. In conjunction with the Master Plan updating, formal consultation with the Fish and Wildlife Service has been initiated in order to determine the most desirable zoning classification for those areas inhabited by the red-cockaded woodpecker. While nesting by either the southern bald eagle or peregrine falcon has not been documented, southern bald eagles have been observed in the region.

4.39 The State of Georgia has a program for threatened or endangered plants. Table 9 is a summary of those threatened or endangered plants which may occur on project lands.

4.40 Lake personnel have been instructed to report all sightings of endangered species to the wildlife biologist so that special consideration can be given to insure their protection.

4.41 Cultural Resources. The upper Savannah River Valley in which Clarks Hill Lake is located is an area of substantial archeological and historical interest. Although few cultural resources investigations have been conducted in the Clarks Hill Lake project area, recent investigations in the neighboring Richard B. Russell Lake project area, have verified the rich cultural heritage of this portion of the Savannah River.

4.42 Smithsonian Institution archeologists made a survey of the Clarks Hill Lake area from January through May 1948 for the purpose of investigating and reporting on the archeological resources of the area to be inundated. As a result of the survey, which included preliminary exploratory excavations, a

TABLE 9

## PLANT PROTECTED BY STATE OF GEORGIA LIKELY TO BE FOUND IN AREA OF CLARKS HILL LAKE

COMMON NAME	SCIENTIFIC NAME	STATUS*	OCCURRENCE BY COUNTY WITH STUDY AREA	HABITAT
Amphianthus	<u>Amphianthus pusillus</u>	E	Columbia County	Granite outcrops in shallow, flat bottomed depression pools
Draba	<u>Draba aprica</u>	E	Columbia County	Shallow depression pools on our around granite outcrops
Spider Lily	<u>Hymenocallis coronaria</u>	E	Lincoln County	Along swamp margins, stream banks, shoals, and rock islands
Georgia Plume	<u>Elliottia racemosa</u>	E	Columbia County	Sand ridges, oak ridges evergreen hammocks and in one instance a sandstone outcrop
Oglethorpe Oak	<u>Quercus oglethorpensis</u>	T	Elbert and Wilkes Counties	Broad level areas along streams where flooding rarely occurs.
Sweet Pitcher-plant	<u>Sarracenia rubra</u>	E	Columbia County	Acid soils in open bags and Savannahs, and low areas in pine flatwoods
Stonecrop	<u>Sedum pusillum</u>	T	Elbert and Columbia Counties	Granite outcrops among mosses partially shaded by trees (cedars)

SOURCE: Georgia's Protected Plants, Georgia Department of Natural Resources, 15 September 1977.

\* E-Endangered, T-Threatened.

report, "Appraisal of the Archeological Resources of the Clark Hill Reservoir Area, South Carolina and Georgia," dated December 1948, was prepared by the Smithsonian Institution. A tabulated summary of all the sites reported in the archeological report is shown in table 10.

4.43 During the investigation, 128 archeological sites were found. The lake waters covered 70 of these sites. Due to the severely limited funding available and the rapidly rising lake waters, only two sites were partially salvaged; the Rembert Mound Group and the Lake Springs sites. The results of the Lake Springs site excavations are reported in "Preliminary Report, Lake Springs Sites, Shell Heap, Columbia County, Georgia." The materials salvaged from the Rembert Mound Group were never evaluated or reported upon and have since been misplaced.

4.44 The National Park Service made a study of the historic sites of the Clarks Hill Lake project area which culminated in a report entitled "Survey of the Historic Sites of the Clark Hill Reservoir Area, South Carolina and Georgia." The study located a number of fort sites, abandoned townsites, mills, mines, and other historic sites. Only one site, Fort Charlotte, was recommended for further study.

4.45 Joseph R. Caldwell conducted the salvage excavations of Fort Charlotte, an abandoned Revolutionary War period fortification. He reported the results of his investigations in "Archeological Investigations of Fort Charlotte, McCormick County, South Carolina."

4.46 Only a few cultural resources investigations have been conducted on Clarks Hill Lake project lands since the impoundment of the lake. These have been small scale reconnaissance- and survey-level investigations of areas of proposed development. The majority of these investigations located previously unrecorded cultural resources. Reports of these investigations are on file at the Savannah District office.

#### 4.47 Socio-Economic Characteristics

4.48 Population. During 1974 there were 2,523,800 people living within the study area. Of this number, 1,391,600 or 55 percent resided in the SMSA's. Total area population increased from 1960-74 by 18 percent for an average annual increase of 1.19 percent. About 77 percent of this growth occurred in the SMSA's. Data indicates that the Georgia population as a whole increased by 24 percent, South Carolina by 17 percent and the United States by 17 percent during the same 14-year period. Rural population declined steadily during this time.

4.49 Population projections indicate that the Clarks Hill region will experience moderate growth from 1980-2020. Only 11 of the 54 counties are expected to decline in population, these being predominantly rural in nature. The population in the entire impact area is expected to increase by 16 percent by 1990 and 40 percent of 2020.

4.50 Recreation. Clarks Hill Lake is one of the largest inland bodies of water in the South covering 80,610 acres of surface water with approximately 1,100 miles of shoreline at elevation 330. An additional 81,000 acres of land are associated with the project and approximately 14,874 acres of this

TABLE 10  
TABULATED SUMMARY OF SITES

	Lincoln Co.	Columbia Co.	Wilkes Co.	Elbert Co.	McDuffie Co.	McCormick Co.	Abbeville Co.	TOTALS
	GA	GA	GA	GA	GA	GA	SC	
Mound sites	1			1		1		3
Village sites	8	2	1	2		13	5	31
Campsites	7	4	2	1	1	4		19
Workshop sites	23	3	4	1	1	8		40
Possible prepot- tery sites	7	8	3	1		16		35
Traces	17	1	2		1	18		39

Village. A site which appeared to have been inhabited for some time and where any considerable number of potsherds were found.

Campsite. A locality which was probably inhabited for only a short interval or by a limited number of people. The amount of pottery or chipped stone artifacts is too small to warrant its being called a village.

Workshop. Where the presence of stone chips and rejects in some abundance suggested that this was the purpose of the site. The availability of stone is considered.

Possible prepottery site. A site with only artifacts of stone, some of which could be recognized as belonging to the Stalling's Island culture or earlier. Some of such sites were doubtless workshops and others may have been villages or camps.

Trace. (Not assigned a site number) A place where artifacts and chips were so scarce they were not put in any of the above categories.

are developed into public recreation park and access areas. The lake was built in an area with a comparatively well-developed network of county, State and Federal roads which invites sightseers into many points overlooking the lake. The natural beauty of its setting with its vegetative cover of mixed stands of pine and hardwoods; its irregular topography and shoreline with its large number of small ridge peninsulas and over 100 islands dotting the main water area; its large open water area; its mild climate; and its abundance of wildlife make the lake a visual treat enjoyed by the visitors year round for recreational activities such as fishing, boating, picnicking, swimming, camping, hunting, horseback riding, and many other outdoor recreational pursuits.

4.51 The development of recreational facilities at Clarks Hill Lake is based on the Master Plan for Public Use and Administrative Facilities. Through the implementation of this plan, the Corps has provided recreational facilities such as campsites, picnic areas, comfort stations and boat launching ramps for use to the general public. Also, through leasing and licensing, lands have been provided for recreational development by private enterprise, clubs groups and governmental bodies at city, county, and State levels. A list of existing recreational facilities including other descriptive data is provided in appendix D.

4.52 The number of visitors to the project increased regularly from 1955 until 1966 when the visitation was approximately 4,700,000, then a slump occurred in 1967 and 1968 sending the visitation down to 3,366,100. However, since 1968, the visitation has again been rising regularly each year to a record high in 1976 of 5,863,700 visitors which ranks the project for the 11th consecutive year among the ten most visited Corps projects in the nation. Most of these people visiting the lake come from the rural areas surrounding the lake for day use activities. Other visitors come from more distant urban areas such as Atlanta, Georgia (166 miles); Columbia, South Carolina (82 miles); and the Greenville-Spartanburg Area of South Carolina (100-120 miles).

4.53 Total Personal Income. In 1972, total personal income for the study area was \$7,188,725,000 (1967 Dollars), resulting in a per capita income of approximately \$2,930. Per capita income for Georgia as a whole in 1972 was \$3,252, for South Carolina it was \$2,882 and for the United States it was \$3,544.

4.54 Earnings. The major earnings categories in 1972 (excluding Government) for the 54 county area (both SMSA and non-SMSA counties) were Manufacturing, Wholesale and Retail Trade, and Services. This suggests that the impact area is more oriented toward industrial production and commerce rather than construction, agriculture or finance.

4.55 Projected earnings in Agriculture, Forestry, and Fisheries were obtained for 1980, 2000, and 2020. A 72 percent increase in agricultural earnings is projected from 1972 to 2020; this is somewhat lower than growth projected for other earnings categories.

4.56 Employment. The major occupations within the impact area in 1970 were Wholesale and Retail Trade, Manufacturing, Services, and Contract

Construction. In Manufacturing, the most important industries (by number of employees) were textiles, machinery, furniture, and chemicals.

4.57 Total employment for the impact area as of July 1976 was 952,745. Approximately 67,325 were unemployed out of a labor force of 1,100,070. This results in an unemployment rate of about 6 percent and a labor force participation rate of 40 percent. The unemployment rate was slightly higher in SMSA areas than non-SMSA's. Summary data on the economic description of the impact area is given in table 11.

#### 5.00 ENVIRONMENTAL CONSEQUENCES:

5.01 Reservoir Regulation and Flood Control. Floodwaters stored at Clarks Hill Lake for varying lengths of time and during different seasons (winter, spring, etc.) have killed many hardwood trees. The most important factor contributing to this condition is the time of year the trees are flooded. The mortality rate for deciduous trees flooded during the dormant season is much lower than for the same species of trees flooded during the growing season. (Yeager, 1949; Green, 1947; Hall & Smith, 1955).

5.02 The operation and maintenance of Clarks Hill Lake is not anticipated to have adverse effects on the social conditions in the project area. Population, housing, transportation, and educational and cultural opportunities will not be affected. Recreational opportunities have been enhanced. The generation of power has enhanced the socioeconomic conditions of the area.

5.03 Water Quality. The primary impacts of the continued operation and maintenance of Clarks Hill Lake on water quality are those resultant from hypolimnetic power generation releases during stratified periods. These releases are notably cooler and contain less dissolved oxygen than what would occur naturally without operation of the dam. The release of waters with lower temperatures has altered the temperature regime of the Savannah River below the dam.

5.04 As stated previously, the releases from Clarks Hill contain low dissolved oxygen levels from July until fall turnover in late October. In late summer and fall, dissolved oxygen concentrations in the release waters may reach as low as 1.0 ppm or 2 ppm. These hypolimnetic releases adversely impact the water quality of the Savannah River to a point downstream where the dissolved oxygen is recovered. Based on observations made over 10 years, dissolved oxygen concentrations in the Clarks Hill tailwaters fell below 6.0 ppm an average of 120 days per year (33 percent), below 5.0 ppm an average of 102 days per year (28 percent), below 4.0 ppm an average of 80 days per year (22 percent), and below 3.0 ppm an average of 40 days per year (11 percent).

5.05 Dissolved oxygen is recovered through aeration as the water flows downstream. Waters released from Clarks Hill Lake at dissolved oxygen levels of 1.0 to 3.0 ppm will recover to 4.0 ppm or more in about 13 miles. The recovery rate increases more rapidly at this point since considerable aeration takes place as the water passes over Stevens Creek Dam and the shallow rocky rapids above Augusta. A dissolved oxygen concentration of 5.0

TABLE 11  
CLARKS HILL STUDY AREA  
ECONOMIC SUMMARY DATA

Indicator		SMSAs <sup>1</sup>	Counties	Entire Area
1960	<u>Population</u>	1,100,332	1,046,321	2,146,653
1970		1,298,903	1,084,378	2,883,281
1974		1,391,600	1,132,200	2,523,800
1960-1974		+ 291,268	+ 85,879	+ 377,147
1980		1,459,000	1,163,000	2,622,000
1990		1,692,700	1,238,300	2,931,000
2000		1,855,900	1,289,600	3,145,500
2020		2,161,900	1,372,100	3,534,000
T.P.I.	<u>Income - 1972</u>	4,294,536	2,894,189	7,188,725
Per Capita	<u>\$(000)</u>	\$3192	\$2611	\$2930
(000)				
Agric.	<u>Earnings - 1972</u>	\$ 33,137	151,547	184,684
Mining		4,869	6,692	11,561
Constr.		266,999	104,454	371,453
Manufac.		1,060,828	915,649	1,976,477
Transp.		217,483	96,995	314,478
Trade		559,000	264,906	823,906
Fire		175,630	59,187	234,817
Services		484,906	223,440	708,346
Govt.		948,143	382,540	1,330,683
1980	<u>Proj. Earnings - Agric.</u>	37,800	166,100	203,900
2000	<u>Forestry, etc.</u>	\$ 44,500	202,300	246,800
2020		57,400	260,900	318,300
Agric.	<u>Occupation - 1970</u>	7,479	24,977	32,456
Mining		2,351	2,750	5,101
Construc.		36,610	29,435	66,045
Manufac.		146,041	167,607	313,648
Transp.		27,947	15,999	43,946
Trade		91,168	60,050	151,218
Fire		20,976	9,505	30,481
Services		147,555	93,571	241,126
Govt.		34,057	12,180	46,237
Furniture	<u>Manufac. Empl. -</u>	4,225	13,693	17,918
Machinery	<u>1970</u>	11,808	10,551	22,359
Textiles		52,244	95,935	148,179
Chemicals		10,790	5,536	16,326
# Empl.	<u>Employment - 7/76</u>	472,679	480,066	952,745
# Unempl.		37,036	30,289	67,325
Lab. Force		589,715	510,355	1,100,000 (2)

6.12%

(1) Incl: Macon & Augusta SMSAs

(2) Unempl. rate for area

ppm is usually attained 15 miles downstream of Clarks Hill Dam. The 6.0 ppm level is normally reached at about 22 miles below Clarks Hill and about 7.0 ppm at New Savannah Bluff Lock and Dam, 34 miles downstream.

5.06 During the last 4 years the Savannah District has been investigating various methods of increasing the dissolved oxygen content of hypolimnetic releases in order to meet State water quality standards. After studying various possible solutions, it was determined that oxygen injection was the most feasible method of meeting minimum dissolved oxygen requirements.

5.07 An initial study by Dr. Richard Speece, Professor of Environmental Engineering at Drexel University, determined that injecting gaseous oxygen continuously into the lake was the most appropriate method of increasing dissolved oxygen levels in releases. Based on the physical characteristics of Clarks Hill Lake, Dr. Speece proposed a prototype which would inject oxygen at a rate of 110 ton/day through diffusers located approximately 1 mile upstream from the dam.

5.08 Prior to testing the prototype, a system of injecting oxygen only when the turbines were discharging was tested and evaluated during the summer of 1975. This system, known as a pulsed-injection system, turns on and off when the turbines turn on and off. This test confirmed that turbine discharges can be raised to dissolved oxygen level of 6 to 8 ppm with an oxygen absorption rate of 85 percent with pulsed oxygen injection matching the water discharge rate.

5.09 In 1976 additional testing, consisting of three phases, was conducted. Phase I was an oxygen diffuser selection study in which the oxygen absorption characteristics of different diffusers at different bubble rise heights were determined. Concurrently, a diffuser study was performed by the TVA in their test tank in Norris, Tennessee, to establish a correlation between the data obtained in the field, and the data obtained in the laboratory. In Phase II, five oxygen diffuser racks were placed 300 feet from the penstock intakes to define the operating conditions required to cause the oxygenated water to come to equilibrium in the layer of water which is withdrawn through the turbines. Phase III involved operation of the injection system at the site where it would be permanently located. Eight racks of diffusers were placed closely together at a point 1 mile upstream of the dam.

5.10 Additional work is needed to optimize a continuous oxygen injection system capable of maintaining a dissolved oxygen level of 6 ppm in the turbine discharges. During the test conducted last year, an average of 4.5 ppm was maintained representing an oxygen uptake of 3 ppm above background. Approximately 85 to 90 percent of the oxygen was absorbed in the lake. About 50 percent of the oxygen was absorbed in the hypolimnion. Forty oxygen diffusers were concentrated on one rack during the test and the energy generated by such a configuration caused the oxygenated water to reach the upper layers of the lake and remain there where it was unavailable for turbine discharge. However, it appears likely that the absorption efficiency can be improved by properly spacing the diffusers or providing suitable deflectors to dissipate the energy generated by the oxygen plume as was successfully demonstrated by a small scale test.

5.11 It has been noted with other deep impoundments with hypolimnetic discharges that the releases may contain high concentrations of iron and manganese. The Environmental Protection Division of the Georgia Department of Natural Resources maintains a water quality sampling station on the Savannah River 14 miles below Clarks Hill Dam at the Augusta Canal Lock (Water Quality Monitoring Data for Georgia Streams, 1976). This data was consulted to determine the manganese and iron concentrations in the water and they were not found to be excessive. The highest total iron concentration found was 0.80 mg/l. The United States Environmental Protection Agency (Quality Criteria for Water, 1976) recommends a maximum level of 1.0 mg/l for freshwater aquatic life. The highest manganese concentration sampled was 0.16 mg/l. EPA does not recommend a criteria for aquatic life, but it is noted that the various tolerance levels that have been reported range from 1.5 mg/l to over 1,000 mg/l. The recommended criteria for domestic water supplies is 0.05 mg/l.

5.12 Recreation. The basic advantage of enforcement of regulations is that it gives a tool which can be used to insure compliance with the regulations. Also, it provides a method by which persistent violators may be dealt with. The disadvantages are that officers could easily become involved in situations where their authority is not adequate and officers implementing the program may at times be subject to considerable danger.

5.13 There are some detrimental effects associated with the recreational program at Clarks Hill Lake, some of which are a decrease in wildlife habitat, minor soil compaction and a change in the natural environment. These effects are partially mitigated by the planting of trees and other desirable vegetation. Other effects of the recreation program as carried out at Clarks Hill Lake are: air, water, noise and visual pollution. Increased criminal activity could also be a possible adverse effect. However, these and other possible effects are greatly reduced by mitigation measures and the enforcement of Title 36 - Rules and Regulations Governing Public Use of Corps of Engineers Lakes and are balanced by the public benefits arising from availability of recreation at Clarks Hill Lake.

5.14 The anticipated impacts of future construction or expansion of existing recreational facilities would entail a minimum disturbance to the terrain and vegetation. Every attempt will be made to construct these facilities with the least possible deterioration to the environment. Grass, trees, and shrubs will be planted to enhance the area and to replace plants damaged or removed during construction. Native species will be used where possible to produce a more natural setting in construction areas.

5.15 Forest Management. Forest management operations and maintenance will be accomplished in accordance with detailed requirements furnished in appendix B to the Master Plan, Forest Management Plan for Clarks Hill Lake Project. South Atlantic Division directive "Operational Procedure for Timber Harvesting Projects" will be used as a reference in coordinating applicable action of timber harvesting sales and disposal.

5.16 The basic objective of the Forest Management Plan is to increase and preserve the diverse values of the lands and vegetation at Clarks Hill Lake for present and future generations of people. This entails establishing and maintaining a healthy and diverse forest community. The primary

considerations of the Forest Management Plan is forest management for the purpose of recreation, wildlife, erosion control and aesthetics. There are no lands at Clarks Hill which are managed for the sole purpose of timber production.

5.17 Some tree planting and similiar landscaping will be carried out in the public use areas. The impact of these plantings and forest management programs will be to provide beneficial effects such as beautification, erosion control, traffic control when used as a barrier, and certain species of trees and shrubs will provide wildlife food and cover. Selective tree thinning will be carried out in dense stands to enhance aesthetics, encourage growth of desirable ground vegetation, and maintain a healthy, vigorous forest.

5.18 Fishery Resources. Planning and development of Clarks Hill Lake's fishery resources began prior to impoundment. To help maintain and enhance the lake's fishery resources, the Savannah District Corps of Engineers developed a Fishery Management Plan. The plan is designed for cooperative implementation with State management activities as it is recognized that fisheries management is a primary responsibility of the appropriate State agency.

5.19 The management plan is intended to be continuous and is designed to provide for long-range enhancement and sustained use of the fishery resources at Clarks Hill Lake. Because of the increasing value of recreation, primary emphasis of the management plan is placed on developing and improving recreational use of the fishery resource. Management, as defined within this plan, embraces not only productivity, but also stresses proper harvesting of the resource on a sustained-yield basis. The objective of this management plan is to provide for proper enhancement of the fishery resource at the optimum level that will meet the recreational fishery demands of present and future generations of visitors. In essence, this entails establishing and maintaining an ecologically balanced and diverse aquatic community at the lake. The Savannah District has a Reservoir Fisheries Biologist at the lake to insure that this plan is implemented so that the recreational sport fishery resources are maximized to the extent possible and to coordinate fishery management programs with the Georgia and South Carolina fishery departments.

5.20 The effectiveness of this management program is reflected by the quality and quantity of sport fish harvested from the lake as discussed earlier in this statement. Some of the major areas of the fishery management program include:

a. Regulation of Water Levels. In order to provide optimum spawning conditions for desirable sport fish species, fluctuating water levels during the spring (March through May) are minimized. This regulatory policy is based upon water temperature information and is in effect until sufficient time for spawning has elapsed.

b. Fishing Piers and Fish Attractors. A major factor influencing fishing success and harvest in large, deep lakes is the inability of fishermen in locating large concentrations of fish. To increase fishing success at the lake, several stands of timber were left standing during

clearing to be inundated following impoundment. The Corps of Engineers, the Georgia Department of Natural Resources, and the South Carolina Wildlife and Marine Resources Department have each placed 10 fish attractors in Clarks Hill Lake. These areas concentrate fish by providing cover or shelter on the lake bottom. Many species of fish prefer areas which have shelter and protection as well as a nearby food supply. The SCWRD and Georgia DNR used brush trees to make fish attractors. The trees and brush were placed in a circle of about 100 feet in diameter. The Corps used discarded tires to make 10 fish attractors. Fifty bundles of nine tires each were placed in two rows on the lake bottom. All fish attractors were placed in 30 to 35 feet of water. Both open water and shoreline locations which offer sufficient depth to avoid exposure of the structures during drawdown were selected, and open water reefs were marked with permanent buoys so they could be located by fishermen. Within the immediate area below the damsite, the Corps has constructed a fishing platform to provide additional access to tailwater fishing.

c. Creel Surveys. To evaluate fishery management programs and to monitor the quality and species composition of sport fishermen harvest creel, a survey of the lake has recently been conducted. Currently, a 3-year creel has been completed with the cooperation of the South Carolina fishery department. The objectives of these creel survey programs are to provide information concerning sport fish population harvest and to provide basic information needed to formulate future management programs. Data from creel surveys in conjunction with fish population studies furnish fisheries biologists (both Federal and State) a more complete understanding of the lakes fishery resources.

d. Participation of the Corps biologist with biologists of the two State agencies in a cooperative rotenone sampling program. Results are analyzed to determine levels of prey and predatory fishes to aid in determining stocking rates of additional predators such as hybrid bass.

e. Participation of Corps fishery biologist with the two State agencies in a cooperative white bass spawning study which will assess this resource to permit better management.

f. A study of the vertical distribution of fishes in Clarks Hill while it is stratified during the summer. Nets which are 100 feet deep will be used to find out at which depths certain fish are located. At the same time, temperature and oxygen measurements will be taken every 3 feet in depth. Information on fish occurrence and temperature and oxygen will be available to the public through news releases.

5.21 Wildlife Management. The variety and numbers of wildlife species on any area are related to seres or successional stages in the plant community. Most species of wildlife require a variety of habitats with their associated edge effects. Wildlife make extensive use of openings and early forest successions and are benefited by an intimate mixture of vegetative, topographic and moisture conditions. The objective of the wildlife management program at Clarks Hill Lake is to provide a continuous management program and stimulate existing wildlife species through sound habitat manipulation programs consistent with the multiple use objective of the lake project. Another objective is to allow wildlife resources to contribute to the greatest good

of the most people over the longest time. In order to make optimum use of available acreage nonconsumptive uses such as photography, birdwatching, and general sightseeing are also highlighted.

5.22 The ecosystem has now stabilized around the lake; however, the existing environment has greatly changed from the previous one. With a wildlife management program to help provide wildlife food and habitat, the overall result of the Clarks Hill project has been an increase in certain wildlife species and hunting availability in the area.

5.23 Endangered and Threatened Species. The continuation of the operation and maintenance should not have any adverse impact on any endangered or threatened species. Lake personnel at the project have been instructed to report sightings of endangered species to the Wildlife Biologist and although management efforts are usually directed toward meeting the needs of the common wildlife species, threatened or endangered species are given special consideration to ensure their protection at the project.

5.24 Cultural Resource Management Program. The Savannah District is presently developing a long-range management program for preserving cultural resources. This program will be fully coordinated with the State Historic Preservation Officers of Georgia and South Carolina and with the Advisory Council on Historic Preservation.

5.25 Savannah District will begin large-scale cultural resources surveys of those project areas which are directly affected by project operation and maintenance activities. These surveys will minimally include the lake shoreline, developed portions of recreation areas, and areas being considered for development. These surveys will identify the cultural resources present, determine their significance, identify impacts, and make recommendations for preservation and/or mitigation.

5.26 Savannah District will also have sample surveys conducted of the remaining project lands. These sample surveys will establish a predictive model for cultural resources site locations and types.

5.27 The direct impact and sample surveys results will provide the basis for the cultural resources management program. The management program will address both long-range and short-range goals, procedures, and priorities for protecting, and when necessary, mitigating significant cultural resources.

5.28 On operation and maintenance projects, all project personnel will be directed to report any incidents of man-induced or natural adverse effects on cultural resources, such as vandalism or shoreline erosion.

5.29 Most of the undesirable effects of the Cultural Resource Management Program on the natural environment will occur during salvage or mitigation operations. These effects are a temporary reduction in the "naturalness" of the site as well as desirable aesthetics, disturbance of wildlife habitat, removal of some desirable vegetation, increased safety hazards and destruction of archeological sites through mitigation activities.

5.30 Some of the beneficial effects will be that archeological sites will have some protection from natural effects and human activity, there will be a continuing inventory and assessment of historic and archeological resources on project lands, and the data will be used in all phases of planning for project land use.

5.31 The Corps of Engineers does not have sole authority for the Cultural Resource Management Program. Therefore, close coordination is required with the responsible agencies such as the National Park Service, the Advisory Council on Historic Preservation and the State Historical Preservation Officer.

5.32 The program will also provide a complete and accurate record of sites and artifacts which can provide supplemental data for any subsequent archeological and historical investigation or research. Those data and artifacts collected can also be used in project oriented interpretive displays which will create an increased awareness of the value of archeological-historical resources among the general public and project personnel. Also, under this program, artifacts and sites of antiquity or historical significance will be preserved for future generations to study and enjoy.

5.33 Savannah District understands that this management program will take several years to develop and implement, and that some type of management program is needed in the interim. This interim management program provides for caution to be used during activity on project lands to avoid alteration or destruction of significant cultural resources.

5.34 Economic and Social Conditions. The economic pattern of the area surrounding Clarks Hill Lake has changed from a predominantly agricultural type to one of agriculture, forestry, commerce, industry, and recreation during the last several years. With the present trend of population shifting from rural to urban areas, higher salaries, and more leisure time, people are turning to recreational activities such as hunting, fishing, swimming, boating, camping, and sightseeing as a means of relaxing and entertaining themselves during the nonworking periods. This trend has resulted in increased efforts on the part of national, State, and municipal agencies to provide more recreational amenities to meet the increased demands of the various segments of the public. The economy of the Clarks Hill Lake area should continue to grow due to the available manpower to serve industry, accessibility, closeness of large metropolitan market areas, and the climate which is favorable for water oriented recreational activities for approximately eight months of the year. At the present time, there are 458 manufacturing establishments employing some 64,760 people located in those counties which lie wholly or partially within a 35-mile radius of the mid-point of Clarks Hill Lake. These establishments are engaged in the manufacturing and processing of items such as textiles, clothing, textile machinery, mobile homes, rubber footwear, office furniture, granite and marble monuments, electric clocks, surgical supplies, meat and poultry processing, steel fabrication, and building products. The agricultural and forestry products of the area include such items as cotton, corn, soybeans, cattle, poultry, fruit, lumber, and pulpwood.

5.35 Management of Leases, Easements, and Other Outgrants: Temporary adverse impacts, such as erosion, water quality and quantity, dust,

vegetation removal, aesthetics, and safety hazards are caused by the outgranting program.

5.36 With each of these outgrants, there has been a change in the natural aesthetics of the outgrant area. In almost all cases, there has been a reduction in the "naturalness" of an area as well as desirable aesthetics.

5.37 Most of the undesirable impacts occur during the construction phases. The removal of vegetation, increased erosion, increased visitor safety hazards, aesthetically displeasing sights, etc., are all common during construction. The density of the outgrants (i.e., the number of outgrants in a given area) is equally as important to significance of the impact as is the actual location of the outgrant.

5.38 Project Zoning. The zoning of all project lands and resources is designed to produce an optimum mix of diverse recreation and fish and wildlife benefits. This zoning is necessary to ensure against undesirable conflicts between the several types of recreation activity which typically occur at the projects. The zoning plan will also assist the resource manager in preparing to accommodate public visitation and other desirable uses of project lands and waters, whether by individuals, families, or groups.

5.39 Sewage Disposal. Some adverse impacts associated with the construction and operation of washhouses, disposal areas for camper trailers, pit toilets, and other sanitary structures resulted due to habitat destruction. Trees, shrubs, and other desirable vegetation in the immediate vicinity of these various sites were removed for construction. Also, a small amount of earthwork was required. However, these impacts have been mitigated to some extent by reseeding and planting desirable shrubs and other vegetation around each facility. This has helped to reestablish the natural aesthetic quality of the area. The operation of each facility has no polluting effect on the environment and conforms to all county, State, and Federal sanitary disposal and pollution regulations.

5.40 Disposal of Solid Waste. Disposal of refuse as outlined previously in this statement results in the elimination of insect and rodent infestations, blowing paper and odors. The primary advantage of this system is that it ensures the disposal of solid waste in an acceptable manner.

5.41 Control of Undesirable Vegetation. Generally, the beneficial impacts of any control measures taken will enhance the aesthetic quality of the environment of the project and visitor pleasure and thus outweigh the undesirable impacts of such programs. Inevitably, such programs tend to reduce the naturalness of the environment and reduce habitat for some species of animal and plant life that might otherwise occupy the area. Brush and other terrestrial vegetation are controlled by mowing and brushhogging where practical and prescribed burning, as described previously, is also used. The aesthetic value of a brushhogged area may be temporarily reduced. However, the new growth that succeeds brushhogging provides food for numerous species as long as adequate "edge effect" areas are created. Herbicides are used in a limited amount where conventional equipment is restricted. All precautions are taken and any chemical used must be registered by the Environmental Protection Agency.

5.42 Insect Control. Larval inspections are periodically made to investigate breeding areas, pinpoint treatment areas and check on effectiveness of spraying. Although anopheline mosquito (malaria vector) control is the primary purpose, a substantial reduction in pest mosquito abundance is also achieved. Any control measures taken will usually enhance visitor pleasure although altering the natural environment by reducing the number of insects inhabiting the area. This, in turn, will reduce the available food supply of any species of wildlife that usually feed on these insects. A possible exception would be forest insect pests. Immediate control and long range prevention through proper forest management practices do not always prevent large infestations of some forest insect pests.

5.43 Construction and Maintenance of Project Roads. The majority of project roads have been hard-surfaced and resurfaced as the need arises. The surfacing of the roads has reduced their maintenance requirements, reduced traffic-generated dust problems in the public use areas and makes their use by the visiting public safer and more pleasant.

5.44 Temporary detrimental effects would be associated with any new road construction at the project. However, these effects would be minor in nature and would occur only during the actual construction period. The roads would be kept to a minimum width to reduce disturbance to wildlife cover and to avoid removal of desirable vegetation. Other effects of the construction activity would be noise and dust pollution and soil erosion. These effects would be mitigated after construction by reseeding and planting desirable shrubs and vegetation. The roads would perhaps have a minor negative aesthetic effect, but would provide increased access to the lake and recreational facilities.

5.45 Maintenance of Project Structures, Buildings, and Facilities. The impacts of any maintenance of project structures, buildings, and facilities will be beneficial to the aesthetic quality of the environment of the project and will enhance visitor pleasure. It also results in safer working conditions for project personnel.

5.46 Adverse Environmental Effects Which Cannot Be Avoided Should The Proposal Be Implemented.

5.47 There are some adverse effects associated with the operation and maintenance of Clarks Hill Lake which are a result of providing more desirable or beneficial uses of the project's resources for the public. These adverse effects include soil erosion and compaction due to recreational activities; traffic in unauthorized areas; wave action on the shoreline; timber damage or loss due to pool fluctuation, mowing damages, and construction activity; wildlife disturbance due to human usage and lake fluctuation; a longer time requirement for downstream flows to return to normal after a period of high water; continuing adverse and irreversible effects on archeological remains due to recreational use, wave action, and flood control regulations; and alterations of the natural environment through recreational development and other minor construction and maintenance activities. Many of these adverse impacts can be minimized through management of resources and people.

5.48 The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity.

5.49 The flood and other water storage functions provided by Clarks Hill Lake are long-term propositions. Clarks Hill Lake is being operated for the aforementioned purposes and land use in adjacent areas may be altered by the following: (1) the availability of water for industrial and municipal uses; (2) a more stabilized and predictable flow of water downstream; (3) flood protection for lands downstream has opened up the flood plain for agriculture, industry and other developments; and (4) a water-oriented recreation situation has developed on the perimeter lands of the lake and adjacent private property. The above factors will enhance and promote the long-term use of the land and resources (total environment) of the area. This is valid, however, only if discriminate planning for and management of project and adjacent private lands is carried out.

5.50 The production of electric power through the transformation of the potential energy of impounded water into the kinetic energy in falling water to turn the turbines of the powerhouse generators poses a trade-off between the benefits derived from that power and the detriments resulting from water being released with lower dissolved oxygen and temperatures. The electricity produced cannot be stored; therefore, power is only generated during peak requirements periods. The benefits of the electricity thus produced will be long-term in relation to the development of the region receiving the electric power.

5.51 The land and resource management program is the most important factor in maintaining a quality environment for future generations. All phases of this program, are or will be designed to maintain and promote sound land management practices.

5.52 Recreation management fundamentally consists of the development of public use areas, disposal of solid waste and sewage, road maintenance and construction, insect control, control of undesirable vegetation (this includes mowing), and managing people. These functions are paramount in maintaining a high-quality, usable outdoor recreation environment. Neglect of any of the above would result in a degradation of a portion of the local environment.

5.53 Any Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Action Should it be Implemented.

5.54 The overall effect of the operation and maintenance activities has been an alteration in the appearance or in the use of the natural environment of the project, i.e., road construction, development of recreation areas, etc., and, while such alterations are not usually considered irreversible or irretrievable, they are committed for the life of the project. It is possible at some future date that some of these facilities could be removed, thus allowing the area to revert to a natural state. The entire ecosystem would be unlike the one which existed prior to impoundment. The labor and materials involved in operating and maintaining the project and related lands are irretrievable.

5.55 Possible Conflicts Between the Proposed Action and the Objectives of Federal, Regional, State, and Local Use Plans, Policies, and Control: Since the Clarks Hill Lake project already exists and represents a source of revenue for State, and local municipalities, and since local, State and regional use plans, policies, and control have been considered in the project Master Plan, no known conflicts of the proposed action and the above factors exist.

5.56 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures: The hydroelectric power generating capacity provides a net gain in electric energy to the surrounding area.

6.00 LIST OF PREPARERS

6.01 The following individuals were primarily responsible for preparing the Environmental Impact Statement.

<u>Name</u>	<u>Expertise</u>	<u>Experience</u>	<u>Professional Discipline</u>
Mr. Thomas Skordal	Fisheries Biologist	3 years planning 2 years regulatory functions	Biologist
Dr. Charles Belin	Estuarine Ecology	11 years in salt marsh ecology, 2 years in regulatory functions	Biologist
Mr. Mickey Fountain	Fish & Wildlife Resources	2 years wildlife management, P&M Lumber Co., 5 years environmental analysis with Soil Conservation Service and Savannah District	Biologist
Ms. Judy L. Wood	Cultural Resources Management	4 years cultural resource management with Omaha and Savannah District	Archeologist
Mr. J. R. Peavy	Planning & Water Quality	9 years in EIS studies and Plan Formulation, Savannah District	Physical Scientist

7.00 PUBLIC INVOLVEMENT SECTION

7.01 Public Involvement Program: Public involvement to date includes the following meetings and workshops.

a. Public meetings:

1. 23 October 1978 - McCormick, South Carolina
2. 24 October 1978 - Augusta, Georgia

b. Workshops:

Workshops were held with the following groups and agencies:

26 February 1979	Chairman, County Commission, Lincoln County, Georgia
27 February 1979	Director, Clarks Hill Authority
27 February 1979	Central Savannah River Planning and Development Council
28 February 1979	McCormick County Development Board, Executive Director
28 February 1979	Boat owners at Clarks Hill Marina
1 March 1979	SC Water Resources Commission and South Carolina PRT
1 March 1979	Director, South Carolina Development Board
2 March 1979	SC Department of Health and Environmental Control
6 March 1979	SC Department of Wildlife and Marine Resources
9 March 1979	Upper Savannah River Planning and Development Council
13 March 1979	SCORP, Coordinator
19 March 1979	Clarks Hill United Clubs Association and Nonprofit Leaseholders Association
20 March 1979	Columbia County, GA, Commissioner and Parks Director
20 March 1979	Resource Manager and Staff, Clarks Hill Lake
2 April 1979	SC Wildlife and Marine Resources
3 April 1979	Representatives of the GA Conservancy League of Women Voters, GA Wildlife Federation, SC Wildlife Federation, Friends of the Savannah River, SC Environmental Association and the Richmond County Commissioners

c. Information obtained from the public as well as local, State, and other Federal agencies was used to prepare a preliminary draft land use/lakeshore management plan which was presented to the public for review and comments on 30 and 31 May 1979. These meetings were again held at McCormick, South Carolina, and Augusta, Georgia, respectively.

7.02 Required Coordination. The Draft Environmental Impact Statement has been coordinated with other local, State and local agencies and conservation groups. The Draft EIS has been filed with the U.S. Environmental Protection Agency (EPA) and circulated for a comment period of 45 days. The agencies listed below were furnished copies of the DEIS, and the Final EIS will also be furnished to them. Regulations provide for a 30-day comment period on the Final EIS.

7.03 Statement Recipients:

Government Agencies and Citizen Organizations. The Draft Environmental Statement was sent to the following Government agencies and citizen organizations requesting their views and comments.

Environmental Protection Agency  
Federal Highway Administration, USDT  
National Marine Fisheries Service, NOAA, Washington, DC  
U.S. Department of Commerce, Washington, DC  
U.S. Department of Health, Education, and Welfare  
U.S. Department of the Interior, Washington, DC  
Soil Conservation Service, USDA  
Forest Service, USDA  
Advisory Council on Historic Preservation  
Federal Energy Regulatory Commission  
Department of Housing and Urban Development  
Georgia State Clearinghouse  
Georgia State Historic Preservation Officer  
Georgia State Archeologist  
Georgia Department of Natural Resources  
South Carolina State Clearinghouse  
State of South Carolina Water Resources Commission  
South Carolina State Commission of Forestry  
South Carolina State Archeologist  
South Carolina Department of Health and Environmental Control  
South Carolina Wildlife and Marine Resources Department  
Georgia Conservancy  
Save America's Vital Environment  
South Carolina Wildlife Federation  
Upper Savannah River Area, APDC  
Sierra Club  
South Carolina Environmental Coalition  
National Audubon Society  
Georgia Wildlife Federation  
Central Savannah River, APDC  
South Carolina Appalachia Regional APDC

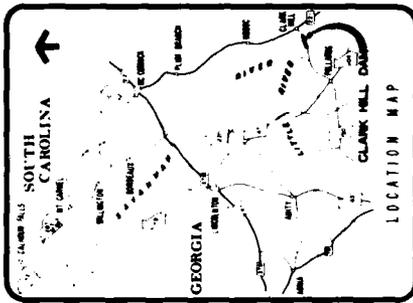
7.04 Public Views and Responses. Three primary areas of concern were expressed by most respondents. First, what types of sewage facilities are found at each of the recreation areas listed in appendix D. This has been answered in both the text of this document (para. 5.39, Sewage Disposal) and in appendix D. The second comment concerned the ambiguity of the statements on cultural resources studies at Clarks Hill Lake. The affected paragraphs in the textual body were modified to eliminate the ambiguity. The last comment addressed the question of turning over of excess lands to the State of South Carolina. This question has been answered in appendix F, Public Views and Responses. The responses to other comments may be found in appendix F.

The Corps' primary purpose is that the Clarks Hill land be put to its highest and best use for the general public as a whole. The Corps shares the view that local development can help the economy of the county. However, the sale alone of additional Federal acreage will not do the job. The Corps will periodically review and evaluate the land requirements at all of the lakes it manages. If at that time, additional lands are identified as nonessential, the Corps will consider other development plans on a case by case basis.

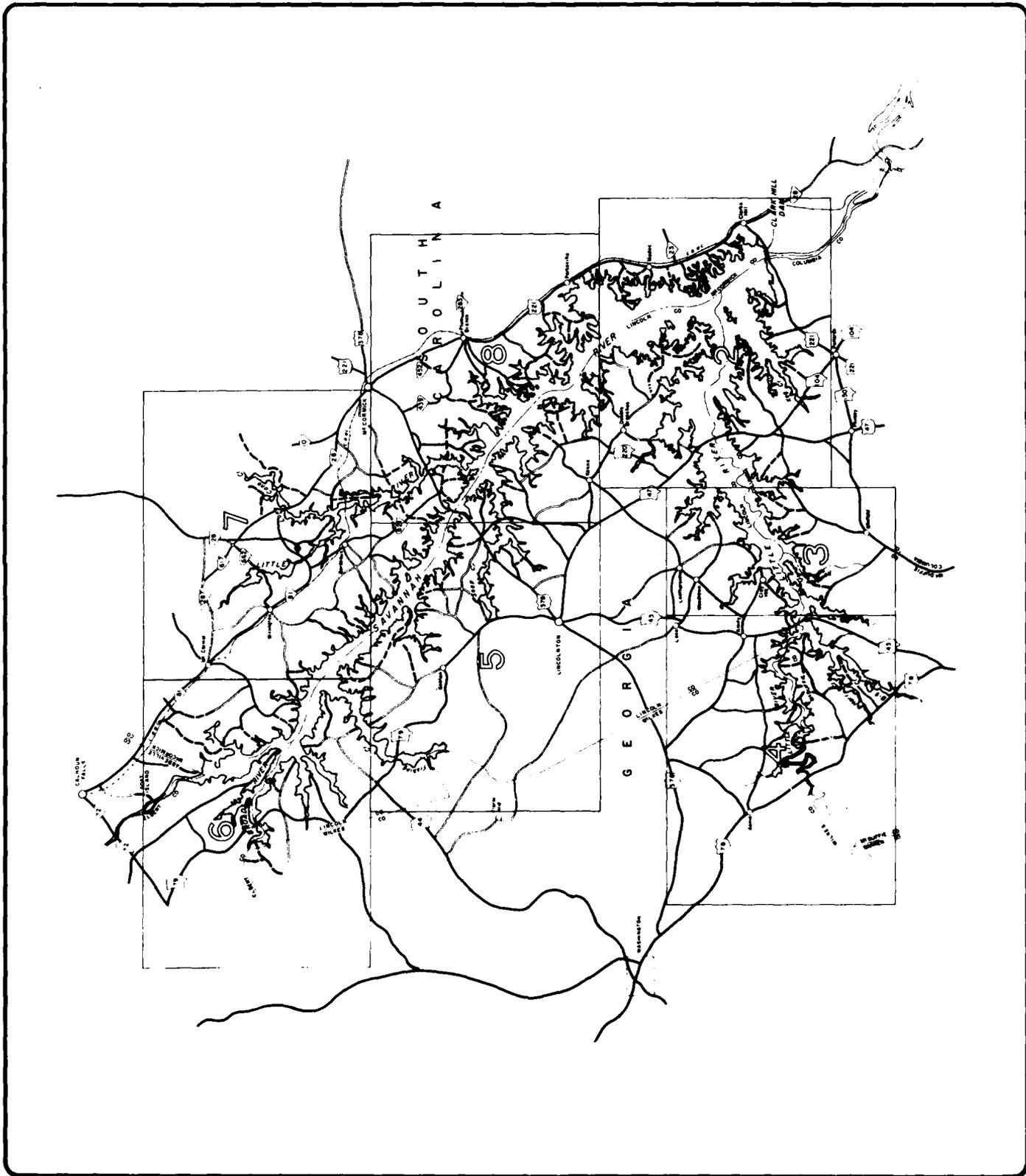
APPENDIX A

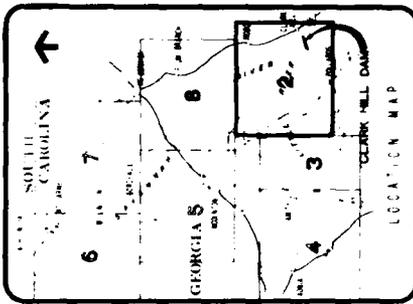
PROJECT MAPS

(Enlarged maps with color coding of the areas of Clarks Hill Lake can be viewed in the District Office, Savannah, Georgia.)



CLANK MILL DAM  
 GEORGIA - SOUTH CAROLINA  
 80 - MASTER PLAN UPDATE





**LAND USE**

**PROJECT OPERATIONS**

- ADMINISTRATIVE
- DAK. AND USE LANDS BELOW 100 FEET

**RECREATION - INTENSIVE USE**

- PUBLIC RECREATION AREA
- EXISTING CLUB AREA
- EXISTING SPORTS AREA
- EXISTING SPECIAL RECREATION

**RECREATION - LOW DENSITY USE**

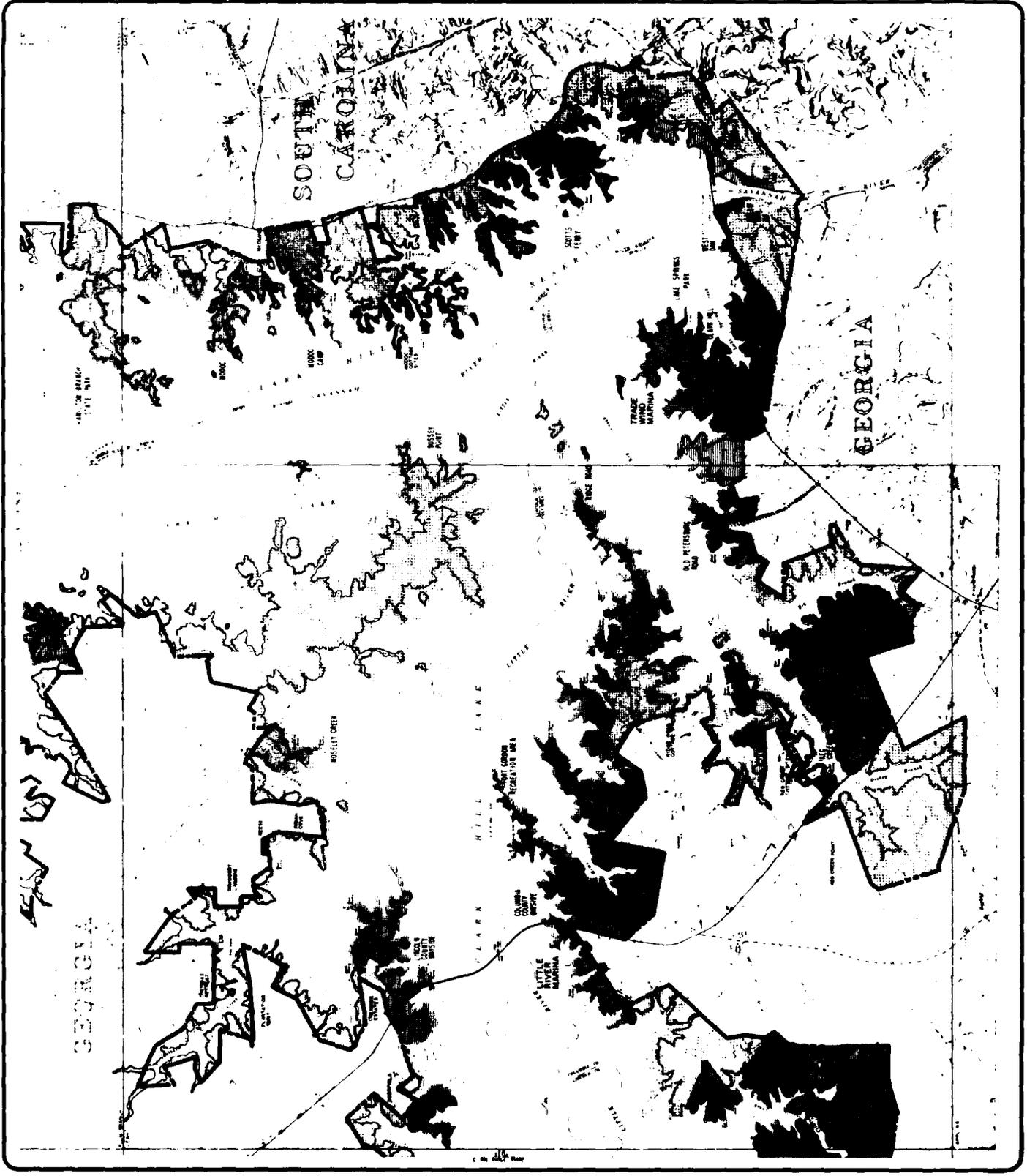
- WILDLIFE MANAGEMENT
- PROPOSED ACQUISITION
- NON-ESSENTIAL LAND

**NOTES:**

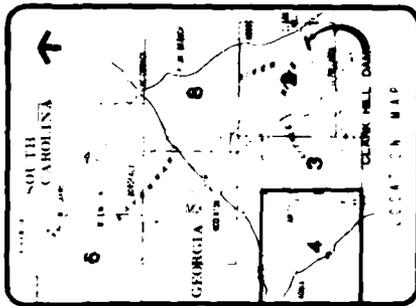
- EXISTING AND PROPOSED BOUNDARIES
- EXISTING AND PROPOSED ELEVATION (FEET)

**LAND USE**

DO MASTER PLAN UPDATE







**LAND USE**

**PROJECT OPERATIONS**

- ADMINISTRATIVE
- DUAL LAND USE - AMHS (IN OR 1/4 MI. RADIUS)
- RECREATION - INTENSIVE USE
- PUBLIC RECREATION AREA
- EXISTING CLUB AREA
- EXISTING WASH. AREA
- EXISTING SPECIAL PERMIT
- RECREATION - LOW DENSITY USE
- WILDLIFE MANAGEMENT
- PROPOSED ACQUISITION
- NON-ESSENTIAL LAND

**NOTE**

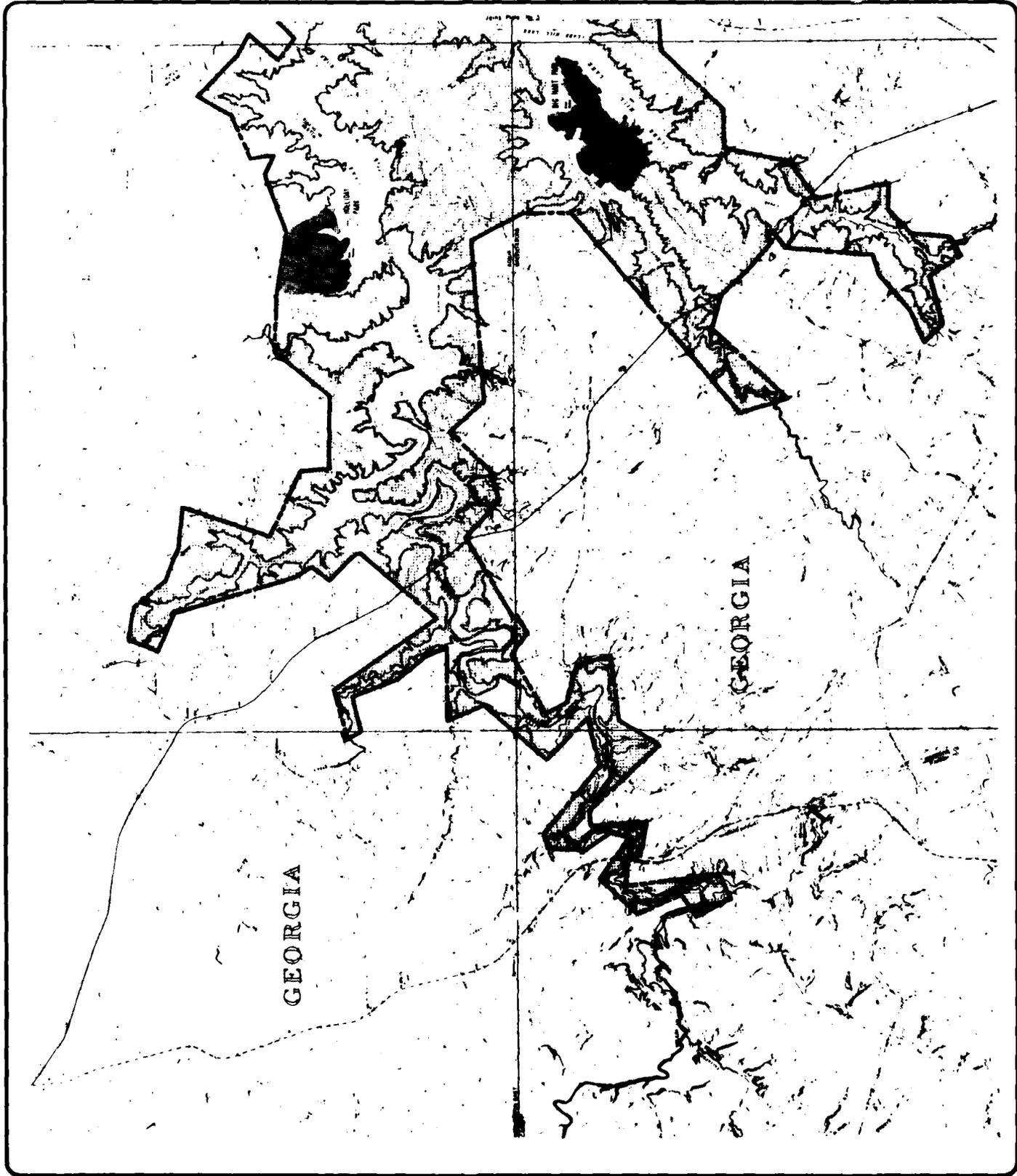
- SENSITIVE PROJECT RECOMMENDED BY STATE
- 5' HORIZ. & 1' VERT. SCALE
- WATERWAY CAPACITY ELEVATION (100 YRS. FLOOD)
- WATERWAY FLOOD ELEVATION (100 YRS. FLOOD)
- PROJECT BOUNDARY

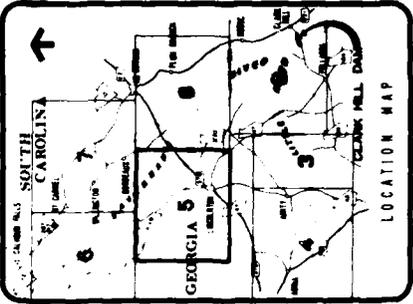
SCALE: 1" = 1 MILE

**LAND USE**

1983

CLARK HILL DAM  
 GEORGIA - 100% COVER  
 80 - MASTER PLAN UPDATE





**LAND USE**

**PROJECT OPERATIONS**

- ADMINISTRATIVE
- PAUL LAND USE (LANDS RELAY 148 861)

**RECREATION - INTENSIVE USE**

- PUBLIC RECREATION AREA
- EXISTING CLIP AREA
- EXISTING WASH AREA
- EXISTING SPECIAL POINT

**RECREATION - LOW DENSITY USE**

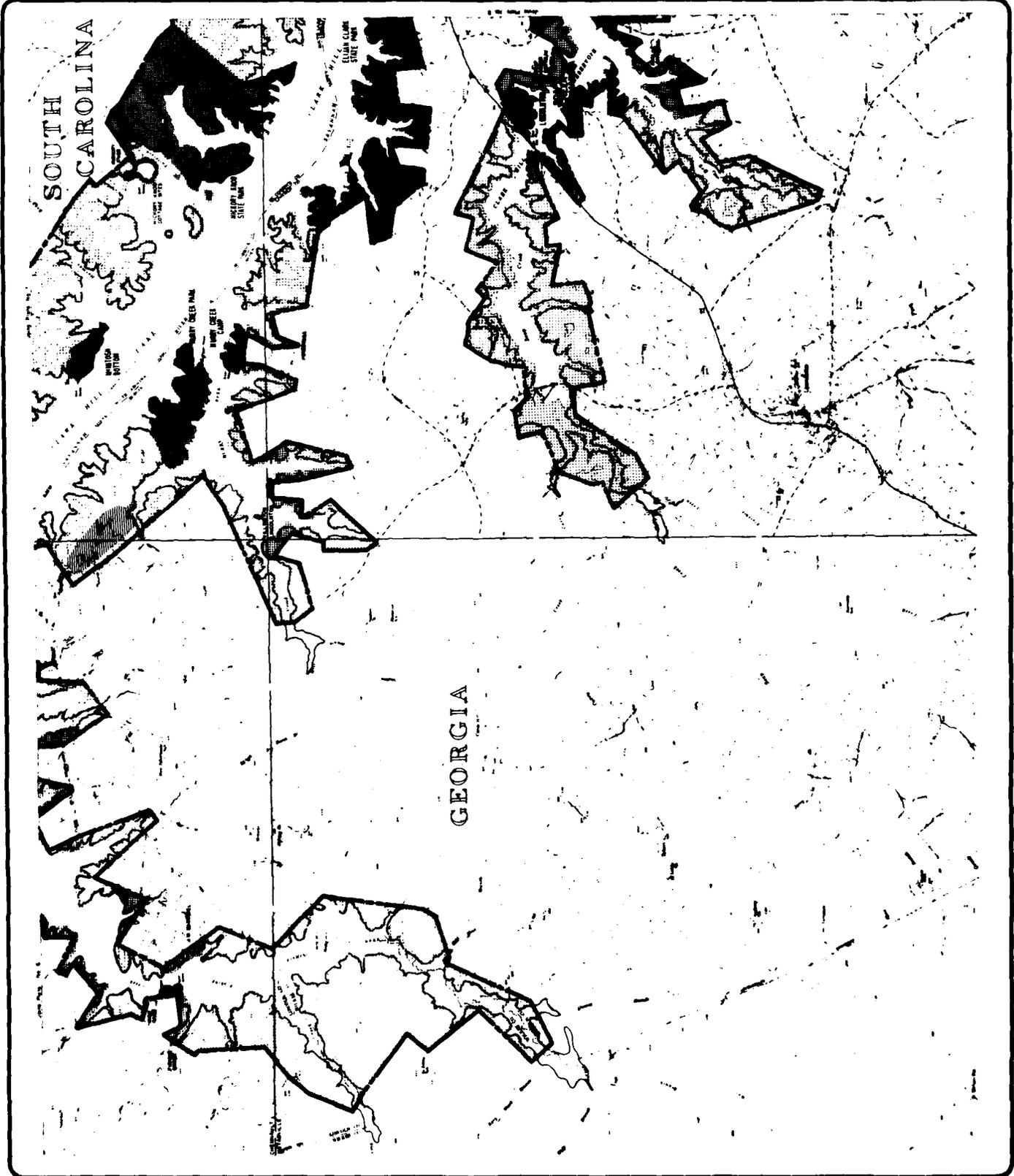
- WILDLIFE MANAGEMENT
- PROPOSED ACQUISITION
- NON-ESSENTIAL LAND

**NOTE**

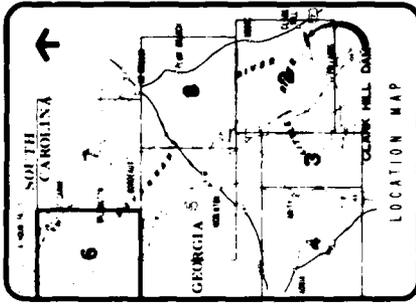
- "SENSITIVE AREAS" DESIGNATED ON PLATS U.S. TOWN 4-S, RANGE 8-TOW 40
- INDICATED SURFACE ELEVATION (1000 FEET)
- NORMAL POND ELEVATION (1300 FEET)
- PROJECT BOUNDARY

**LAND USE**

**5**



DATE: 11/11/88  
 DRAWN: JERRY WILSON  
 SO - MASTER PLAN UPDATE



**LAND USE**

**PROJECT OPERATIONS**

- ADMINISTRATIVE
- DUAL LAND USE (LANDS BELOW 100 FEET)

**RECREATION - INTENSIVE USE**

- PUBLIC RECREATION AREA
- EXISTING CLUB AREA
- EXISTING DISH AREA
- EXISTING SPECIAL POINT

**RECREATION - LOW DENSITY USE**

- WILDLIFE MANAGEMENT
- PROPOSED ACQUISITION
- NON-ESSENTIAL LAND

**NOTE**

- "SENSITIVE AREAS" DESIGNATED BY STATES
- "S" FIND # 5 "FINDS # 10 AND # 16"
- MAXIMUM SURCHARGE ELEVATION (SARMS)
- NORMAL POOL ELEVATION (1300 MSL)
- PROJECT BOUNDARY

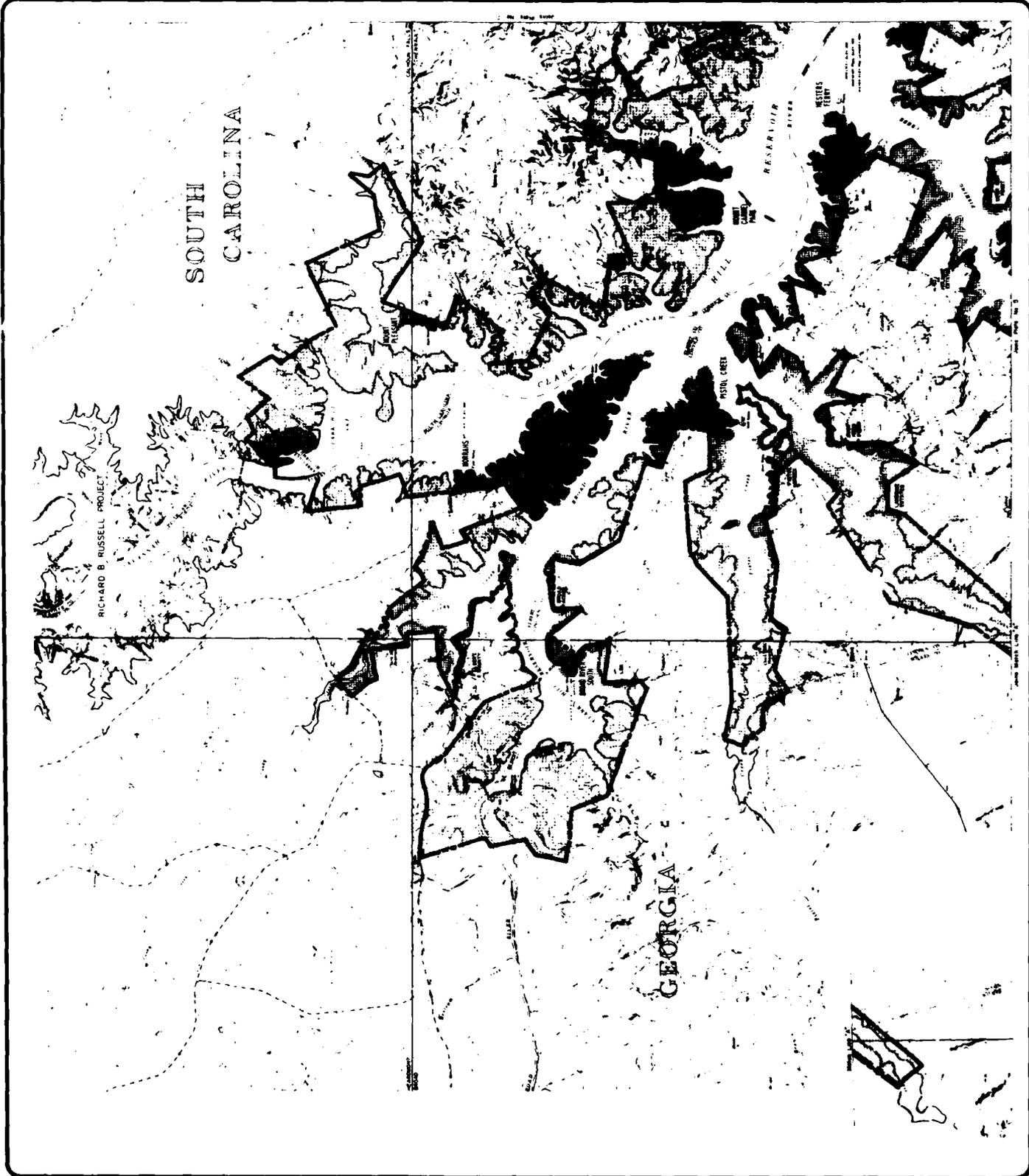
**LAND USE**

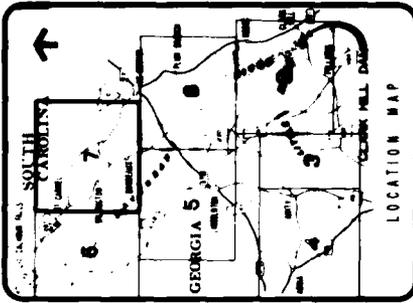
**LAND USE**

CLARK HILL DAM

GEORGIA - SOUTH CAROLINA

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**LAND USE**

**PROJECT OPERATIONS**

- ADMINISTRATIVE
- FINAL LAND USE (LANDS BELOW 540 FEET)

**RECREATION - INTENSIVE USE**

- PUBLIC RECREATION AREA
- EXISTING CLUB AREA
- EXISTING GOLF AREA
- EXISTING SPECIAL PERMIT

**RECREATION - LOW DENSITY USE**

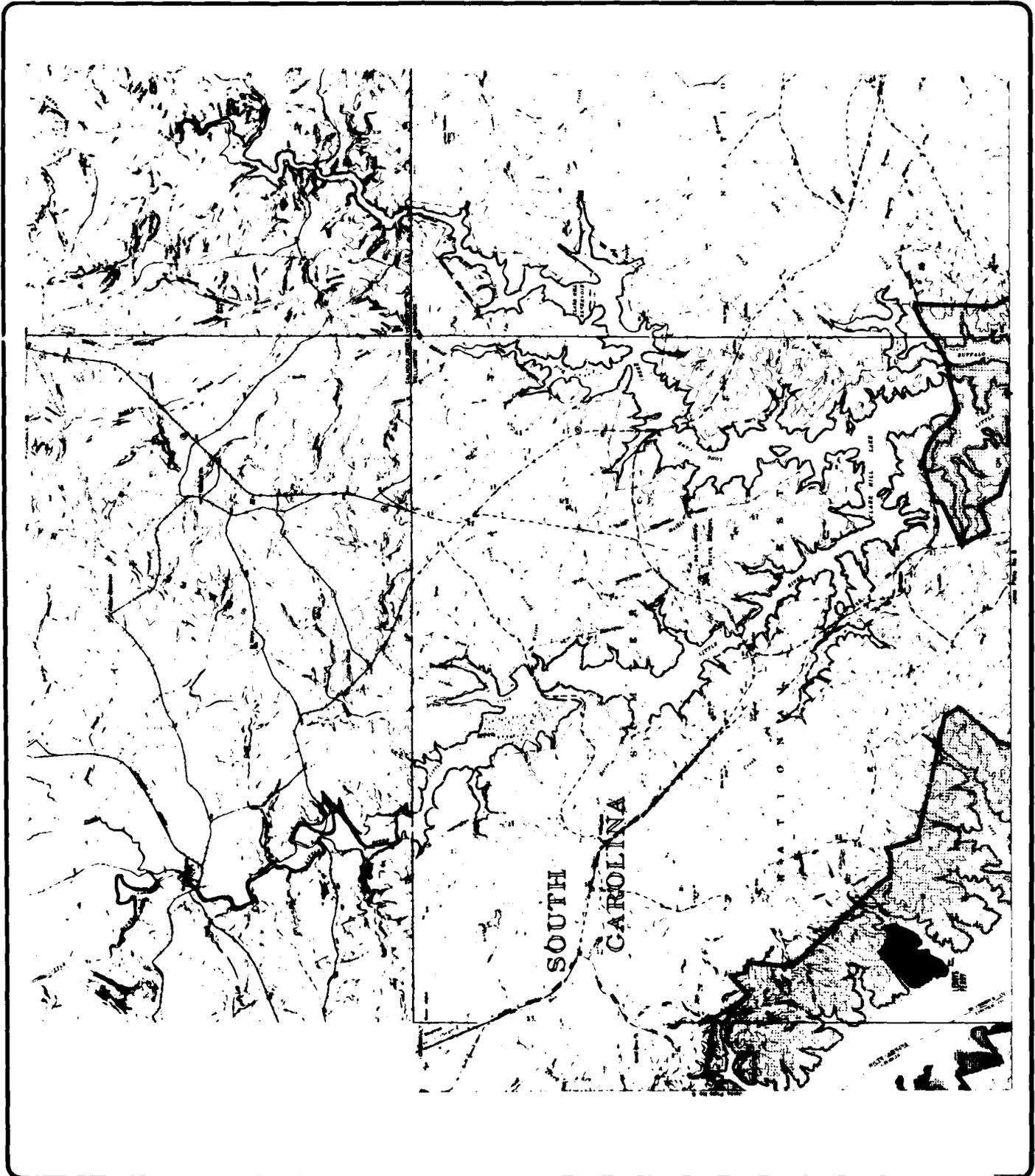
- WILDLIFE MANAGEMENT
- PROPOSED ACQUISITION
- NON-ESSENTIAL LAND

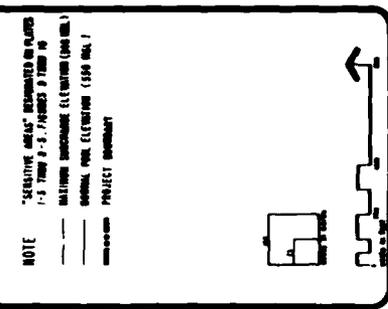
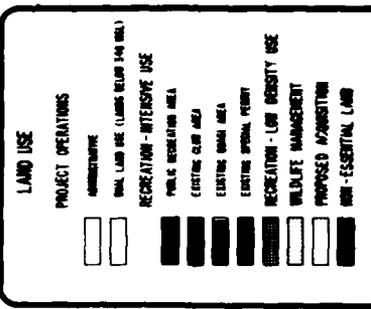
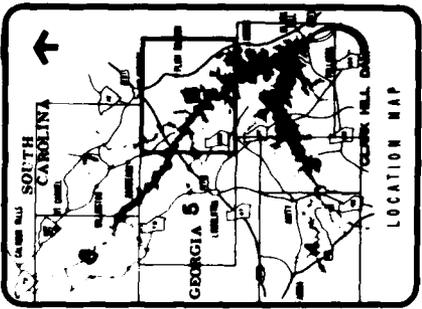
**NOTE**

- SENSITIVE AREAS DESIGNATED BY PLATES 1-5, 7 AND 8-5, 7 AND 8
- EXISTING SURFACE ELEVATION (400 FEET)
- NORMAL TIDE ELEVATION (330 FEET)
- PROJECT BOUNDARY

**LAND USE** 7

CLARK HILL DAM  
 SECTION 7 - SOUTH CAROLINA  
 80 - MASTER PLAN UPDATE

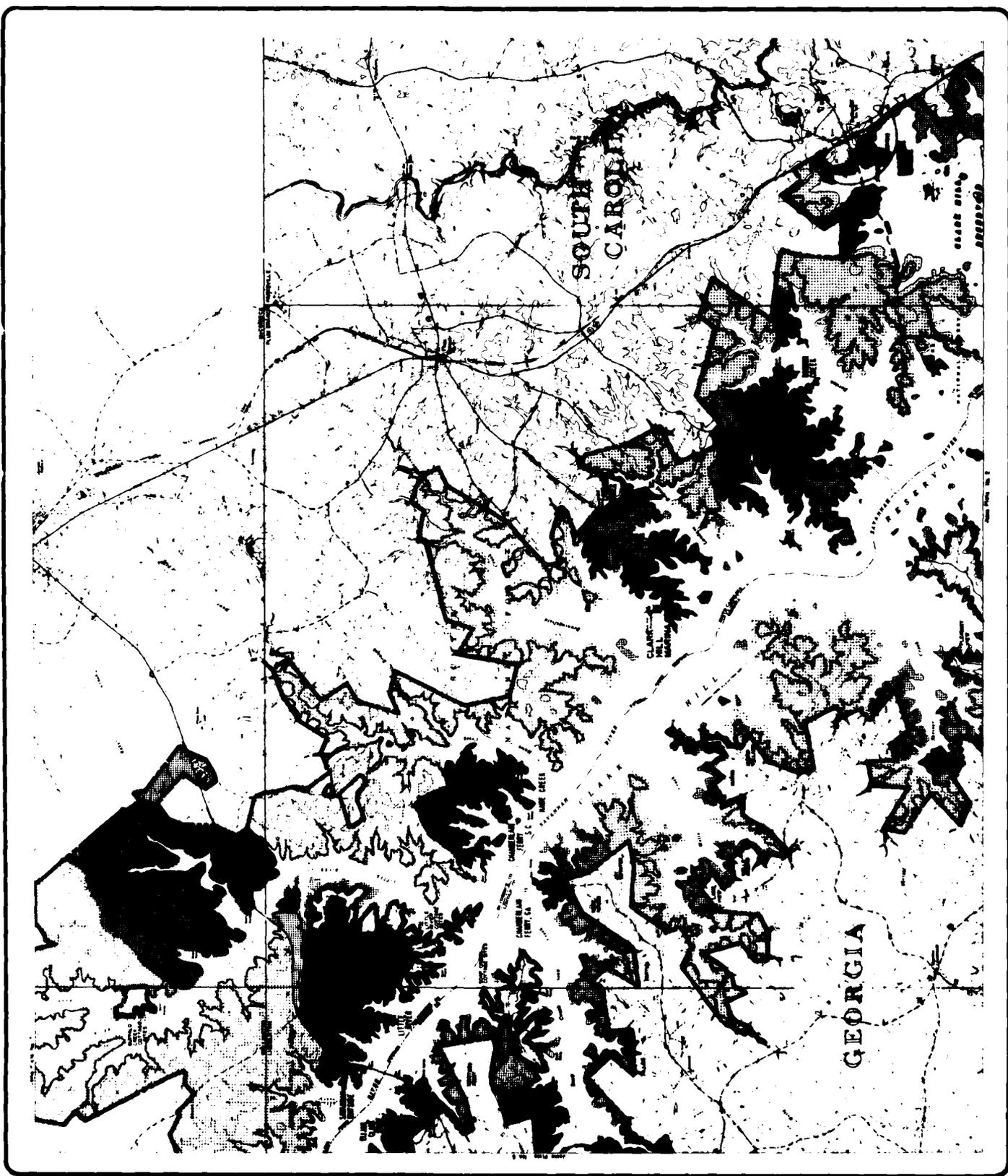




**LAND USE** 8

NEW DIL USE      EXISTING DIL USE

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APPENDIX B

FLORA AND FAUNA IN THE CLARKS HILL LAKE AREA

TABLE 1  
MAJOR PLANT SPECIES AND THEIR WILDLIFE USES

RELATIVE OCCURRENCE

- C = Common (generally abundant through the basin, occurring in many localities)
- O = Occasional (occurs in several areas but not abundantly)
- U = Uncommon (may occur in the study area in small numbers)
- R = Rare (highly localized or at extreme limits of range)

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- Britton, Nathaniel Lord and Hon. Addison Brown, 1970. An illustrated flora of the Northern United States and Canada, Dover Publications, Inc., New York 3 Vol.
- Duncan, Marien Bennett, 1942. Flora of the aquatic habitats of Clarke County, Georgia, M.S. Thesis, University of Georgia, Athens, p. 35
- Martain, Alexander C., Herbert S. Zim and Arnold L. Nelson, 1961. American wildlife and plants - a guide to wildlife food habitats. Dover Publications, Inc., New York pp. 500.
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TREES & SHRUBS

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Pine ( <u>Pinus</u> )		
Loblolly Pine ( <u>P. taeda</u> )	C, uplands and lowlands	Young pine stands with dense ground foliage make good year-round cover for small mammals, gamebirds, and white-tail deer. Mature pine forests are utilized as nesting and feeding sites for a variety of songbirds; pine stands are also utilized by squirrels, rabbits, and small rodents.
Longleaf Pine ( <u>P. palustris</u> )	C, uplands and lowlands	
Shortleaf Pine ( <u>P. echinata</u> )	C, dry upland areas	
Virginia Pine ( <u>P. virginiana</u> )	R, dry rocky uplands	
Eastern Red Cedar <u>Juniperus virginiana</u>	C, pasture, forests and disturbed lands	Browse for deer, blueish-black berry-like fruit utilized by numerous songbirds and small mammals. Provide valuable shelter and nesting cover for a variety of songbirds.
Black Walnut <u>Juglans nigra</u>	U, well-drained bottom lands	Nut heavily utilized by gray and fox squirrel when available.
Hickory ( <u>Carya</u> )		
Mockernut ( <u>C. tomentosa</u> )	C, well-drained soils	Nuts heavily utilized by variety of wildlife such as wood duck, common crow, raccoon, gray and fox squirrel, eastern chipmunk, cottontail rabbit and whitetail deer.
Pignut ( <u>C. glabra</u> )	C, upland dry sites	
Bitternut ( <u>C. pallida</u> ) (Pale)	C, along streams and bottom lands	
Sand ( <u>C. pallida</u> ) (Pale)	U, dry upland sites	
Shagbark ( <u>C. ovata</u> )	U, moist soils and bottom lands	
Southern Shagbark ( <u>C. caroliniae-septentrionalis</u> )	U, shallow fertile rocky soils	
Pecan ( <u>C. illinoensis</u> )	Escaped cultured plant	
River Birch <u>Betula nigra</u>	C, lowlands and streambanks	Limited use by wildlife: seeds, buds and catkins may be used for food by songbirds and small mammals; bark sometimes eaten by beaver.

TREES & SHRUBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Hophornbeam <u>Ostrya virginiana</u>	C, lowlands and streambanks	Limited wildlife value; seeds (nutlets), buds and catkins eaten by songbirds (grosbeak, finch and woodpecker), squirrels and white-footed mouse. Deer occasionally browse on twigs and foliage.
Hornbeam or Ironwood <u>Carpinus caroliniana</u>	C, lowlands and streambanks	Like Hophornbeam, this tree is of secondary importance to wildlife. Its seeds are eaten by several kinds of birds and squirrels. Its catkins are also used to a limited extent by wood duck, deer and songbirds.
American Beech <u>Fagus grandifolia</u>	C, moist lowland soils, usually along streambanks	Beechnut is eaten by songbirds as well as mammals and is a particularly important food for squirrels and chipmunks.
Chinquapin <u>Castanea pumila</u>	O, uplands and lowlands	Low wildlife food value, burr covered nuts are occasionally eaten by squirrels.
Oaks ( <u>Quercus</u> ) White ( <u>Q. alba</u> ) Post ( <u>Q. stellata</u> ) Northern Red ( <u>Q. rubra</u> ) Southern Red ( <u>Q. falcata</u> ) Blackjack ( <u>Q. marilandica</u> ) Water ( <u>Q. nigra</u> ) Bluejack ( <u>Q. incana</u> )	C, rich upland and bottom lands C, dry upland sites C, well-drained lowlands C, uplands O, dry upland disturbed sites O, along streams, moist lowlands O, along streams, moist lowlands	Oak trees are a major source of food for wildlife. Acorns rate at or very near the top of the wildlife food list, not so much because they are a preferred food item but because they constitute a good and abundant food source.

TREES & SHRUBS (Cont'd)

Species

Oaks (Quercus) (Cont'd)  
Willow (Q. phellos)  
Swamp Chestnut (Q. prinus)  
Black (Q. velutina)  
Scarlet (Q. coccinea)

Relative Occurrence

R, moist river bottoms, streambanks  
R, moist lowlands  
O, uplands  
O, dry upland soils

Wildlife Use

Their greatest value is in the critical winter season when other foods are scarce. Oaks which bear small acorns are eaten by ducks, especially wood ducks and mallards, quail, songbirds, squirrels, rabbits, and rodents. Deer are fond of larger acorns and also browse on foliage. Oaks also provide useful wildlife cover and nesting sites.

Elms (Ulmus)

American (U. americana)  
Slippery (U. rubra)  
Winged (U. alata)

C, moist lowlands  
C, moist lowlands, streambanks  
C, mostly upland areas

Wildlife value of elms is lower than oaks, maples or dogwoods; however, the seeds and buds are heavily utilized by songbirds, wood duck, quail, squirrels and small rodents. Birds often nest in thick foliage.

Hackberry, Sugarberry (Celtis)  
Georgia Hackberry  
(C. occidentalis var.  
georgiana)  
Sugarberry (C. laevigata)

U, upland areas  
U, moist lowlands  
O, uplands and lowlands

Provide valuable winter food for wildlife. Fruit heavily utilized by game and songbirds, squirrels, skunks, foxes and small rodents. Also provide cover and nesting sites for birds.

Paper Mulberry  
Broussonetia papyrifera

Similar wildlife value as mulberry below.

TREES & SHRUBS - Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Mulberry ( <u>Morus</u> ) White ( <u>M. alba</u> ) Red ( <u>M. rubra</u> )	U, escape ornamental U, fertile lowlands	Mulberry fruits ripen in the spring and are one of the most popular foods of songbirds. Fruit also utilized by squirrel, deer, raccoon, opossum and small rodents.
Tulip Tree or Yellow Poplar <u>Liriodendron tulipifera</u>	C, rich upland and lowland soils	Moderate significance to wildlife. Seeds (winged samaras) are eaten by songbirds (purple finch and cardinal principal users), squirrels and white-footed mouse. Bark and twigs are eaten by beaver and deer.
Pawpaw <u>Asimina parviflora</u>	O, sandy dry soils	Relative wildlife value unknown, fruit eaten by skunks, raccoons, opossum and deer.
Sassafras <u>Sassafras albidum</u>	C, dry soils and old fields	Wildlife importance undetermined, fruit eaten by quail, squirrel, rabbit, and a variety of songbirds.
Sweetgum <u>Liquidambar styraciflua</u>	C, bottom land, moist upland soils	Limited wildlife value, seeds eaten by a few songbirds and squirrel. Beaver occasionally feed on bark and seeds.
Witch-Hazel <u>Hamamelis virginiana</u>	O, fertile uplands and lowlands	Low wildlife value, bark and foliage eaten by beaver and white-tail deer.

TREES & SHRUBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Sycamore <u>Platanus occidentalis</u>	C, fertile moist lowlands	Low wildlife value, seeds are not heavily utilized by songbirds or other wildlife.
Serviceberry <u>Amelanchier arborea</u> <u>A. canadensis</u>	O, upland slopes O, bottom lands	Sweet fruit sought by numerous species of songbirds and is an important wildlife food in the early summer. Squirrels, deer, raccoon, opossum, fox, and skunks feed upon the fruit.
Chokeberry <u>Sorbus arbutifolia</u>	C, moist lowlands	Minor importance to wildlife although fruit is available throughout most of the winter.
Hawthorn <u>Crataegus uniflora</u> <u>C. flava</u>	C, dry upland soils C, sandy dry upland soils	Heavily utilized by birds for nesting sites and cover. Fruit utilized by songbirds and mammals to a lesser degree.
Plum ( <u>Prunus</u> ) <u>Chickasaw (P. angustifolia)</u> <u>Black Cherry (P. serotina)</u>	C, woodlands and pastures C, woodlands and pastures	Fruit not extensively utilized with gray and red fox principal consumers; however, the dense foliage furnishes valuable protective shelter and nesting sites for a variety of birds.
Honey Locust <u>Gleditsia triacanthos</u>	O, old fields, moist lowlands	Wildlife value undetermined.

TREES & SHRUBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Black Locust <u>Robinia pseudo-acacia</u>	C, uplands and lowlands	Low wildlife value, seeds are consumed to a limited extent by quail and songbirds.
Redbud <u>Cercis canadensis</u>	C, fertile well-drained soils	Wildlife value undetermined.
Holly ( <u>Ilex</u> ) American ( <u>I. opaca</u> ) Deciduous ( <u>I. decidua</u> )	C, occasionally upland, mostly lowland C, occasionally upland, mostly lowland	Provide food, shelter and nesting sites for numerous species of songbirds. Fruit utilized by quail, mourning dove, squirrels and a variety of small mammals.
Maple ( <u>Acer</u> ) Box Elder ( <u>A. negundo</u> ) Red ( <u>A. rubrum</u> ) Chalk ( <u>A. saccharum</u> var. <u>leucoderme</u> )	O, moist bottom lands, streambanks C, uplands and lowlands U, moist hillsides and slopes U, moist bottom lands and streambanks	Maples are extensively utilized by wildlife. Seeds, buds, and flowers provide food for numerous species of songbirds, quail and mammals. Deer and beaver browse on foliage.
Florida ( <u>A. saccharum</u> var. <u>floridanum</u> )	O, moist lowlands, streambanks	Wildlife value unknown.
Painted Buckeye <u>Aesculus sylvatica</u>	O, moist well-drained soils	Relatively minor importance to wildlife. Squirrels and chipmunks eat the seeds (nutlets) and rabbits and deer feed on other parts. The seeds are practically of no use to songbirds.

TREES & SHRUBS (Cont 'd)

Species	Relative Occurrence	Wildlife Use
Black Tupelo	C, well-drained bottom land soils	Valuable wildlife species, fruit utilized by a variety of song-birds, wood duck, foxes, raccoon, squirrels, and rodents. Deer and beaver feed on leaves, stems, and bark.
<u>Nyssa sylvatica</u>		
Dogwood ( <u>Cornus</u> )		
Flowering ( <u>C. florida</u> )	C, fertile, well-drained soils	Valuable wildlife food, fleshy fruits which ripen in late summer are available through fall and are utilized by wood duck, quail, numerous songbirds, opossums, foxes, rabbits, skunks, and a variety of small mammals. Deer browse on foliage.
Alternate leaved ( <u>C. alterniflora</u> )	O, streambanks	
Swamp ( <u>C. amomum</u> )	O, moist lowlands, wetlands	
Swamp ( <u>C. stricta</u> )	O, wetlands, streambanks	
Sourwood	O, well-drained lowlands, streambanks	Wildlife value undetermined; deer browse on foliage.
<u>Oxydendrum arboreum</u>		
Persimmon		
<u>Diospyros virginiana</u>	C, upland and lowland	Valuable wildlife food, fruit heavily utilized in fall and winter by songbirds, raccoons, opossum, squirrels, foxes, cotton rabbit, and whitetail deer. Deer also browse on foliage.
Blueberries ( <u>Vaccinium</u> )		
Sparkleberry ( <u>V. arboreum</u> )	C, sandy dry soils	High wildlife value, blueberries are among the most important summer and early fall food.
Gooseberry ( <u>V. stamineum</u> )	C, well-drained dry soils	Utilized by numerous songbirds, squirrels, foxes, raccoons,
Black Blueberry ( <u>V. elliptoti</u> )	O, streambanks, moist lowlands	opossum, deer, and small mammals.
Low Blueberry ( <u>V. vacillans</u> )	O, dry upland soils	Deer and cottontail rabbit browse on foliage and twigs.

TREES & SHRUBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Ash ( <u>Fraxinus</u> ) White ( <u>F. americana</u> ) Green ( <u>F. pennsylvanica</u> )	C, moist bottom land soils C, moist bottom lands, streambanks	Moderate wildlife value, seeds eaten by wood duck, quail, various songbirds, squirrels, and small rodents. Deer browse on foliage and beaver feed on bark and foliage.
Cottonwood <u>Populus deltoides</u>	O, moist lowlands	Moderate wildlife value, buds and catkins provide winter and spring food for quail, dove, songbirds, squirrels, cottontail rabbit, and various small mammals. Twigs, bark and foliage are utilized by deer, rabbit and beaver.
Black Willow <u>Salix nigra</u>	C, streambanks, moist soils	Moderate wildlife value, buds and catkins are eaten by various songbirds, squirrels, and small mammals. Cottontail rabbit, beaver, and deer feed extensively on foliage, bark and twigs.

WOODY BUSHES AND VINES

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Buttonbush <u>Cephalanthus occidentalis</u>	C, wetlands, streambanks	Moderate value to wildlife; waterfowl (wood duck, mallard, and teal) songbirds and small mammals eat the seeds. Deer and beaver feed on foliage and wood.
Privet <u>Ligustrum sinense</u>	O, bottom lands	Minimal or little wildlife value.
Sumac ( <u>Rhus</u> ) Poison Ivy ( <u>R. radicans</u> ) Poison Oak ( <u>R. toxicodendron</u> ) Winged Sumac ( <u>R. copallina</u> ) Smooth Sumac ( <u>R. glabra</u> )	C, Sumacs are found in a variety of sites--thickets, woods, pastures, disturbed lands, fence rows, roadsides, etc.	Moderate wildlife value; although not a preferred food, sumacs are an important winter food for numerous species of game and songbirds. Rabbits, deer, and small mammals feed on seeds and foliage.
Honeysuckle ( <u>Lonicera</u> ) Japanese ( <u>L. japonica</u> ) Coral ( <u>L. sempervirens</u> )	C, Woodlands, thickets, fence rows C, Woodlands, thickets, fence rows	High wildlife value; seeds are eaten by songbirds and small mammals, foliage and seeds are eaten by rabbits and deer. Provides excellent protection cover for wildlife.
<u>Viburnum (Viburnum)</u> Black Haw ( <u>V. prunifolium</u> ) Blue Haw ( <u>V. rufidulum</u> )	O, wetlands, moist lowlands O, uplands, dry soils	Heavily utilized by wildlife. Fruit is eaten by quail, dove, numerous songbirds, rabbits, squirrels, and small rodents. Deer and cottontail rabbit browse on twigs and foliage.

WOODY BUSHES AND VINES (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Blackberry ( <u>Rubus</u> ) Dewberry ( <u>R. flagellaris</u> ) Blackberry ( <u>R. argutus</u> )	O, pastures, old fields, thickets C, border of woodlands, old fields, thickets	Highly utilized by wildlife, especially in the summer when berries are ripe. Numerous song and game birds, large and small mammals including fox, raccoon, opossum, deer, feed on fruit. Snakes, lizards, and turtles also utilize fruit. Also provide nesting areas in the summer and winter cover for numerous wildlife species.
Greenbrier ( <u>Smilax</u> ) Greenbrier ( <u>S. rotundifolia</u> ) Greenbrier ( <u>S. bona-nox</u> ) Smooth Greenbrier ( <u>S. glauca</u> )	C, woods, thickets C, woods, thickets C, moist woods, wetlands, lowlands	High wildlife value; provides good protective cover for cottontail rabbit, songbirds, and other small wildlife species. Important food source in the winter for wildlife. Greenbrier rates as one of the most important secondary foods for whitetail deer.
Virginia Creeper <u>Parthenocissus quinquefolia</u>	C, uplands and lowlands	Important fall and winter food eaten by songbirds, foxes, squirrels, cottontail rabbit, deer and rodents.
Grape ( <u>Vitis</u> ) Muscadine ( <u>V. rotundifolia</u> ) Possum ( <u>V. baileyana</u> ) Summer ( <u>V. aestivalis</u> )	C, Wild grapes occur on fertile C, soils commonly found along C, streambanks, fence rows and near margins of woods.	High wildlife value; fruit is utilized by wood duck, quail, mourning dove, numerous species of songbirds, skunks, foxes, squirrels, rabbits, deer, opossum and

WOODY BUSHES AND VINES (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Cross Vine <u>Anisostichus capreolata</u>	C, thickets, bottom land forests	small mammals. In summer the dense foliage provides good escape and shelter cover as well as nesting sites for songbirds. Wildlife value unknown.
Trumpet Vine <u>Campsis radicans</u>	C, woodlands, fence rows, roadsides	Wildlife value unknown.
Wild Rose <u>Rosa carolina</u>	C, upland pastures, woodland borders	Seed eaten by songbirds and small mammals; provides excellent nesting and protective cover for small mammals and songbirds.
Sensitive Brier <u>Schrankia microphylla</u>	O, roadsides, pastures, open woods	Wildlife value unknown.
Mountain Laurel <u>Kalmia latifolia</u>	U, moist uplands, well-drained lowlands	Wildlife value undetermined in southeast.
Partridge Berry <u>Mitchella repens</u>	O, streambanks, wooded lowlands	Low to minor wildlife value; fruit eaten by a few songbirds.
Elderberry <u>Sambucus canadensis</u>	O, open lands, wooded bottom lands	High wildlife value; important source of summer food for numerous songbirds, squirrels, and small rodents. Bark and foliage utilized by deer and cottontail rabbit.

WOODY BUSHES AND VINES (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Hercules Club <u>Aralia spinosa</u>	O, uplands and lowlands	Low wildlife value; fruit and seeds eaten by a few songbirds and mammals (fox, raccoon, opossum, squirrel, and small rodents).
Groundsel-Tree <u>Baccharis halimifolia</u>	O, fields, woodlands, disturbed lands	Wildlife value undetermined.

GRASSES AND HERBS

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Brome Perennial Brome ( <u>B. purgans</u> ) Rescue Brome ( <u>B. cathartis</u> ) Common Chess ( <u>B. secalinus</u> ) Common Annual Brome ( <u>B. secalinus</u> ) Japanese Annual Brome ( <u>B. japonicus</u> )	Bottom lands, rich wooded soils Disturbed lands, roadsides, fields Disturbed lands, roadsides, fields Disturbed lands, roadsides, fields Disturbed lands, roadsides, fields	Considerably utilized by wildlife; seeds eaten by songbirds and rodents. Leaves, roots, and stems are also consumed by cottontail rabbit, deer, ground squirrel, gopher, field mice, and rats.
Common Fescuegrass ( <u>Festuca</u> ) Annual Fescue ( <u>F. octoflora</u> )	Old fields, roadsides, disturbed lands Old fields, roadsides, disturbed lands Low woods and roadsides	Wildlife value similar to that of Brome grasses but to a lesser extent.
Coarse Perennial Fescue ( <u>F. elatior</u> ) Cespitose Perennial Fescue ( <u>F. obtusa</u> )	Disturbed areas, roadsides, fields Bottom land hardwoods	High wildlife value, especially seed-eating birds. Seeds eaten by songbirds, quail, dove, and small rodents. Grazed upon by small mammals, cottontail rabbit, and whitetail deer.
Common Bluegrasses ( <u>Poa</u> ) Annual Bluegrass ( <u>P. annua</u> ) Cespitose Perennial Bluegrass ( <u>P. autumnalis</u> ) Perennial Bluegrass ( <u>P. cuspidata</u> ) Kentucky Bluegrass ( <u>P. pratensis</u> )	Bottom land hardwoods Lawns, roadsides, disturbed lands, old fields	Little wildlife value, seeds eaten sparingly by songbirds.
Orchard Grass <u>Dactylis glomerata</u>	An introduced forage grass	Not heavily utilized by wildlife, small mammals; deer and rabbit occasionally forage on plant.
Ryegrasses ( <u>Lolium</u> ) Rye ( <u>L. temulentum</u> ) Italian ( <u>L. multiflorum</u> ) Italian ( <u>L. perenne</u> )	Pastures, fields, roadsides Fields, roadsides Pasturelands, roadsides	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Peppergrass ( <u>Lepidium</u> ) Poor-mans Pepper ( <u>L. virginicum</u> ) Cowcress ( <u>L. campestre</u> )	Fields, gardens, disturbed lands Cultivated fields, disturbed lands	Moderately low wildlife value; seed pods utilized to some extent by songbirds, rodents, and small mammals.
Sheperd's-purse <u>Capsella bursa-pastoris</u>	Fields, pastures, disturbed lands	Wildlife value similar to above.
Strawberry ( <u>Fragaria virginiana</u> ) Indian Strawberry ( <u>Duchesnea indica</u> )	Old fields, woodland borders Lawns, old fields, pastures, disturbed lands	High wildlife value; leaves and fruit utilized by numerous song- birds, cottontail rabbit, squirrels, foxes, rodents, opossum, and whitetail deer.
Partridge Peas ( <u>Cassia</u> ) Sicklepod ( <u>C. obtusifolia</u> ) Partridge Pea ( <u>C. fasciculata</u> )	Old fields, disturbed lands Old fields, disturbed lands, wood- land borders. Old fields, roadsides, disturbed lands	Moderate wildlife value; limited use by songbirds and whitetail deer. However, seeds are heavily utilized by bobwhite quail.
Wild Sensitive Plant ( <u>C. nictitans</u> )	Old fields, roadsides, disturbed lands	
Indigos ( <u>Baptisia</u> ) Large-bracked Indigo ( <u>B. bracteata</u> ) Yellow Wild Indigo ( <u>B. tinctoria</u> ) White Wild Indigo ( <u>B. alba</u> )	Sandy soils and open woods, pastures Open woods and clearings Open woods and clearings	Wildlife value undetermined; seed pods are eaten by quail, song- birds, and small mammals. Browsed upon by whitetail deer and cotton- tail rabbit.

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Clover ( <u>Trifolium</u> )		
Rabbitfoot Clover ( <u>T. arvense</u> )	Fields, roadsides, disturbed lands	Moderate value to wildlife; seeds are eaten by numerous songbirds and small mammals. Plant is foraged upon by a wide variety of mammals, principally rabbit, rodents, and whitetail deer.
Purple or Red Meadow Clover ( <u>T. pratense</u> )	Fields and roadsides	
White Clover ( <u>T. ripens</u> )	Lawns, fields and roadsides	
Yellow Clover ( <u>T. campestre</u> )	Lawns, fields, disturbed lands	
Least Hopclover ( <u>T. dubium</u> )	Lawns, fields, disturbed lands	
Crimson Clover ( <u>T. incarnatum</u> )	Fields and roadsides	
Dropseedgrasses ( <u>Sporobolus</u> )		
Smutgrass ( <u>S. poiretii</u> )	Roadsides, old fields, disturbed lands	Good wildlife food for quail, dove, and ground-feeding songbirds and rodents feed on seeds. Deer and rabbit feed on foliage.
Dropseed ( <u>S. clandestinus</u> )	Open woodlands and roadsides	
Bermuda Grass		
<u>Cynodon dactylon</u>	Pastures, lawns, disturbed lands	Very little importance to wildlife
Crabgrasses ( <u>Digitaria</u> )		
Slender ( <u>D. filiformis</u> )	Sandy fields and roadsides	Good wildlife food for dove, quail and ground-feeding songbirds obtain a considerable part of their food from seeds.
Smooth ( <u>D. ischaemum</u> )	Fields and lawns, disturbed lands	
Hairy ( <u>D. sanguinalis</u> )	Fields and roadsides, disturbed lands	
Paspalums ( <u>Paspalum</u> )		
Joint-grass ( <u>P. distichum</u> )	Wetlands, moist lowlands	Seeds utilized by waterfowl, quail, dove, numerous songbirds, small mammals, and rodents.
Dallis Grass ( <u>P. dilatatum</u> )	The remaining listed species occur along roadsides, pastures, old fields, gardens, low woodlands, disturbed and abused lands	Whitetail deer and cottontail rabbit forage on stems and leaves.
Paspalum ( <u>P. urvillei</u> )		
Bull Paspalum ( <u>P. boscianum</u> )		
Long-stacked ( <u>P. setaceum</u> )		
Field ( <u>P. laeve</u> )		
Florida ( <u>P. floridanum</u> )		

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Panic grasses ( <u>Panicum</u> )		
Flat Stem Panicum ( <u>P. anceps</u> )	Roadsides, old fields	Due to the wide distribution and abundance, Panicums are one of the most important sources of food for wildlife. Numerous species of waterfowl, upland and lowland songbirds feed extensively on the seeds. Whitetail deer, cottontail rabbit, gophers, rodents, and other small mammals feed on stems, leaves, and roots.
Tall Flat Panicum ( <u>P. stipitatum</u> )	Wetlands, moist lowlands	
Red Top Panicum ( <u>P. agrostoides</u> )	Wetlands, moist lowlands	
Spreading Witch Grass ( <u>P. dichotomiflorum</u> )	Wetlands, moist lowlands	
Witch Grass ( <u>P. hians</u> )	Open woods, roadsides	
Lax Flowered Panicum ( <u>P. laxiflorum</u> )	Wetlands, moist lowlands	
Narrow Leafed Panicum ( <u>P. augustifolium</u> )	Open woods, moist lowlands	
Woolly Panicum ( <u>P. lanuginosum</u> )	Open woods and fields	
White-haired Panicum ( <u>P. villosissimum</u> )	Sandy woods	
Commons' Panicum ( <u>P. commutatum</u> )	Wetlands, moist woodlands	
Velvety Panicum ( <u>P. scoparium</u> )	Ditches, low woods	
Bosc's Panicum ( <u>P. boscii</u> )	Dry upland woods	
Foxtailgrasses ( <u>Setaria</u> )		
Foxtail ( <u>S. geniculata</u> )	Roadsides, pastures, disturbed lands	High wildlife value, ranks above all grasses or forbs for food.
Yellow Foxtail ( <u>S. glauca</u> )	Roadsides, pastures, disturbed lands	Seeds are very utilized by game and songbirds, waterfowl, small mammals and rodents. Deer, rabbit, and rodents feed on leaves and stems.
Golden Millet ( <u>S. italica</u> )	Cultivated species	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Broomsedge and Bluestem ( <u>Andropogon</u> )		
Little Bluestem ( <u>A. scoparius</u> )	Fields, woodsides, disturbed lands	Provide good protective cover for wildlife and nesting sites for grown dwelling birds; also provide seeds which are utilized during winter. Seeds and plant are utilized by cottontail rabbit, ground squirrel, and rodents.
Big Bluestem ( <u>A. gerardii</u> )	Fields and open dry woods	
Silver Bluestem ( <u>A. ternarius</u> )	Fields, roadsides, open woods	
Elliott's Beard-grass ( <u>A. eliottii</u> )	Fields, roadsides, open dry woods	
Annual Broomsedge ( <u>A. virginicus</u> )	Abused lands, roadsides, old fields	
<b>Sedges (<u>Carex</u>)</b>		Moderate wildlife value because of their wide availability in both lowland and upland areas; the seeds are eaten by many kinds of wildlife. Normally, the plants are not abundant enough near the streams, lakes, and water margins to make their seeds of major importance to waterfowl; but ducks (wood ducks, mallards and teal) frequently feed on seed when available. Other shoreline and songbirds, small mammals, also feed on seeds. Other wildlife utilize seeds and foliage -- squirrels, cottontail rabbit and deer.
<u>C. retroflexa</u>	Dry woods and bottom lands	
<u>C. muhlenbergii</u>	Sandy woods and fields	
<u>C. vulpinoidea</u>	Wetlands, ditches, moist lowlands	
<u>C. annectens</u>	Wetlands, ditches, moist lowlands	
<u>C. stipata</u>	Wetlands, ditches, moist lowlands	
<u>C. laevivaginata</u>	Wetlands, ditches, moist lowlands	
<u>C. tribuloides</u>	Moist wood lowlands	
<u>C. festucacea</u>	Moist woodlands and meadows	
<u>C. leptalea</u>	Wetlands, moist lowlands	
<u>C. willdenowii</u>	Moist, rich wooded lowlands	
<u>C. nigromarginata</u>	Dry upland woods	
<u>C. digitalis</u>	Bottom land woods	
<u>C. striatula</u>	Bottom land woods	
<u>C. amphibola</u>	Bottom land woods	
<u>C. debilis</u>	Moist bottom land woods	
<u>C. caroliniana</u>	Moist, rich wooded lowlands ditches, and meadows	
<u>C. complanata</u>	Wooded lowlands, pinelands, ditches, and meadows	
<u>C. crinita</u>	Wooded lowlands, meadows, ditches	
<u>C. frankii</u>	Bottom land woods and meadows	
<u>C. lurida</u>	Ditches and meadows	
<u>C. typhina</u>	Wooded lowlands	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Sedges (Carex) Cont'd		
<u>C. intumescens</u>	Bogs, wooded lowlands	
<u>C. grayi</u>	Wooded lowlands	
<u>C. lupulina</u>	Wooded lowlands	
Jack-in-the-Pulpit ( <u>Arisaema</u> )	Wooded lowlands	Wildlife value undetermined.
Green Dragon ( <u>A. dracontium</u> )	Rich woods, wooded lowlands, bogs	
Indian Turnip ( <u>A. triphyllum</u> )		
Sheepsorrel ( <u>Rumex</u> )		
Sheep-sorrel ( <u>R. acetosella</u> )	Pasture, fields, and roadsides	High wildlife value; seeds and leaves are eaten by a variety of wildlife. Seeds are eaten by numerous ground feeders such as birds. Foliage and seeds are fed upon by rodents, cottontail rabbit and whitetail deer.
Curled Dock ( <u>R. crispus</u> )	Pasture, fields, disturbed lands	
Knotweeds ( <u>Polygonum</u> )		
Knot-grass ( <u>P. aviculare</u> )	Dry open fields, pastures	Valuable wildlife food; seeds eaten by quail, mourning dove, various songbirds, and small mammals.
Knot-weed ( <u>P. pensylvanicum</u> )	Fields, pastures, moist disturbed lands	
Knot-weed ( <u>P. punctatum</u> )	Wetlands, moist lowlands	
Knot-weed ( <u>P. persicaria</u> )	Fields, pastures, disturbed lands	
Knot-weed ( <u>P. setaceum</u> )	Wetlands, moist bottom land woods	
Knot-weed ( <u>P. sagittatum</u> )	Wetlands, moist bottom land woods	
Black Blindweed ( <u>P. convolvulus</u> )	Roadsides, fields, disturbed lands	
Goosefoot & Lambsquarter ( <u>Chenopodium</u> )		
Goosefoot ( <u>C. ambrosioides</u> )	Cultivated fields, pastures, disturbed lands	Seeds heavily utilized by quail, mourning doves, and various songbirds and small rodents.
Lambsquarter ( <u>C. album</u> )	Cultivated fields, pastures, disturbed lands	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Pigweeds ( <u>Amaranthus</u> ) Pigweed ( <u>A. hybridus</u> ) Pigweed ( <u>A. spinosus</u> )	Cultivated fields, disturbed lands Barnyards and disturbed lands	Valuable wildlife food especially in winter and early spring. Seeds are heavily utilized by quail, dove, and songbirds.
Polkweed <u>Phytolacca americana</u>	Pastures, fields, disturbed lands	Important source of wildlife food in the late fall and early winter. Fruit and seed eaten by songbirds, rodents, raccoon, fox, and opossum opossum.
Chickweed ( <u>Stellaria</u> ) Common Chickweed ( <u>S. media</u> ) Chickweed ( <u>S. pubera</u> )	Disturbed lands, cultivated fields Bottom land woods	Heavily utilized by game and songbirds, especially in late winter early spring when seeds are present.
Buttercups ( <u>Ranunculus</u> ) Hairy Buttercup ( <u>R. parviflorus</u> )  Smooth-leaved Crowfoot ( <u>R. abortivus</u> ) Rough Crowfoot ( <u>R. recurvatus</u> ) Hispid Buttercup ( <u>R. hispidus</u> )	Cultivated fields and disturbed lands Moist fields and disturbed lowlands Moist lowlands and low woods Dry and moist woodlands, pastures	Low wildlife value; although seeds, are eaten by songbirds and rodents this usage is generally minor. Wood duck will feed upon seeds when available.
Medic ( <u>Medicago</u> ) Alfalfa ( <u>M. sativa</u> ) Black Medic ( <u>M. lupulina</u> ) Spotted Medic ( <u>M. arabica</u> )	Roadsides, fields, disturbed lands Roadsides, fields, disturbed lands	Wildlife value undetermined.

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Sweetclovers ( <u>Melilotus</u> )		
Yellow Sweetclover ( <u>M. officinalis</u> )	Roadsides, fields, disturbed lands	Low to moderate wildlife value; seeds eaten by birds, plants grazed upon by deer and cottontail rabbit.
White Sweetclover ( <u>M. alba</u> )	Roadsides, fields, disturbed lands	
Pencil Flower <u>Stylosanthes biflora</u>	Open woods and borders, disturbed lands	Wildlife value undetermined; seeds eaten by songbirds and rodents.
Tick-trefoil, Beggar Tick's ( <u>Desmodium</u> )		
Tick-trefoil ( <u>D. nudiflorum</u> )	Woodlands, thickets, forests	Limited wildlife value; bobwhite quail is the only known species to feed on trefoil to any extent.
Dollarleaf ( <u>D. rotundifolium</u> )	Woodlands, thickets, forests	
Hoary Tick-trefoil ( <u>D. canescens</u> )	Fields, woodland borders, open woods	Plant occasionally browsed upon by whitetail deer.
Tick-Trefoil ( <u>D. ciliare</u> )	Fields, woodland borders, open woods	
Panicled Tick-trefoil ( <u>D. paniculatum</u> )	Fields and open woods	
Smooth Tick-trefoil ( <u>D. laevigatum</u> )	Fields and open woods	
Velvet-leaved Tick-trefoil ( <u>D. viridiflorum</u> )	Fields and open woods	
Lespedezas ( <u>Lespedeza</u> )		
Korean Clover ( <u>L. stipulacea</u> )	Fields, roadsides, disturbed lands	Low to moderate wildlife value; although generally considered to be important as a wildlife food, bobwhite quail and relatively few songbirds and rodents utilize the seed to any extent. Deer and rabbit forage on plant. In dense stands lespedeza offers considerable cover and shelter for small mammals and songbirds.
Japanese Clover ( <u>L. striata</u> )	Fields, roadsides, disturbed lands	
Trailing Bushclover ( <u>L. procumbens</u> )	Open woods, fields, roadsides	
Slender Bushclover ( <u>L. virginica</u> )	Open woods, fields, roadsides	
Creeping Bushclover ( <u>L. repens</u> )	Open woods, fields, roadsides	
Sture's Bushclover ( <u>L. stuevei</u> )	Open woods, fields, roadsides	
Wand-like Bushclover ( <u>L. intermedia</u> )	Open woods, fields, roadsides	
Sericea Lespedeza ( <u>L. cuneata</u> )	Open woods, fields, roadsides	
Hairy Bushclover ( <u>L. hirta</u> )	Open woods, fields, roadsides	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
<u>Vetches (Vicia)</u>		
Common Vetch ( <u>V. angustifolia</u> )	Fields, roadsides, disturbed lands	Limited wildlife value; seeds and foliage utilized to a limited extent by songbirds and small mammals.
Smooth Vetch ( <u>V. dasycarpa</u> )	Fields, roadsides, disturbed lands	
Hairy Vetch ( <u>V. villosa</u> )	Fields, roadsides, disturbed lands	
Carolina or Pole Vetch ( <u>V. caroliniana</u> )	Woods and wooded borders	
Hog Peanut <u>Amphicarpa bracteata</u>	Thickets and woods	Limited wildlife use because limited abundance; several songbirds, quail, deer, rabbit, rodents, and small mammals forage on plant and seeds.
<u>Wood Sorrel (Oxalis)</u>		
Violet Woodsorrel ( <u>O. violaces</u> )	Rich upland and lowland woods	Moderate wildlife value; seed pods, leaves and subterranean bulbs are eaten by quail, mourning dove, songbirds, rodents, cotton-tail rabbit, deer, and small mammals.
Creeping Lady's Sorrel ( <u>O. dillenii</u> )	Lawns, gardens, fields, disturbed lands	
Florida Woodsorrel ( <u>O. florida</u> )	Lawns, gardens, fields, disturbed lands	
Yellow Woodsorrel ( <u>O. stricta</u> )	Lawns, gardens, fields, disturbed lands	
<u>Geraniums (Geranium)</u>		
Wild Geranium ( <u>G. maculatum</u> )	Bottom land woods	Seeds eaten by quail, mourning dove, songbirds, rodents, and small mammals.
Carolina Geranium ( <u>G. carolinianum</u> )	Gardens, fields, pastures, disturbed lands	
Crane's bill Geranium ( <u>G. dissectum</u> )	Fields and pastures	
Doveweed ( <u>Croton glandulosus</u> )	Fields, roadsides, pastures	High wildlife value; heavily utilized by doves, bobwhite quail, songbirds, and small mammals.

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Slender Three-Seeded Mercury ( <u>Acalypha gracilens</u> )	Woodlands, fields, roadsides disturbed lands	Wildlife value undetermined.
Slender Three-Seeded Mercury ( <u>A. rhomoidea</u> )	Woodlands, fields, roadsides disturbed lands	
Spurges ( <u>Euphorbia</u> ) Flowing or Tramps Spurge ( <u>E. corollata</u> )	Woodland borders, embankments, and disturbed lands	Wildlife value moderate; seeds fed upon by mourning dove, quail, various songbirds, and small and rodents.
Spotted Spurge ( <u>E. supina</u> )	Woodland borders, embankments, disturbed lands	
Spurge ( <u>E. maculata</u> )	Cultivated and disturbed lands, roadsides	
Spotted Touch-Me-Not (Jewel Weed) <u>Impatiens capensis</u>	Wetlands, streambanks, moist bottom land woods	Moderate wildlife value; seeds are eaten by quail and several songbirds and rodents. Nectar from flower is favorite of hummingbirds.
New Jersey Tea <u>Ceanothus americanus</u>	Mixed deciduous forests and borders	Wildlife value undetermined.
St. John's-Wort ( <u>Hypericum</u> ) St. Andrew's Cross ( <u>H. hypericoides</u> ) Common St. John's Wort ( <u>H. walteri</u> )	Dry upland woods  Sandy woods	Wildlife value undetermined.
Pinewood ( <u>H. gentianoides</u> ) Slender St. John's Wort Naked St. John's Wort ( <u>H. nudiflorum</u> ) Spotted St. John's Wort ( <u>H. punctatum</u> )	Fields, roadsides, rock outcrops Wetlands, ditches, moist soils Low woods, streambanks  Fields, woods, ditches, disturbed lands	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
<u>Violet (Violaceae)</u>		
<u>Crowfoot Violet (V. pedata)</u>	Rocky or sandy upland woods	Low to moderate wildlife value;
<u>Hooded Blue Violet (V. papilionacea)</u>	Lawns, roadsides, woods	seeds eaten by songbirds, quail, and dove. Cottontail rabbit and deer browse on plant.
<u>Early Blue Violet (V. palmata)</u>	Wooded slopes, bottom land woods	
<u>Primrose-leaved Violet (V. primulifolia)</u>	Wetlands, streambanks	
<u>Field Pansy (V. rafinesquii)</u>	Pastures, roadsides, disturbed lands	
<u>Prickly Pear Cactus</u>	Sandy or rocky areas, abused lands	Moderate wildlife fruit eaten by numerous songbirds, cottontail rabbit, and squirrels.
<u>Opuntia compressa</u>		
<u>Ludwigia (Ludwigia)</u>		
<u>Primrose-willow (L. decurrens)</u>	Wetlands, roadside ditches, moist open lands	Wildlife value undetermined.
<u>Seedbox or Rattlebox (L. alternifolia)</u>	Wetlands, roadside ditches, moist open lands	
<u>Cylindric-fruited Ludwigia (L. glandulosa)</u>	Wetlands, moist woody lowlands	
<u>Ludwigia (L. palustris)</u>	Wetlands, moist woody lowlands	
<u>Evening Primrose (Oenothera)</u>		
<u>Common Evening Primrose (O. biennis)</u>	Fields, pastures, disturbed lands	Wildlife value undetermined.
<u>Evening Primrose (O. laciniata)</u>	Fields, pastures, disturbed lands	
<u>Sundrops (O. fruticosa)</u>	Fields, pastures, disturbed lands	
<u>Wild Carrot</u>		
<u>Daucus carota</u>	Woodsides, fields, pastures, abused lands	Low wildlife value.
<u>Yellow Jessamine</u>		
<u>Gelsemium sempervirens</u>	Thickets, woods, fence rows, roadsides	Wildlife value undetermined.

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Ground Cherry ( <u>Physalis</u> ) Clammy Ground Cherry ( <u>P. heterophylla</u> ) Virginia Ground Cherry ( <u>P. virginiana</u> ) Cut-leaved Ground Cherry ( <u>P. angulata</u> ) Low Hairy Ground Cherry ( <u>P. pubescens</u> )	Woodlands, clearings, roadsides Pine woods, roadsides, fields Sandy field borders, roadsides, open woodlands Woodlands, roadsides, disturbed lands	Low to moderate wildlife value; berry fed upon by various ground and songbirds, opossum, skunks, foxes, rabbits and rodents; but the total eaten use is minor.
Nightshade ( <u>Solanum</u> ) Horse-Nettle ( <u>S. carolinense</u> )  Black or Deadly Nightshade ( <u>S. americanum</u> )	Roadsides, old fields, disturbed lands Woodland borders, fields, disturbed lands	Moderate to high wildlife value; fruit eaten by wood duck, quail, doves, numerous songbirds, racoons, skunks, rodents and small mammals.
Mullein ( <u>Verbascum</u> ) Common Mullein ( <u>V. blattaria</u> ) Woolly Mullein ( <u>V. thapsus</u> )	Fields, roadsides, disturbed lands Fields, roadsides, pastures	Wildlife value undetermined. Seeds are eaten by game and songbirds and rodents. Leaves are occasionally foraged upon by cottontail rabbit.
Toad-Flax <u>Linaria canadensis</u>	Fallow fields, roadsides, disturbed lands	Wildlife value undetermined.
Veronica ( <u>Veronica</u> ) ( <u>V. peregrina</u> ) ( <u>V. arvensis</u> )	Fields, roadsides, disturbed lands Fields, roadsides, disturbed lands	Wildlife value undetermined.

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Plantain ( <u>Plantago</u> )		
Pale Plantain ( <u>P. rugelii</u> )	Plantagos occur on disturbed lands	High wildlife value; seeds eaten
Buckhorn Plantain ( <u>P. lanceolata</u> )	such as lawns, roadsides, fields,	by numerous songbirds, rodents,
Large-bracted Plantain	pastures, open woodlands, over-	and small mammals. Plantain
( <u>P. aristata</u> )	grazed pastures, and cultivated	leaves are a favorite food of
Hooker's Plantain ( <u>P. hookeriana</u> )	lands	cottontail rabbit which gives
White Plantain ( <u>P. virginica</u> )		rise to the plant's being
Many-seeded Plantain		referred to as rabbit tobacco.
( <u>P. heterophylla</u> )		
Milkweed ( <u>Asclepias</u> )		
Swamp Milkweed ( <u>A. incarnata</u> )	Wetlands, streambanks, moist	Wildlife value undetermined, but
	meadows	songbirds are known to eat the
Whorled Milkweed	Dry open woods, roadsides, rocky	seeds as are small mammals.
( <u>A. verticillata</u> )	slopes	
Butterfly-Weed ( <u>A. tuberosa</u> )	Dry fields and woodland borders	
Blunt-leaved Milkweed	Open woods, clearings, fields,	
( <u>A. amplexicaulis</u> )	and roadsides	
White Milkweed ( <u>A. variegata</u> )	Open woods, clearings, fields, and	
	roadsides	
Morning Glories ( <u>Ipomoea</u> )		
Red Morning Glory ( <u>I. coccinea</u> )	Cultivated fields, roadsides, dis-	
	turbed lands	
Common Morning Glory	Cultivated fields, roadsides, dis-	
( <u>I. purpurea</u> )	turbed lands	
Ivy-leafed Morning Glory	Disturbed lands, woodland borders	
( <u>I. hederacea</u> )		
White Morning Glory ( <u>I. lacunosa</u> )	Fields, roadsides, disturbed lands	Little wildlife value; large seeds
White Potato Vine ( <u>I. pandurata</u> )	Dry open roadsides, fence rows, old	occasionally eaten by bobwhite
	fields	quail, some songbirds, and few
		rodents.

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Verbenas ( <u>Verbena</u> ) Verbena ( <u>V. brasiliensis</u> ) Verbena ( <u>V. bonariensis</u> ) White or Nettle-leaved Verbena ( <u>V. urticifolia</u> )	Old fields, disturbed lands Old fields, disturbed lands Woodlands, old fields, disturbed lands	Low wildlife value
Mountain Mints ( <u>Pycnanthemum</u> ) Narrowleaf Mountain Mint ( <u>P. tenuifolium</u> ) Hoary Mountain Mint ( <u>P. incanum</u> )	Wetlands, moist meadows and pastures Woodlands, thickets, pastures, and old fields	Wildlife value undetermined.
Bugle-weed <u>Lycopus virginicus</u>	Wetlands, moist lowland woods, wet fields	Wildlife value undetermined.
Buttonweeds ( <u>Diodia</u> ) Large Buttonweed ( <u>D. virginiana</u> ) Rough Buttonweed ( <u>D. teres</u> )	Wetlands, moist lowlands, stream-banks Sandy fields, woodlands, roadsides, disturbed lands	Low wildlife value; bobwhite quail and songbirds occasionally feed on seeds.
Bluets ( <u>Houstonia</u> ) Innocence Bluets ( <u>H. caerulea</u> ) Small Bluets ( <u>H. pusilla</u> ) Large Houstonia ( <u>H. purpurea</u> )	Hardwood forests, meadows, clearings Hardwood forests, meadows, clearings Hardwood forests, meadows, clearings	Wildlife value undetermined.
Bedstraw ( <u>Galium</u> ) Cross-cleavers ( <u>G. ciraezans</u> ) Hairy Bedstraw ( <u>G. pilosum</u> ) Goose-grass ( <u>G. aparine</u> ) Fragrant Bedstraw ( <u>G. triflorum</u> ) Marsh Bedstraw ( <u>G. tinctorium</u> )	Bottomland forests Woods, clearings, roadsides Meadows, woods, disturbed lands Hardwood forests, fields, roadsides Wetlands, streambanks, roadside ditches	Wildlife value undetermined.

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Venus' Looking-glass ( <u>Specularia</u> )		
Venus' Looking-glass ( <u>S. perfoliata</u> )	Roadsides, fields, gardens	Wildlife value undetermined.
Small Venus' Looking-glass ( <u>S. biflora</u> )	Roadsides, fields, gardens	
Ragweeds ( <u>Ambrosia</u> )		
Giant Ragweed ( <u>A. trifida</u> )	Cultivated fields, pastures, disturbed lands	High wildlife value, ranking among the top wildlife foods, especially in the fall and winter months.
Common Ragweed ( <u>A. artemisiifolia</u> )	Cultivated fields, pastures, disturbed lands	Seeds are heavily utilized by game and numerous songbirds, small mammals. Whitetail deer also browse on plant.
Cocklebur <u>Xanthium strumarium</u>	Fields, pastures, streambanks, disturbed lands	Wildlife value undetermined.
Rattlesnake Root ( <u>Prenanthes</u> )		
Slender Rattlesnake Root ( <u>P. altissima</u> )	Woodlands and thickets	Moderate wildlife value; basal leaves are eaten by rabbit, deer, and small mammals.
Gall-of-the-earth ( <u>P. serpentina</u> )	Woodlands, thickets, and roadsides	
Lettuce ( <u>Lactuca</u> )		
Prickly Lettuce ( <u>L. scaiola</u> )	Fields, roadsides, disturbed lands	Moderately low wildlife values; seeds are occasionally eaten by birds and foraged upon by whitetail deer.
Canada Wild Lettuce ( <u>L. canadensis</u> )	Pastures, woodlands, disturbed lands	
Sow-thistle ( <u>Sonchus</u> )		
Spiney-leaved Sow-thistle ( <u>S. asper</u> )	Fields, pastures, disturbed lands	Wildlife value undetermined.
Common Sow-thistle ( <u>S. oleraceus</u> )		

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Hawkweed ( <u>Hieracium</u> )		
Rattlesnake Weed ( <u>H. venosum</u> )	Woodlands, woodland borders	Wildlife value undetermined.
Hairy Hawkweed ( <u>H. gronovii</u> )	Roadsides, pastures, woodlands	
Dwarf Dandelion	Rocky woods, roadsides, pastures, lawns	Wildlife value similar to <u>Taraxacum</u> genus below.
<u>Krigia virginica</u>		
False Dandelion	Meadows, roadsides, pastures, lawns	Wildlife value similar to <u>Taraxacum</u> genus below.
<u>Pyrrhopappus carolinianus</u>		
Common Dandelion	Pastures, lawns, disturbed lands	Moderate to high wildlife value; seeds are eaten by numerous song-birds and small mammals. Plant is also foraged upon by rabbit, gophers, small mammals, and whitetail deer.
<u>Taraxacum officinale</u>		
Ironweed ( <u>Vernonia</u> )		
Ironweed ( <u>V. acaulia</u> )	Upland sandy woods	Wildlife value undetermined.
Ironweed ( <u>V. angustifolia</u> )	Old fields, sandy pine woods	
Broadleaved Ironweed ( <u>V. glauca</u> )	Upland woods	
New York Ironweed ( <u>V. noveboracensis</u> )	Wetlands, streambanks, moist lowlands	
Thoroughwort ( <u>Eupatorium</u> )		
Trumpetweed ( <u>E. dubium</u> )	Wetlands, meadows, open woodlands	Wildlife value undetermined.
Spotted Joe-Pye Weed ( <u>E. fistulosum</u> )	Wetlands, moist wood lowlands, meadows	
Dog-fennel ( <u>E. capillifolium</u> )	Fields, pastures, disturbed lands	
Thoroughwort ( <u>E. compositifolium</u> )	Fields, pastures, disturbed lands	
White Thoroughwort ( <u>E. album</u> )	Woodlands, old fields, pine woods	
Mistflower ( <u>E. cuneifolium</u> )	Sandy soils, old fields, pastures, woodlands	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Thoroughwort ( <u>Eupatorium</u> ) Cont'd		
Hyssop-leaved Thoroughwort ( <u>E. hyssopifolium</u> )	Old fields, pastures, woodlands	
White Snake-root Thoroughwort ( <u>E. aromaticum</u> )	Woodlands and old fields	
Round leaf Thoroughwort ( <u>E. rotundifolium</u> )	Woodlands and pastures	
Fleabanes ( <u>Erigeron</u> )		
Daisy Fleabane ( <u>E. annuus</u> )	Roadsides, pastures, fields, disturbed lands	Wildlife value undetermined.
Daisy Fleabane ( <u>E. stigosus</u> )	Roadsides, fields, disturbed lands	
Horseweed or Hogweed ( <u>E. canadensis</u> )	Fields, roadsides, pastures	
Asters ( <u>Aster</u> )		
White-topped Aster ( <u>A. paternus</u> )	Woodlands, thickets, roadbanks	Low wildlife value; seeds and plants are seldom extensively utilized.
White-topped Aster ( <u>A. solidagineus</u> )	Woodlands, thickets, roadbanks	
Hart-leaved Aster ( <u>A. divaricatus</u> )	Woodlands, thickets, roadbanks	
Wavy-leaf Aster ( <u>A. undulatus</u> )	Woodlands and wooded roadsides	
Late Purple Aster ( <u>A. patens</u> )	Woodlands, woodland borders, old fields	
Eastern Silver Aster ( <u>A. concolor</u> )	Woodlands, thickets, old fields	
Stiff-leaved Aster ( <u>A. linearifolius</u> )	Woodlands, woodland borders	
Frost Aster ( <u>A. pilosus</u> )	Old fields, pastures, disturbed lands	
Starved Aster ( <u>A. lateriflorus</u> )	Low meadows, lowland woods	
Common Blue Wood Aster ( <u>A. dumosus</u> )	Woodlands, pastures, old fields	

GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Goldenrod ( <u>Solidago</u> )	Streambanks, moist wooded lowlands	Relatively low wildlife value.
Bluestem Goldenrod ( <u>S. caesia</u> )	Upland woods, roadbanks	
Downy Ragged Goldenrod ( <u>S. petiolaris</u> )	Woodlands, old fields	
Slender Goldenrod ( <u>S. erecta</u> )	Woodlands, pastures, roadsides	
Cut-leaved Goldenrod ( <u>S. arguta</u> )	Pastures, old fields, disturbed	
Field Goldenrod ( <u>S. nemoralis</u> )	lands	
Sweet Goldenrod ( <u>S. odora</u> )	Woodlands, roadbanks, pastures	
Tall Hairy Goldenrod ( <u>S. rugosa</u> )	Wetlands, moist wooded lowlands,	
	pastures	
Tall Goldenrod ( <u>S. altissima</u> )	Old fields, pastures, disturbed	
	lands	
Late Goldenrod ( <u>S. gigantea</u> )	Moist wood lowlands, streambanks	
Coneflowers ( <u>Rudbeckia</u> )		
Greenheaded Coneflower ( <u>R. laciniata</u> )	Woodlands, streambanks, moist	Wildlife value; seeds eaten by
Orange Coneflower ( <u>R. fulgida</u> )	soils	songbirds.
Black-eyed Susan ( <u>R. hirta</u> )	Woodlands, pastures	
	Meadows, pastures, old fields,	
	roadsides.	
Sunflower ( <u>Helianthus</u> )		
Swamp Sunflower ( <u>H. augustifolius</u> )	Wetlands, moist bottom land fields,	High wildlife value; seeds are
Hairy Wood Sunflower ( <u>H. atrorubens</u> )	pastures	eaten by numerous game and song-
Woodland Sunflower ( <u>H. divaricatus</u> )	Roadsides, pastures, old fields,	birds, some rodents and small
Small Wood Sunflower ( <u>H. microcephalus</u> )	woodlands	mammals.
Jerusalem Artichoke ( <u>H. tuberosus</u> )	Woodlands, roadbanks, roadsides	
	Woodlands, roadbanks, pastures	
	Disturbed lands, thickets,	
	woodland borders	

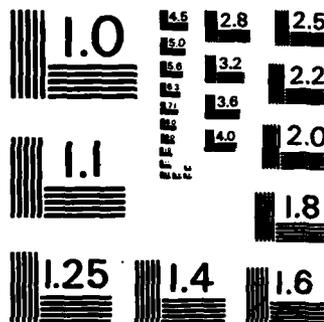
GRASSES AND HERBS (Cont'd)

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Crownhead <u>Verbesina occidentalis</u>	Woodlands, old fields, pastures	Moderately low wildlife value; seeds eaten occasionally by song-birds and small mammals.
Tickseed ( <u>Coreopsis</u> ) Lance-leaved Tickseed ( <u>C. lanceolata</u> )	Roadsides, thickets, sandy woods	Wildlife value undetermined.
Woodland Tickseed ( <u>C. major</u> ) Garden Tickseed ( <u>C. tinctoria</u> )	Woodlands, old fields, thickets Fields, pastures, roadsides	
Yarrow <u>Aschillea millefolium</u>	Pastures, fields, roadsides, disturbed lands	Low wildlife value; cottontail rabbit browses on leaves.
Camomile ( <u>Anthemis</u> ) Corn or Field Camomile ( <u>A. arvensis</u> ) Mayweed or Dog Fennel ( <u>A. cotula</u> )	Roadsides, pastures, disturbed lands Roadsides, pastures, disturbed lands	Moderate wildlife value; when abundant seeds are eaten by song-birds.

WETLAND AND AQUATIC VEGETATION

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Algae Filamentous algae Muskgrass ( <u>Chara sp.</u> )	Shallow ponds, lakes Occasionally in wetlands	Good waterfowl food and provides protection for small fish and aquatic organisms. However, can become a serious problem if algal growth is excessive.
Cattail ( <u>Typha</u> ) Common Cattail ( <u>T. latifolia</u> ) Narrow-leaved Cattail ( <u>T. angustifolia</u> )	Wetlands, moist lowlands, ponds Sluggish creeks and rivers	Moderate wildlife value; provides shelter for various wildlife species. Although seldom utilized by ducks as a source of food, the rootstocks are eaten by geese, muskrats and occasionally by beavers.
Burr-reed <u>Sparganium americanum</u>	Streams, shallow pond, wetlands, near the water margin	Burr-like seed heads are commonly eaten by waterfowl and marsh-visiting songbirds. Muskrats use the entire plant.
Pondweed (Potamogeton) ( <u>P. diversifolius</u> ) ( <u>P. berchtoldii</u> ) ( <u>P. natans</u> ) ( <u>P. pulcher</u> ) ( <u>P. nodosus</u> )	Pools, ponds and lakes Pools, ponds and lakes Wetlands, slow streams and ponds Ponds, ditches, wetlands, and slow streams Shallow to deep water ponds wetlands and streams	High wildlife value; excellent waterfowl food (leaves and seeds). Also utilized by shoreline birds, muskrats, and beaver. Provide shelter for fish and other aquatic organisms.
Southern Bushy-pondweed <u>Najas guadalupensis</u>	Wetlands, lakes and ponds	Good waterfowl food; provides shelter for fish, snakes, frogs, and other aquatic organisms.





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

WETLAND AND AQUATIC VEGETATION

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Southern Bushy-pondweed <u>Najas guadalupensis</u>	Wetlands, lakes and ponds	Good waterfowl food; provides shelter for fish, snakes, frogs, and other aquatic organisms.

WETLAND AND AQUATIC VEGETATION

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Water Plantain <u>Alisma subcordatum</u>	Wetlands, ponds, stream borders	Wildlife value undetermined.
Creeping Water Plantain <u>Echinodorus cordifolius</u>	Wetlands, streambanks, ditches	Wildlife value undetermined.
Arrowhead or Duck Potato ( <u>Sagittaria</u> ) ( <u>S. latifolia</u> )	Wetlands, wet woodlands, ditches, stream margins	Moderate wildlife value; seeds and tubers eaten by waterfowl and muskrats. Seed heads occasionally utilized songbirds. In shallow water provides shelter for small fish and aquatic organisms.
( <u>S. pubescens</u> )	Wet woodlands, wetlands, ponds, ditches	
( <u>S. longirostra</u> )	Wetlands, pond margins, ditches	
Cutgrass ( <u>Leersia</u> ) ( <u>L. virginica</u> )	Wetlands, ditches, moist low woods, pond margins	Moderate wildlife value; seeds are eaten by waterfowl and songbirds.
( <u>L. oryzoides</u> )	Wetlands, ditches, moist low woods, pond margins	
Wildmillets ( <u>Echinochloa</u> ) ( <u>E. conolum</u> )	Low fields, ditches, wetlands, pond margins	High wildlife value; seeds are an important food source for ducks, songbirds, small mammals and waterfowl. Plantis utilized by muskrat, beaver and rabbits (swamp and cottontail).
( <u>E. erugalli</u> )		

WETLAND AND AQUATIC VEGETATION

Species

Wildlife Use

Relative Occurrence

Sedges (Cyperus)  
(C. tenuifolius)  
(C. flavescens)  
(C. polystachyos)  
(C. albomarginatus)  
(C. erythrorhizos)  
(C. rotundus)  
(C. esculentus)  
(C. pseudovegetus)

Valuable wildlife food; seeds are sought by waterfowl, upland game and songbirds. Roots and tubers are eaten by waterfowl. Sedges also occur in areas upland and provide a food source for upland mammals (squirrel, rabbit, rodents, etc.).

Wetlands, low fields, pond margins  
Wetlands, low fields, pond margins  
Wetlands, low fields, pond margins  
Ditches, pond banks, low fields  
Wetlands, pond banks, moist lowlands  
Old fields and disturbed lands  
Old fields and disturbed lands  
Wetlands, pond margins, moist depressions  
Wetlands, pond margins, moist depressions  
Dry woods and pinelands  
Sandy woods, old fields

(C. strigosus)  
(C. retrorsus)  
(C. ovalaris)

B-35

Bullrushes (Scirpus)  
(S. pushianus)  
(S. validus)  
(S. atrovirens)  
(S. polyphyllus)

Principal occurrence of this species is around wetlands but also occurs along pond margins, moist roadside ditches, streams, and moist, low woodlands.

Moderate to high wildlife value; seeds are eaten extensively by waterfowl. Also eaten by shoreline songbirds and rodents. Stems are eaten by muskrat and beaver. Provides shelter for numerous aquatic dwelling organisms.

Spikerushes (Eleocharis)  
(E. quadrangulata)  
(E. obtusa)  
(E. tuberculosa)  
(E. microcarpa)

Pond margins, wetlands  
Ditches, wetlands, pond margins  
Wetlands  
Wetlands

Low to moderate wildlife value; utilization similar to that of sedges (Cyperus) but to a lesser extent.

Arrow-arum  
Peltandra virginica

Wetlands, pond margins

Moderate wildlife value; seeds extensively eaten by wood duck and occasionally by other waterfowl and songbirds.

WETLAND AND AQUATIC VEGETATION

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Duckweeds (Lemnaceae) <u>Spirodela</u> sp. <u>Lemna gibba</u> <u>Wolffia columbiana</u> <u>Wolffiella floridana</u>	The duckweed group occurs on water surfaces of ponds, roadside pools, sluggish streams and other lentic bodies of water.	All four genera of the duckweed group are a valuable food source for waterfowl and some shoreland birds.
<u>Pickerelweed</u> <u>Pontederia cordata</u>	Muddy shores of ponds, streams, and wetlands	Low wildlife value; seeds eaten occasionally by waterfowl and muskrats.
Smart or Knotweeds ( <u>Polygonum</u> ) (In addition to the wildlife value of these species previously listed under Knotweeds, the following species of Polygonums have additional usage.) <u>Bigseed Smartweed</u> ( <u>P. pennsylvanicum</u> ) <u>Dotted Smartweed</u> ( <u>P. punctatum</u> ) <u>Ladythumb</u> ( <u>P. persicaria</u> )		Very high wildlife value; extensively utilized by numerous species of waterfowl, shorebirds, and songbirds. In addition to heavy bird utilization, plants and seeds are eaten by raccoon, opossum, rabbits, squirrels, rodents, and small mammals. In most instances, any aquatic area (pond edges, lake margins, wetlands) which has smartweeds offers a valuable wildlife habitat.
<u>Watershield</u> <u>Brasenia schreberi</u>	Ponds, wetlands, sluggish streams	Seeds are utilized by waterfowl, but the extensive wildlife use and value have not been determined.

WETLAND AND AQUATIC VEGETATION

<u>Species</u>	<u>Relative Occurrence</u>	<u>Wildlife Use</u>
Lilies American Waterlily ( <u>Nymphaea odorata</u> ) Yellow Cowlily ( <u>Nuphar luteum</u> ) Yellow Nelumbo ( <u>Nelumbo lutea</u> )	Lakes, pools, ponds, and sluggish streams Lakes, pools, ponds, and sluggish streams	Low to moderate wildlife value; seeds are eaten by waterfowl to a small extent. Provides shelter and cover for fish and other aquatic organisms.
Coontail <u>Ceratophyllum demersum</u>	Ponds and lakes	Moderate to low wildlife value; plant is foraged upon by waterfowl to a small extent. Provides good cover for small fish and aquatic organisms.
Parrot-Feather <u>Myriophyllum brasiliense</u>	Pools, ponds, and lakes	Wildlife value similar to that of Coontail.

## MAJOR CULTIVATED CROPS

The listing of major agricultural crops below is an indication of their use as a source of food. Although most of the crops listed have relatively high wildlife value, it should not be interpreted to mean that these areas provide good wildlife habitats, which they generally do not.

### Wheat (Triticum)

Excellent wildlife food; wheat is third to Pondweeds (Potamogeton) and Corn in comparison to other natural and cultivated plants as a wildlife food. The seeds are utilized by almost all non-predatory birds (waterfowl, game and songbirds) and numerous mammals. In young stages of growth, wheat is foraged upon by waterfowl (ducks and geese), rabbit, skunks, squirrels, foxes, rodents and whitetail deer. Wheatfields oftentimes are invaded by ragweed, which is another high value wildlife food.

### Rye (Secale)

Wildlife usage similar to that of wheat but to a much lesser extent.

### Barley (Hordeum)

Wildlife usage similar to that of wheat but to a lesser degree.

### Oat (Avena)

Wildlife usage as a cultivated crop, ranks fourth behind corn and wheat. Wildlife utilization of oats is similar to that of wheat and corn but is most frequently utilized after seed heads have developed.

### Sorghum (Sorghum)

Heavily utilized by waterfowl, game and songbirds. Seeds and foliage are also extensively utilized by numerous large and small mammals.

### Corn (Zea)

Corn is the most heavily utilized cultivated crop by wildlife. Except for exclusively predatory species, corn is fed upon by almost all birds and mammals in one way or another. Birds mostly feed on the seeds, while numerous mammal species feed on plant and fruit during different development stages.

### Peanut (Arachis)

Peanuts offer an excellent food source when available above ground.

MAJOR CULTIVATED CROPS (Cont'd)

Soybean (Glycine)

Moderate to high wildlife value; although songbirds generally do not utilize soybeans, bobwhite quail, mourning dove, waterfowl, and crows feed heavily on seeds during the winter. Numerous mammals browse on plant and seeds such as raccoon, rabbit, foxes, rodents, and whitetail deer.

TABLE 2

FISHERY SPECIES OF CLARKS HILL LAKE AND TAILWATERS  
(FRESHWATER FISHES)

<u>Scientific Name</u>	<u>Common Name</u>
<u>Lepisosteus osseus</u>	Longnose Gar
<u>Amia calva</u>	Bowfin
<u>Dorosoma cepedianum</u>	Gizzard Shad
<u>D. petenense</u>	Threadfin Shad
<u>Salmo gairdneri</u>	Rainbow Trout
<u>S. trutta</u>	Brown Trout
<u>Esox niger</u>	Chain Pickerel
<u>Carassius auratus</u>	Goldfish
<u>Cyprinus carpio</u>	Carp
<u>Hybognathus nuchalis</u>	Silvery Minnow
<u>Hybopsis rubrifrons</u>	Rosyface Chub
<u>Nocomis leptocephalus</u>	Bluehead Chub
<u>Notemigonus crysoleucas</u>	Golden Shiner
<u>Notropis cummingsae</u>	Dusky Shiner
<u>N. galacturus</u>	Whitetail Shiner
<u>N. hudsonius</u>	Spottail Shiner
<u>N. lutipinnis</u>	Yellowfin Shiner
<u>N. niveus</u>	Whitefin Shiner
<u>N. szepticus</u>	Sandbar Shiner
<u>Semotilus atromaculatus</u>	Creek Chub
<u>Carpiodes sp. cf. cyprinus</u>	
<u>C. sp. cf. velifer</u>	
<u>Erismyzon oblongus</u>	Creek Chubsucker
<u>E. sucetta</u>	Lake Chubsucker
<u>Hypentelium nigricans</u>	Northern Hog Sucker
<u>Minytrema melanops</u>	Spotted Sucker
<u>Moxostoma anisurum</u>	Silver Redhorse
<u>M. rupiscartes</u>	Striped Jumprock
<u>Ictalurus brunneus</u>	Snail Bullhead
<u>I. furcatus</u>	Blue Catfish
<u>I. catus</u>	White Catfish
<u>I. natalis</u>	Yellow Bullhead
<u>I. nebulosus</u>	Brown Bullhead
<u>I. platycephalus</u>	Flat Bullhead
<u>I. punctatus</u>	Channel Catfish
<u>Noturus gyrinus</u>	Tadpole Madtom
<u>N. insignis</u>	Margined Madtom
<u>N. leptacanthus</u>	Speckled Madtom
<u>Pylodictis olivaris</u>	Flathead Catfish
<u>Fundulus n. lineolatus</u>	Lined Topminnow
<u>Gambusia affinis</u>	Mosquitofish
<u>Labidesthes sicculus</u>	Brook Silverside

TABLE 2 (Cont'd)

<u>Scientific Name</u>	<u>Common Name</u>
<u>Morone chrysops</u>	White Bass
<u>M. saxatilis</u>	Striped Bass
<u>M. saxatilis X M. chrysops</u>	Hybrid
<u>Centrarchus macropterus</u>	Flier
<u>Lepomis auritus</u>	Redbreast Sunfish
<u>L. cyanellus</u>	Green Sunfish
<u>L. gibbosus</u>	Pumpkinseed
<u>L. gulosus</u>	Warmouth
<u>L. macrochirus</u>	Bluegill
<u>L. marginatus</u>	Dollar Sunfish
<u>L. megalotis</u>	Longear Sunfish
<u>L. microlophus</u>	Redear Sunfish
<u>L. punctatus</u>	Spotted Sunfish
<u>Micropterus coosae</u>	Redeye Bass
<u>M. salmoides</u>	Largemouth Bass
<u>Pomoxis annularis</u>	White Crappie
<u>P. nigromaculatus</u>	Black Crappie
<u>Etheostoma fricksium</u>	Savannah Darter
<u>E. fusiforme</u>	Swamp Darter
<u>E. hopkinsi</u>	Christmas Darter
<u>E. inscriptum</u>	Turquoise Darter
<u>E. olmstedii</u>	Tessellated Darter
<u>E. serriferum</u>	Sawcheek Darter
<u>Perca flavescens</u>	Yellow Perch
<u>Percina nigrofasciata</u>	Blackbanded Darter
<u>Stizostedion canadense</u>	Sauger
<u>S. v. vitreum</u>	Walleye

TABLE 3

AMPHIBIANS AND REPTILES

The following list includes those amphibians and reptiles that could occur in the Clark Hill Project Area. Many of the species listed have localized colonies within the Piedmont Region of Georgia. Therefore, the indicated occurrence does not necessarily mean that the organism would be found in the entire province.

OCCURRENCE:

- C - Common (generally abundant throughout the basin, occurring in many localities)
- O - Occasional (occurs at several localities in small numbers)
- U - Uncommon (may occur in the study area in small numbers)
- R - Rare (highly localized, or restricted in range)
- S - Seasonal (migratory, found during warmer months of the year)

HABITAT:

- A - Water restricted forms, some species having activity on adjacent shorelines
- S - Shoreline forms, with some aquatic activity
- L - Lowland forms and those forms inhabiting seepage areas or marshy areas
- U - Upland forms and forest forms, not restricted by water
- W - Wide ranging forms, both lowland and upland

SOURCES:

Conant, Roger, 1975. A field guide to reptiles and amphibians of Eastern and Central North America. Houghton Mifflin Company, Boston, Mass. pp. 429.

Martof, Bernard S., 1956. Amphibians and reptiles of Georgia. University of Georgia Press, Athens, Georgia. pp. 94.

AMPHIBIANS

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Hellbender <u>Cryptobranchus alleganiensis</u> <u>alleganiensis</u>	R	A	Larger streams and rivers; water bodies with several feet of water and objects on the bottom that may be used for cover.
Two-toed Amphiuma (Two-toed Congo Eel) <u>Amphiuma means</u>	U	A	Almost completely aquatic, but occasionally moves overland through wetlands on rainy nights. Habitats include ditches, sloughs, pools, streams and ponds where they utilize lairs in mud or bottom debris.
Mole Salamander <u>Ambystoma talpoideum</u>	U	L	Confirmed burrower, found in moist bottom lands under logs or other damp objects.
Marble Salamander <u>Ambystoma opacum</u>	C	W	Inhabits a variety of habitats ranging from moist conditions of upland forest under logs and stones to wet bottom land habitats near streams.
Spotted Salamander <u>Ambystoma maculatum</u>	C	W	Although the species can be found in various habitats during wet seasons, it seems to prefer water bodies in deciduous forests where ponds, slow streams and temporary pools offer suitable breeding places.

AMPHIBIANS

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Red-spotted Newt <u>Notophthalmus viridescens</u> <u>viridescens</u>	O	A	Mainly found in ponds, lakes, ditches, and quiet portions of streams, but occasionally adults inhabit moist terrestrial areas such as under logs and rocks.
Southern Dusky Salamander <u>Desmognathus auriculatus</u>	C	L	Most abundant along edges of streams, wetlands, spring and seepage areas under leaves, rocks and miscellaneous debris which provide ample shelter.
Eastern Mud Salamander <u>Pseudotriton montanus</u> <u>montanus</u>	U	L	Occurs in muddy habitats along springs, seeps, wetlands and streams in which it burrows into the soft bottoms.
Northern Red Salamander <u>Pseudotriton ruber ruber</u>	C	W	Found near springs and streams in waters that are not stagnant and in pastures, meadows and wooded areas that have bottoms of sandy gravel or rocks.
Slimy Salamander <u>Plethodon glutinosus</u> <u>glutinosus</u>	C	U	Moist wooded ravines and hillsides which are very moist.

AMPHIBIANS (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Four-toed Salamander <u>Hemidactylium scutatum</u>	R	L	Normally found around boggy woodlands, wetlands, and woodland ponds that have sphagnum moss present.
Southern Two-lined Salamander <u>Eurycea bislineata cirrigera</u>	C	L	Commonly found hiding beneath all types of sheltering objects including mosses of wet leaves in creeks, seeps, and wetlands.
Three-lined Salamander <u>Eurycea longicauda guttolineata</u>	U	W	Occurs in river bottom swamps (wetlands), wet ditches, hillside seeps, and streambanks; occasionally will wander considerable distances from water in damp habitats.
Dunn's Spring Salamander <u>Gyrinophilus porphyriticus dunni</u>	U	U	Generally occur near springs, seeps, wet forest areas and swift running streams.
Eastern Spadefoot Toad <u>Scaphiopus holbrooki holbrooki</u>	C	W	Generally occur in bottom land and upland forests or wooded areas that have sandy or loose soils.
Eastern Narrow-mouth Toad <u>Gastrophryne carolinensis</u>	C	W	Wide-ranging habitats commonly found in areas where moist shelter is present (rocks, debris, logs, etc.).

AMPHIBIANS (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
American Toad <u>Bufo americanus</u>	C	W	Wide-ranging habitats including urbanized areas, pastures, woods, and wetlands.
Fowler's Toad <u>Bufo woodhousei fowleri</u>	O	W	Prefers moist land habitats with sandy soils near ponds, lakes, and streams.
Barking Treefrog <u>Hyla gratiosa</u>	U	L	Wooded lowlands and wetlands but also takes shelter in roots or clumps of grasses during warm weather.
Spring Peeper <u>Hyla crucifer</u>	C	W	Habitats include wetlands, seeps, borders streams, lakes, under litter in dense woods and other areas with wet conditions through most of the year.
Gray Treefrogs <u>Hyla versicolor</u> <u>Hyla chrysoscelis</u>	C	L	Not often seen on ground or at water's edge except in breeding season. Forage aloft, chiefly in small trees and shrubs and near or in shallow bodies of water.
Upland Chorus Frog <u>Pseudacris triseriata feriarum</u>	C	W	Grassy swales, moist woodlands, river bottoms, swamps, environs of ponds and marshes.

AMPHIBIANS (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Northern Cricket Frog <u>Acris crepitans crepitans</u>	C	S	Occur around permanent bodies of shallow water with cover; also occur along sandy, gravelly or muddy bars and banks of small sluggish or intermittent streams.
Green Frog <u>Rana clamitans melanota</u>	C	S	Common around shallow freshwater, springs, creeks, small streams and along edges of lakes and ponds.
Bullfrog <u>Rana catesbeiana</u>	C	A	Aquatic and prefers larger bodies of water; common in lakes, ponds, sluggish portions of streams. Usually seen at water's edge or amidst vegetation.
Southern Leopard Frog <u>Rana utricularia</u>	C	L	Shallow aquatic habitats, ventures well away from water bodies in summer, when weeds and other vegetation provide shelter and shade.
Pickereel Frog <u>Rana palustris</u>	C	L	Occurs along turbid creeks and streams, ponds and lakes. Wanders out into grassy fields or weed-covered areas in the summer.

REPTILES

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Common Snapping Turtle <u>Chelydra serpentina serpentina</u>	C	A	Practically any permanent water bodies (ponds and streams). Preferred habitats are mud-bottomed ponds and streams. It is a bottom-dweller and poor swimmer. Occasionally found on land when moving to other water bodies. Sometimes inhabits stagnant and polluted areas.
Common Musk or Stinkpot Turtle <u>Sternotherus odoratus</u>	C	A	Sluggish or still deep waters with mud bottoms, along river banks, in ponds, lakes and wetlands. Seldom bask in sun and are mostly bottom dwellers.
Eastern Mud Turtle <u>Kinosternon subrubrum subrubrum</u>	C	A	Any deep or deep mud-bottom waters. Niche very similar to that of common musk turtle.
Eastern Box Turtle <u>Terrapene carolina carolina</u>	C	W	Fields and woods both upland and lowland forest types. Occasionally found near moist areas during hot, dry periods.

REPTILES (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Eastern Yellow Painted Turtle <u>Chrysemys picta picta</u>	O	A	Shallow, warm waters with some plant growth, such as ponds, ditches, streams, lakes and still pools in rivers. Stagnant and polluted waters are sometimes inhabited.
Yellow-bellied Turtles <u>Chrysemys scripta scripta</u>	C	A	Permanent bodies of water are inhabited such as ponds, creeks, rivers and marshes. Still waters with mud bottoms are preferred. Often seen on logs and banks basking in the sun.
River Cooter <u>Chrysemys concinna concinna</u>	O	A	Mostly streams and rivers, however, occasionally occurs in wetlands with silt-laden bottoms. Very wary of human activities.
Gulf Coast Spinysoftshell Turtle <u>Trionyx spiniferus asperus</u>	C-O	A	Rivers and streams are usual habitat where soft bottoms are available. Well-drained lakes and ponds may be inhabited, but temporary waters are shunned.
Green Anole <u>Anolis carolinensis carolinensis</u>	C	U	Trees, shrubs, vines, low vegetation, fences and around old wooden structures. Found in upland and bottom land wooded habitats.

REPTILES (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Northern Fence Lizard <u>Sceloporus undulatus</u> <u>hyacinthinus</u>	C	U	Dry open woodlands. They frequently spend much of the day on the ground, but trees and shrubs are needed. Since they frequently sun, dense, heavy woods are shunned.
Six-lined Racerunner <u>Cnemidophorus sexlineatus</u> <u>sexlineatus</u>	C	U	Dry, open woodlands and pastures. Prefers relatively dry areas where sandy or loose soils with short grasses and low growing vegetation are prevalent.
Ground Skink <u>Leiolopisma laterale</u>	C	W	Found in wooded areas on the ground among leaves and other debris; moist places, near streams are preferred. Less commonly they are found in open fields or on grass hills, under stones and logs. Secretive and seldom seen in the open.
Five-lined Skink <u>Eumeces fasciatus</u>	C	U	Commonly found in wooded areas, usually on the ground, under stones, in piles of leaves and in rotten bogs. A moist but not wet environment is preferred.

REPTILES (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Southeastern Five-lined Skink <u>Eumeces inexpectatus</u>	C	U	Generally restricted to forests where it is commonly seen on logs, brush piles and standing trees. More arboreal than the common species, but often found on the ground. Prefers bottom land areas near water.
Broad-headed Skink <u>Eumeces laticeps</u>	C	W	Habitats vary from swamp forests to empty urban lots strewn with debris. Basically a woodland species; makes use of hollow trees and is occasionally seen on rail fences or high branches of dead or decaying trees.
Slender Glass Lizard <u>Ophisaurus attenuatus</u>	U	U	Superficially appears to be a snake but is a limbless lizard. Found on the ground in moist grass, wooded and pasture lands, burrowing in sandy soils and leaves.
Water Snakes Brown Water Snake <u>Natrix taxispilota</u> Red-bellied Water Snake <u>N. erythrogaster erythrogaster</u> Northern Water Snake <u>N. sipedon sipedon</u> Midland Water Snake <u>N. sipedon pleuralis</u>	C	A,S,L	Water snakes are found in a variety of aquatic habitats and normally bask in the sunshine for most of the day. These species can be found in lakes, ponds, streams, wetlands and areas which have very moist conditions such as seeps and springs. During wet periods, they may be found in moist, grassy and bottom land hardwood areas.

REPTILES (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Water Snakes (Cont'd)			
Banded Water Snake			
<u>N. fasciata fasciata</u>			
Queen Snake			
<u>N. septemvittata</u>			
Brown Snakes			
Midland Brown Snake			
<u>Storeria dekayi wrightorum</u>			
Red-bellied Snake			
<u>S. occipitamaculata</u>			
Eastern Ribbon Snake			
<u>Thamnophis sauritus sauritus</u>			
Eastern Garter Snake			
<u>Thamnophis sirtalis sirtalis</u>			
Eastern Hog-nosed Snake			
<u>Heterodon platyrhinos</u>			
Southern Ringneck Snake			
<u>Diadophis punctatus punctatus</u>			

C L  
Frequent moist situations, generally under rocks, logs or other cover in creek beds and in bottom land hardwoods.

C L  
Generally confined to the immediate vicinity of permanent water bodies. Mostly along the shores of wetlands, lakes and streams, especially where grass and vegetation come up to water's edge.

C U  
In wooded areas under stones, logs and in upland and lowland forested areas.

C W  
Found in dry upland woods and dry, sandy lowlands, but seldom occurs in moist, heavily wooded areas.

C L  
Commonly occur in moist bottom land hardwood forests under rocks, rotten logs and litter.

REPTILES (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Eastern Worm Snake <u>Carphophis amoenus amoenus</u>	C	L	Commonly occur in moist bottom land hardwood forests under rocks, rotten logs and litter.
Southern Black Racer <u>Coluber constrictor priapus</u>	C	W	Ubiquitous species occurring in moist and dry habitats. Very common in pasture and areas with thickets and near open fields.
Eastern Coachwhip <u>Masticophis flagellum flagellum</u>	C	U	Terrestrial species usually found in open woods, pastures and open fields.
Rough Green Snake <u>Ophedrys aestivus</u>	C	W	Open woods, pastures and wetlands. It occurs on the ground and in bushes and low trees.
Corn Snake <u>Elaphe guttata guttata</u>	C	U	Commonly found in old barns, houses, and thickets but not in dense forest habitats.
Black Rat Snake <u>Elaphe obsoleta obsoleta</u>	C	W	This species is partial to moist thickets and densely wooded areas.
Northern Pine Snake <u>Pituophis melanoleucus melanoleucus</u>	U	U	Found under rocks, logs and debris of hardwood and well-drained pine forests.

REPTILES (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat</u>	<u>Remarks</u>
Eastern Kingsnake <u>Lampropeltis getulus getulus</u>	C	L	Generally occur in moist bottom land woods along streams and ponds.
Copperheads Northern Copperhead <u>Agkistrodon contortrix mokasen</u> Southern Copperhead <u>Agkistrodon c. contortrix</u>	C	L	Found in woody areas generally on hillsides with rocks, under logs and thickets; also occur along bottom land hardwood forests along streams and wetlands.
Carolina Pigmy Rattlesnake <u>Sistrurus miliarius miliarius</u>	O	L	In bottom land hardwood forests and fields, usually near water.
Timber Rattlesnake <u>Crotalus horridus horridus</u>	C	U	Usually found near upland forests with rocky outcrops.
American Alligator <u>Alligator mississippiensis</u>	R	L	Questionable sightings: usually found in streams or ponds.

TABLE 4

BIRDS

The following list includes those birds that could occur in the Clark Hill Project Area. Many of the species listed have localized colonies within the Piedmont region of Georgia. Therefore, the indicated occurrence does not necessarily mean that the organism would be found in the entire area.

STATUS AND SEASONAL OCCURRENCE:

- C - Common (seen frequently in the appropriate habitat and season)
- O - Occasional (seen fairly often but not in great numbers)
- U - Uncommon (not seen very often)
- R - Rare (rarely seen; often does not appear for years at a time)
- W- Winter visitor (spends winter in the area)
- S - Summer visitor (spends summer and breeds in the area)
- P - Permanent resident (lives the entire year in the area)
- T - Transient (migrates through the area in either the spring or fall or both)

PREFERRED HABITATS:

- F - Forests
- F,P - Fields, Pastures
- FWM,P - Freshwater Marshes, Ponds

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<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>	<u>Preferred Habitat</u>		
			F	F,P	FWM,P
<u>Gavia immer</u>	Common Loon	U/W,T			X
<u>Podiceps auritus</u>	Horned Grebe	U/W,T			X
<u>Podilymbus podiceps</u>	Pied-billed Grebe	C/P			X
<u>Phalacrocorax auritus</u>	Double-crested Cormorant	U/T			X
<u>Anhinga anhinga</u>	Anhinga	U/T			X
<u>Ardea herodias</u>	Great Blue Heron	O/P			X
<u>Butorides virescens</u>	Green Heron	C/S			X
<u>Florida caerulea</u>	Little Blue Heron	U/S			X
<u>Bubulcus ibis</u>	Cattle Egret	U/S		X	
<u>Casmerodius albus</u>	Common Egret	U/S			X
<u>Hydranassa tricolor</u>	Louisiana Heron	U/S			X
<u>Nycticorax nycticorax</u>	Black-crowned Night Heron	U/S			X
<u>Nyctanassa violacea</u>	Yellow-crowned Night Heron	U/S			X
<u>Ixobrychus exilis</u>	Least Bittern	U/S			X
<u>Botaurus lentiginosus</u>	American Bittern	U/W			X
<u>Mycteria americana</u>	Wood Ibis	U/S		X	X
<u>Eudocimus albus</u>	White Ibis	U/S		X	X
<u>Branta canadensis</u>	Canada Goose	O/P		X	X
<u>Chen hyperborea</u>	Snow Goose	R/W			X
<u>C. caerulescens</u>	Blue Goose	U/W			X
<u>Anas platyrhynchos</u>	Mallard	C/W			X
<u>A. rubripes</u>	Black Duck	C/W			X
<u>A. strepera</u>	Gadwall	C/W			X
<u>A. acuta</u>	Pintail	U/W			X
<u>A. discors</u>	Blue-winged Teal	C/W			X
<u>Mareca americana</u>	American Widgeon	C/W			X
<u>Spatula clypeata</u>	Shoveler	U/W			X
<u>Aix sponsa</u>	Wood Duck	C/P			X
<u>Aythya collaris</u>	Ring-necked Duck	C/W			X
<u>A. affinis</u>	Lesser Scaup	C/W			X
<u>Bucephala clangula</u>	Common Goldeneye	U/W			X
<u>B. albeola</u>	Bufflehead	O/W			X
<u>Clangula hyemalis</u>	Oldsquaw	R/W			X
<u>Oxyura jamaicensis</u>	Ruddy Duck	U/W			X
<u>Lophodytes cucullatus</u>	Hooded Merganser	C/W			X
<u>Mergus serrator</u>	Red-breasted Merganser	O/W			X
<u>Cathartes aura</u>	Turkey Vulture	C/P	X	X	
<u>Coragyps atratus</u>	Black Vulture	C/P	X	X	
<u>Accipiter striatus</u>	Sharp-shinned Hawk	U/P	X		
<u>A. cooperii</u>	Cooper's Hawk	U/P	X		
<u>Buteo jamaicensis</u>	Red-tailed Hawk	C/P		X	
<u>B. lineatus</u>	Red-shouldered Hawk	C/P	X	X	
<u>B. platypterus</u>	Broad-winged Hawk	C/S	X		
<u>Circus cyaneus</u>	Marsh Hawk	C/W		X	X
<u>Pandion haliaetus</u>	Osprey	U/T			X
<u>Falco columbarius</u>	Merlin (Pigeon Hawk)	U/W		X	
<u>F. sparverius</u>	American Kestrel	C/P		X	
<u>Colinus virginianus</u>	Bobwhite	C/P	X	X	
<u>Meleagris gallopavo</u>	Turkey	C/P	X	X	

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>	<u>Preferred Habitat</u>		
			F	F,P	FWM,P
<u>Grus canadensis</u>	Sandhill Crane	R/T		X	
<u>Rallus elegans</u>	King Rail	R/S			X
<u>Porzana carolina</u>	Sora	R/W			X
<u>Fulica americana</u>	American Coot	C/W			X
<u>Charadrius semipalmatus</u>	Semipalmated Plover	U/T			X
<u>C. vociferus</u>	Killdeer	C/P		X	
<u>Philohela minor</u>	American Woodcock	O/P	X	X	
<u>Capella gallinago</u>	Common Snipe	C/W		X	X
<u>Actitis macularia</u>	Spotted Sandpiper	C/T			X
<u>Tringa solitaria</u>	Solitary Sandpiper	C/T			X
<u>Totanus melanoleucus</u>	Greater Yellowlegs	U/T			X
<u>T. flavipes</u>	Lesser Yellowlegs	U/T			X
<u>Erolia melanotos</u>	Pectoral Sandpiper	U/T		X	X
<u>E. minutilla</u>	Least Sandpiper	U/T			X
<u>E. alpina</u>	Dunlin	U/T			X
<u>Ereunetes pusillus</u>	Semipalmated Sandpiper	U/T			X
<u>E. mauri</u>	Western Sandpiper	U/T			X
<u>Limnodromus griseus</u>	Short-billed Dowitcher	U/T			X
<u>L. scolopaceus</u>	Long-billed Dowitcher	U/T			X
<u>Larus argentatus</u>	Herring Gull	U/W			X
<u>L. delawarensis</u>	Ring-billed Gull	C/W			X
<u>Sterna hirundo</u>	Common Tern	U/T			X
<u>Chlidonias niger</u>	Black Tern	U/T			X
<u>Columba livia</u>	Rock Dove (Pigeon)	C/P			X
<u>Zenaidura macroura</u>	Mourning Dove	C/P			X
<u>Coccyzus americanus</u>	Yellow-billed Cuckoo	C/S	X		
<u>Tyto alba</u>	Barn Owl	U/P		X	
<u>Otus asio</u>	Screech Owl	C/P	X	X	
<u>Bubo virginianus</u>	Great Horned Owl	U/P	X		
<u>Strix varia</u>	Barred Owl	C/P	X		
<u>Asio otus</u>	Long-eared Owl	U/W	X		
<u>A. flammeus</u>	Short-eared Owl	U/W		X	X
<u>Caprimulgus carolinensis</u>	Chuck-will's Widow	C/P	X	X	
<u>C. vociferus</u>	Whip-poor-will	C/S	X		
<u>Chordeiles minor</u>	Common Nighthawk	C/S	X	X	X
<u>Chaetura pelagica</u>	Chimney Swift	C/S	X		
<u>Archilochus colubris</u>	Ruby-throated Hummingbird	C/P			X
<u>Megaceryle alcyon</u>	Belted Kingfisher	C/P	X		
<u>Colpates auratus</u>	Yellow-shafted Flicker	C/P	X		
<u>Drycopus pileatus</u>	Pileated Woodpecker	C/P	X		
<u>Centurus carolinus</u>	Red-bellied Woodpecker	C/P	X		
<u>Melanerpes erythrocephalus</u>	Red-headed Woodpecker	O/P	X		
<u>Sphyrapicus varius</u>	Yellow-bellied Sapsucker	C/W	X		
<u>Dendrocopos villosus</u>	Hairy Woodpecker	U/P	X		
<u>D. pubescens</u>	Downy Woodpecker	C/P	X		
<u>D. borealis</u>	Red-cockaded Woodpecker	U/P	X		
<u>Tyrannus tyrannus</u>	Eastern Kingbird	C/S		X	
<u>Myiarchus crinitus</u>	Great Crested Flycatcher	C/S	X		
<u>Sayornis phoebe</u>	Eastern Phoebe	C/P	X		

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>	<u>Preferred Habitat</u>		
			F	F,P	FWM,P
<u>Empidonax minimus</u>	Least Flycatcher	U/T	X		
<u>E. virescens</u>	Acadian Flycatcher	C/S	X		
<u>Contopus virens</u>	Eastern Wood Peewee	C/S	X		
<u>Eremophila alpestris</u>	Horned Lark	O/W		X	
<u>Iridoprocne bicolor</u>	Tree Swallow	Y/T		X	X
<u>Stelgidopteryx ruficollis</u>	Rough-winged Swallow	C/S			X
<u>Hirundo rustica</u>	Barn Swallow	C/S		X	X
<u>Petrochelidon pyrrhonota</u>	Cliff Swallow	C/T			X
<u>Progne subis</u>	Purple Martin	C/S	X		X
<u>Cyanocitta cristata</u>	Blue Jay	C/P	X		
<u>Corvus brachyrhychos</u>	Common Crow	C/P	X	X	
<u>Parus carolinensis</u>	Carolina Chickadee	C/P	X		
<u>Parus bicolor</u>	Tufted Titmouse	C/P	X		
<u>Sitta carolinensis</u>	White-breasted Nuthatch	C/P	X		
<u>S. canadensis</u>	Red-breasted Nuthatch	U/W	X		
<u>S. pusilla</u>	Brown-headed Nuthatch	C/P	X		
<u>Certhia familiaris</u>	Brown Creeper	U/W	X		
<u>Troglodytes aedon</u>	House Wren	C/S	X		
<u>T. troglodytes</u>	Winter Wren	C/W	X		
<u>Thryomanes bewickii</u>	Bewick's Wren	U/W		X	
<u>Thryothorus ludovicianus</u>	Carolina Wren	C/P	X		
<u>Cistothorus platensis</u>	Short-billed Marsh Wren	U/T		X	
<u>Mimus polyglottos</u>	Mockingbird	C/P	X	X	
<u>Dumetella carolinensis</u>	Catbird	C/S	X		
<u>Toxostoma rufum</u>	Brown Thrasher	C/P	X		
<u>Turdus migratorius</u>	Robin	C/P	X	X	
<u>Hylocichla guttata</u>	Hermit Thrush	C/W	X		
<u>H. ustulata</u>	Swainson's Thrush	C/T	X		
<u>H. minima</u>	Gray-cheeked Thrush	U/T	X		
<u>H. fuscescens</u>	Veery	C/T	X		
<u>H. mustelina</u>	Wood Thrush	C/S	X		
<u>Sialia sialis</u>	Eastern Bluebird	C/P	X	X	
<u>Poliioptila caerulea</u>	Blue-gray Gnatcatcher	C/S	X	X	
<u>Regulus satrapa</u>	Golden-crowned Kinglet	U/W	X		
<u>R. calendula</u>	Ruby-crowned Kinglet	C/W	X		
<u>Anthus spinoletta</u>	Water Pipit	U/W		X	
<u>Bombycilla cedrorum</u>	Cedar Waxwing	C/W	X		
<u>Lanius ludovicianus</u>	Loggerhead Shrike	C/P		X	
<u>Sturnus vulgaris</u>	Starling	C/P		X	
<u>Vireo griseus</u>	White-eyed Vireo	C/S	X		
<u>V. flavifrons</u>	Yellow-throated Vireo	C/S	X		
<u>V. solitarius</u>	Solitary Vireo	U/P	X		
<u>V. olivaceus</u>	Red-eyed Vireo	C/S	X		
<u>Mniotilta varia</u>	Black-and-white Warbler	C/S	X		
<u>Protonotaria citrea</u>	Prothonotary Warbler	C/S	X	X	
<u>Limnothlypis swainsonii</u>	Swainson's Warbler	U/S	X	X	
<u>Helmitheros vermivorus</u>	Worm-eating Warbler	U/S	X		
<u>Vermivora chrysoptera</u>	Golden-winged Warbler	O/T	X		
<u>V. pinus</u>	Blue-winged Warbler	C/T	X	X	
<u>V. peregrina</u>	Tennessee Warbler	U/T	X		

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>	<u>Preferred Habitat</u>		
			F	F,P	FWM,P
<u>Parula americana</u>	Parula Warbler	C/S	X		
<u>Dendroica petechia</u>	Yellow Warbler	C/S	X		X
<u>D. magnolia</u>	Magnolia Warbler	U/T	X		
<u>D. cerulea</u>	Cerulean Warbler	U/T	X		
<u>D. castanea</u>	Bay Breasted Warbler	U/T	X		
<u>D. tigrina</u>	Cape May Warbler	C/T	X		
<u>D. caerulescens</u>	Black-throated Blue Warbler	C/T	X		
<u>D. coronata</u>	Myrtle Warbler	C/W	X		
<u>D. virens</u>	Black-throated Green Warbler	U/T	X		
<u>D. fusca</u>	Blackburnian Warbler	U/T	X		
<u>D. dominica</u>	Yellow-throated Warbler	C/S	X		
<u>D. pensylvanica</u>	Chestnut-sided Warbler	U/T	X		
<u>D. striata</u>	Blackpoll Warbler	C/T	X		
<u>D. pinus</u>	Pine Warbler	C/P	X		
<u>D. discolor</u>	Prairie Warbler	C/S	X		
<u>D. palmarum</u>	Palm Warbler	C/W	X	X	
<u>Seiurus aurocapillus</u>	Ovenbird	C/S	X		
<u>S. noveboracensis</u>	Northern Waterthrush	C/T	X		
<u>S. motacilla</u>	Louisiana Waterthrush	C/S	X		
<u>Oporornis formosus</u>	Kentucky Warbler	C/S	X		
<u>O. agilis</u>	Connecticut Warbler	U/T	X		
<u>Geothlypis trichas</u>	Yellowthroat	C/P	X		
<u>Icteria virens</u>	Yellow-breasted Chat	C/S	X	X	
<u>Wilsonia citrina</u>	Hooded Warbler	C/S	X		
<u>W. pusilla</u>	Wilson's Warbler	U/T	X		
<u>W. canadensis</u>	Canada Warbler	U/T	X		
<u>Setophaga ruticilla</u>	American Redstart	C/T	X		
<u>Passer domesticus</u>	House Sparrow	C/P		X	
<u>Dolichonyx oryzivorus</u>	Bobolink	C/T		X	
<u>Sturnella magna</u>	Eastern Meadowlark	C/P		X	
<u>Agelaius phoeniceus</u>	Redwinged Blackbird	C/P		X	X
<u>Icterus spurius</u>	Orchard Oriole	C/S	X		
<u>I. galbula</u>	Baltimore Oriole	U/T	X		
<u>Euphagus cyanocephalus</u>	Brewer's Blackbird	U/W		X	
<u>E. carolinus</u>	Rusty Blackbird	C/W	X		X
<u>Quiscalus quiscula</u>	Common Grackle	C/P	X	X	X
<u>Molothrus ater</u>	Brown-headed Cowbird	C/P		X	
<u>Piranga olivacea</u>	Scarlet Tanager	C/T	X		
<u>P. rubra</u>	Summer Tanager	C/S	X		
<u>Richmondia cardinalis</u>	Cardinal	C/P	X		X
<u>Pheucticus ludovicianus</u>	Rose Breasted Grosbeak	C/T	X		
<u>Guiraca caerulea</u>	Blue Grosbeak	C/S	X	X	
<u>Passerina cyanea</u>	Indigo Bunting	C/S	X	X	
<u>Spiza americana</u>	Dickcissel	U/W	X		
<u>Hesperiphona vespertina</u>	Evening Grosbeak	C/W	X		
<u>Carpodacus purpureus</u>	Purple Finch	C/W	X	X	
<u>Spinus pinus</u>	Pine Siskin	C/W	X		
<u>S. tristis</u>	American Goldfinch	C/P	X	X	
<u>Pipilo erythrophthalmus</u>	Rufous-sided Towhee	C/P	X		

<u>Scientific Name</u>	<u>Common Name</u>	<u>Occurrence</u>	<u>Preferred Habitat</u>		
			F	F,P	FWM,P
<u>Passerculus s. sandwichensis</u>	Savannah Sparrow	C/W		X	
<u>Ammodramus savannarum</u>	Grasshopper Sparrow	C/S		X	
<u>Poocetes gramineus</u>	Vesper Sparrow	C/W		X	
<u>Aimophila aestivalis</u>	Bachman's Sparrow	U/P	X		
<u>Junco hyemalis</u>	Slate-colored Junco	C/W	X	X	
<u>Spizella passerina</u>	Chipping Sparrow	C/P		X	
<u>S. pusilla</u>	Field Sparrow	C/P		X	
<u>Zonotrichia albicollis</u>	White-throated Sparrow	C/W	X	X	
<u>Passerella iliaca</u>	Fox Sparrow	O/W	X		
<u>Melospiza georgiana</u>	Swamp Sparrow	U/W			X
<u>M. melodia</u>	Song Sparrow	C/P	X	X	X

TABLE 5

MAMMALS

The following list includes those mammals that could occur in the Clark Hill Project Area. Many of the species listed have localized colonies within the Piedmont Region of Georgia. Therefore, the indicated occurrence does not necessarily mean that the organism would be found in the entire area.

OCCURRENCE:

- C - Common (generally abundant throughout the basin, occurring in many localities)
- O - Occasional (occurs at several localities in small numbers)
- R - Rare (highly localized, or restricted in range)
- S - Seasonal (migratory, found during warmer months of the year)

MAMMALS

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Opossum <u>Didelphis marsupialis</u>	S	Ubiquitous	The opossum is often found in forests in bottom land or along stream margins. This nocturnal mammal requires hollow trees, fallen logs or ground burrows for protective cover during the day and for nest sites. Although the prehensile tail and opposable rear toe indicate that the opossum is arboreal, it is often seen on the ground away from trees.
Southern Shrew <u>Sorex longirostris</u>	C	Ubiquitous	Appears to inhabit moist situations near wetlands, ponds, streams, as well as in woods and open fields.
Short-tailed Shrew <u>Blarina brevicauda</u>	C	Ubiquitous	Found in moist, deciduous forests, where it will build burrows or tunnels through leaves and humus. It may also be encountered in moist fields and other moist areas where the abundance of snails, earthworms and other invertebrate foods can be obtained.
Least Shrew <u>Cryptotis parva</u>	C	Grassland/Pastures	Often encountered in abandoned fields, where it commonly uses runways of cotton rats. Most abundant in areas undergoing old-field succession.

MAMMALS

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Eastern Mole <u>Scalopus aquaticus</u>	C	Pasture; Fields; Hardwood Forests	Burrows in loose soils in search of worms and other underground insects. Prefers moist, sandy loam soils, lawns, golf courses, gardens, fields, and meadows; avoids extremely dry soil.
Little Brown Myotis <u>Myotis lucifugus</u>	C	Upland Forest; Lowland Forest	In the colder seasons it is generally seen grouped in colonies in caves or in abandoned mines. During the warmer portions of the year, they may be located in buildings and hollow trees, as well as in caves.
Mississippi Myotis <u>Myotis austroriparius</u>	U	Forests; Buildings; Beneath Bridges	Inhabits caves, mine tunnels, hollow trees, buildings, culverts and beneath bridges. Appears from roosting sites when dark and flies low over water and fields to feed.
Silver-haired Bat <u>Lasionycteris noctivagans</u>	S	Hardwood Forests	Typically found under bark or among tree leaves. Flies high and feeds along water courses and forests. Probably migrates in the winter.
Eastern Pipistrelle <u>Pipistrellus subflavus</u>	C	Caves; Cliffs; Buildings	This bat is a weak erratic flyer and leaves its retreats to hunt food early in the evening.

MAMMALS

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Big Brown Bat <u>Eptesicus fuscus</u>	S	Forests; Buildings	A hardy species commonly found in houses in urban areas. This bat leaves its daytime retreat in buildings, hollow trees, or caves later in the evening than the smaller bats and generally has only one activity period before midnight.
Red Bat <u>Lasiurus borealis</u>	S	Forests	Prefers to roost in trees. Commonly leaves its roost before darkness and forages around the branches of trees.
Seminole Bat <u>Lasiurus seminolus</u>	S	Forests	Roosts in dense wooded areas and feeds early in the evening, seeking prey over water areas, cleared lands and pine barrens.
Hoary Bat <u>Lasiurus cinereus</u>	S	Forests	Flies late at night and feeds off the forest floor. Solitary in nature, migrates south in the fall.
Evening Bat <u>Nycticeius humeralis</u>	O	Forests; Buildings; Bridges	Roosts in trees, buildings and under bridges; usually colonial, sometimes solitary.

MAMMALS (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Eastern Big-eared Bat <u>Plecotus refinesquei</u>	0	Forests; Buildings	Roosts in hollow trees or in buildings.
Mexican Freetail Bat <u>Tadarida brasiliensis</u>	0	Houses; Barns; Bridges	Often found in houses, stables or other structures. Leaves roost early in the evening or late afternoon and may travel long distances to feeding grounds.
Cottontail Rabbit <u>Sylvilagus floridanus</u>	C	Ubiquitous	Found in uplands, both wooded and open areas. It may border swamp rabbit habitat in the drier season. Probably optimum habitat is in old fields with abundant green forbs for food adjacent to honey-suckle or blackberry thickets which afford cover.
Swamp Rabbit <u>Sylvilagus aquaticus</u>	0	Wetlands; Creeks; Bottom lands	Inhabits flood plains of river and creeks and is seldom encountered far from this habitat.
Eastern Chipmunk <u>Tamias striatus</u>	0	Open Hardwood Forests; Brushy Pastures	Greatest abundance occurs in open woodlands and feeds on berries, fruits, nuts, but occasionally utilizes insects, mice, snails, and small birds.

MAMMALS (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Gray Squirrel <u>Sciurus carolinensis</u>	C	Hardwood Forests	Commonly occurring in upland and bottom land hardwood forests and adapts to urbanized forested areas.
Fox Squirrel <u>Sciurus niger</u>	O	Upland Forests	Occur in both pine and hardwood lands where they appear to be more tolerant of open conditions than are gray squirrels.
Southern Flying Squirrel <u>Glaucomys volans</u>	C	Hardwood Forests	Inhabits hardwood forests, mainly active at night. Feeds on nuts, seeds, fruits, and insects.
Beaver <u>Castor canadensis</u>	C	Water Bodies; Streams; Wetlands	Found along rivers, streams, lakes and lowland areas where food and suitable water conditions prevail.
Rice Rat <u>Oryzomys palustris</u>	C	Lowland Forests; Wetlands	Occur in areas with dense grasses on sedges, occasionally found in dry dense grasslands.
Harvest Mouse <u>Reithrodontomys humulis</u>	C	Wet Grasslands; Wetlands	Commonly occurs in abandoned fields in late herbaceous and early broom sedge stage of succession, roadside ditches and thickets and wet meadows.

MAMMALS (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Old Field Mouse <u>Peromyscus polionotus</u>	C	Grasslands Habitats; Near Wetlands	Common in pasture lands and fields in the herbaceous stage of old field succession and feeds primarily on seeds of grasses and herbs.
White-footed Mouse <u>Peromyscus leucopus</u>	O	Hardwood Forests; Thickets	Nocturnal mouse found in oak-hickory forests that have dense herbaceous undergrowth. Also occur in bottom lands and hardwood forests along river bottoms and wetlands.
Golden Mouse <u>Peromyscus nuttalli</u>	C	Dense Woodland Habitats; Near Wetlands	Prefer wooded areas with dense undergrowth, such as areas between wetland bottoms and more open drier upland forests. Commonly found in underbrush bordering rivers and streams.
Hispid Cotton Rat <u>Sigmodon hispidus</u>	C	Grasslands	Found where the cover is sufficiently dense to provide it with some security against overhead predation and where succulent grasses and forbs are abundant. It is particularly common in thickets of honeysuckle or blackberries growing on field contours in marshy areas, and in well-developed broomsedge fields. Railroad rights-of-way and road-

MAMMALS (Cont 'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Pine Vole <u>Pitymys pinetorum</u>	C	Pine & Hardwood Forests	sides also support sizable populations. At times of high population density, surplus animals take up residence in herb-dominated old fields, field-crops and brush thickets. Some may even be encountered in hardwood forests.  The pine mouse is a fossorial rodent and lives in underground nests or in nests built beneath stumps or logs. It occurs most commonly in wooded areas in hardwood as well as pine forests with dense growths of honeysuckle or green brier and in old-fields covered with broomsedge.
Muskrat <u>Ondatra zibethica</u>	C	Waterbodies; Streams; Wetlands	The muskrat requires a permanent pond or stream with an abundance of aquatic plants. These conditions are most satisfactorily met in farm ponds, rivers and streams with an abundance of aquatic vascular vegetation.
Meadow Jumping Mouse <u>Zapus hudsonius</u>	R	Moist Grasslands; Pastures	Occurs in moist meadows but is also found in pine and hardwood forests. It is seldom found far from a source of water.

MAMMALS (Cont'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Red Fox <u>Vulpes fulva</u>	O	Brushy Openlands	Prefers more open habitat than does the gray fox; in areas with brushy thickets and open lands nearby.
Gray Fox <u>Urocyon cinereoargenteus</u>	C	Open Forest;	Occurs in moist terrestrial habitat but reaches greatest abundance in areas having a diversity of fields and woods, especially areas under cultivation with thickets nearby.
Raccoon <u>Procyon lotor</u>	C	Ubiquitous	Wide ranging habitat. In farmland and mixed woodlands, they prefer the bottom lands where plentiful den trees are available and range over upland habitats in search of food.
Long-tailed Weasel <u>Mustela frenata</u>	R	Lowland Forest	Normally occurs in bottom land hardwood forests that have well developed understorey. Also ranges upland and in open lands. Principal food is rats, mice, chipmunks and shrews.
Mink <u>Mustela vison</u>	C	Wetlands	Semi-aquatic mammal which is generally found along streams, ponds, wetland, and moist bottom hardwoods. Principal food items are rice rat, fish, frogs, aquatic insects, snakes and birds.

MAMMALS (Cont 'd)

<u>Species</u>	<u>Occurrence</u>	<u>Habitat Preference</u>	<u>Remarks</u>
Spotted Skunk <u>Mephitus mephitus</u>	C	Grasslands; Thickets	Occurs in the vicinity of farms and open woodlands where it often dens beneath buildings and sometimes dens in trees.
Striped Skunk <u>Spilogal putorius</u>	O	Brushy Thickets; Open Woodlands	Most abundant in agricultural lands or in open pasture rather than in dense forests. Also common in pasture lands with thickets and bottom lands.
River Otter <u>Lutra canadensis</u>	O	Rivers; Streams; Wetlands	Inhabits creeks, beaver ponds, lakes and wetlands along rivers where it seeks its principal foods, fish.
Bobcat <u>Lynx rufus</u>	O	Bottom land Hardwood; Wetlands	Occurs along river bottom swamps, thickets dense upland hardwood areas. Principal food consists of rabbits, small rodents and birds.
White-tail Deer <u>Odocoileus virginianus</u>	C	Forest; Wetlands; Pasturelands	The whitetail deer is a remarkably adaptable animal capable of living in deep forest, swamps and open farmland with scattered woodlots. The optimum habitat is the brushy stage of deciduous forest where young trees and shrubs provide a variety of food and cover.

APPENDIX C

WATER QUALITY CRITERIA FOR GEORGIA AND SOUTH CAROLINA

TABLE 1

WATER QUALITY CRITERIA  
GEORGIA AND SOUTH CAROLINA

GENERAL CRITERIA FOR ALL WATERS

Georgia

1. All waters shall be free from materials associated with municipal or domestic sewage, industrial waste, or any other waste which will settle to form sludge deposits that become putrescent, unsightly, or otherwise objectionable.
2. All waters shall be free from oil, scum and floating debris associated with municipal or domestic sewage, industrial waste or other discharges in amounts sufficient to be unsightly or to interfere with legitimate uses.
3. All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor, or other objectionable conditions which interfere with legitimate water uses.

South Carolina

1. The waters of the State shall be free at all times from substances attributable to sewage, industrial waste or other waste that will settle to form sludge deposits that are unsightly, putrescent, or odorous to such a degree as to create a nuisance or that interferes directly or indirectly with water uses.
2. The waters of the State shall be free at all times from floating debris, oil, grease, scum, and other floating materials attributable to sewage, industrial waste, or other waste in amounts sufficient to be unsightly to such a degree as to create a nuisance or that interfere directly or indirectly with water uses.
3. The waters of the State shall be free from materials attributable to sewage, industrial waste or other wastes which produce taste, odor, or change the existing color or other physical and chemical conditions in the receiving stream to such a degree as to create a nuisance, or that interfere directly or indirectly with water uses.

TABLE 1 (Cont'd)

Georgia

4. All waters shall be free from corrosive, acidic, and caustic substances discharged from municipalities, industries, or other sources in amounts, concentrations, or combinations which are harmful to humans, animals, or aquatic life.
  
5. The maximum permissible concentrations of radio nuclides in the waters of the State must conform to the limits which are cited in Chapter 270-5-20, "Control of Radioactive Materials," of the Rules and Regulations of the Georgia Department of Public Health.

South Carolina

4. The waters of the State shall be free from high temperature, toxic, corrosive, or other deleterious substances attributable to sewage, industrial waste or other waste in concentrations or combinations which interfere directly or indirectly with water uses, or which are harmful to plant, human, or aquatic life.

TABLE 2

WATER QUALITY CRITERIA  
GEORGIA AND SOUTH CAROLINA

SPECIFIC CRITERIA FOR RECREATIONAL AND DIRECT CONTACT WATERS

<u>Georgia (Recreational)</u>	<u>South Carolina (Direct Contact)</u>
<p>1. The fecal coliform level is not to exceed a geometric mean of 200/100 ml based on at least four samples taken during a 30-day period. Should natural fecal coliform levels exceed 200/100 ml (geometric mean) occasionally, then the allowable geometric mean fecal coliform level shall not exceed 300/100 ml in lakes and reservoirs and 500/100 ml in free flowing freshwater streams.</p>	<p>1. Fecal coliform not to exceed a geometric mean of 200/100 ml nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 ml.</p>
<p>2. pH is to be within the range of 6.0-8.5.</p>	<p>2. pH in the range between 6.0 and 8.0.</p>
<p>3. Dissolved oxygen must have a daily average of 6.0 mg/l and be no less than 5.0 mg/l at all times for waters designated as trout streams (the reach 10 miles below Hartwell Dam). A daily average of 5.0 mg/l must be maintained at all times for waters supporting warmwater species of fish.</p>	<p>3. Dissolved oxygen must not be less than 5 mg/l.</p>
<p>4. Toxic wastes and other deleterious materials cannot occur in concentrations that would harm man, fish and game, or other beneficial aquatic life.</p>	<p>4. Amounts of toxic wastes, deleterious substances, colored or other wastes shall not exceed limitations set forth in the latest regulations established pursuant to Section 1412 Public Service Act amended by Safe Drinking Water Act (Public Law 93-523) and related regulations applicable to public water systems.</p>

TABLE 2 (Cont'd)

Georgia (Recreational)

5. Temperature is not to exceed 90°F. At no time is the temperature of more than 5°F above intake temperature. In streams designated as secondary (put-and-take) trout and smallmouth bass waters, a 2°F maximum elevation of stream temperature above natural stream temperature may be permitted.
5. Waters shall not exceed a temperature of 90° F (32°C) at any time after adequate mixing of heated and normal waters as a result of heated liquids; nor shall the water temperature after passing through an adequate zone for mixing be more than 18°F (10°C) greater than that of water unaffected by the heated discharge.
6. Phosphorous within lakes, ponds, and impoundments is not to exceed a monthly average of 0.05 mg/l TOT-P in the epilimnion.

APPENDIX D

CLARKS HILL LAKE RECREATION AREAS

## APPENDIX D

### RECREATION AREAS OF CLARKS HILL LAKE

1. Public Use Areas. Increasing population in the area within 50 miles of Clarks Hill Lake plus the opening of Interstate Highway 20 provides a direct link between Columbia, South Carolina, and Atlanta, Georgia, indicates an increase in visitation to the project. It is anticipated that an increase of 5-15 percent may be expected annually for the next several years. Designated public use areas are briefly described below. Unless otherwise indicated, each is operated by the Corps of Engineers.

a. Below Dam, South Carolina, Site No. 1.

(1) This 29-acre area is located on the east bank of the Savannah River immediately below Clarks Hill Dam. The area was developed to provide bank fishing at the tailrace and boating access to the river. A fishing platform is constructed alongside the tailrace. Access and circulation roads are paved. The area offers good downstream viewing of the dam. Picnicking and parking facilities are provided. The power house and switchyard are adjacent to the area.

(2) Visitation for 1980 was recorded as 60,893.

b. Clarks Hill Recreation Area, Site No. 4.

(1) This 32-acre area is located approximately .7 mile from the eastern end of the dam. Entrance is from U.S. Highway 221 and paved access and circulation roads serve the area. Development includes picnic facilities, picnic shelter, a waterborne\* comfort station, and a boat ramp. The area is extensively used for swimming and waterskiing. The area provides boat access to excellent fishing areas and is well used year round.

(2) Visitation for 1980 was recorded as 89,469.

c. Scotts Ferry Site No. 5.

(1) This 112-acre area is located approximately 2 1/2 miles up the Savannah River from the dam. A paved access road enters the area from U.S. Highway 221. Present development includes a paved launching ramp, parking lot, and picnic facilities. A natural beach behind a protective point is quite popular.

(2) Visitation for 1980 was recorded as 28,245.

\*The term "waterborne" applies to any facility that uses water for plumbing purposes.

d. Modoc Tent and Trailer Camp, Site No. 6.

(1) This 119-acre area is developed for camping, but also provides a small picnic area and a launching ramp. The area is located approximately 5 1/2 miles up the Savannah River from the dam. Access to the area is from U.S. Highway 221 by paved road. Development includes 50 camp pads, each with table, grill, trash receptacle, a wet garbage pit, and pit latrine. A central shower washhouse and trailer dump station are located on the access road. Approximately two-thirds of the circulation roads are paved. The westernmost tip of the main peninsula is experiencing severe erosion from wave action. The area is popular for bank fishing.

(2) Visitation for 1980 was recorded as 46,423.

e. Modoc, Site No. 7.

(1) This 96-acre area is located approximately 6 miles up the Savannah River from the dam. Road access is by a State secondary road intersecting with U.S. Highway 221 in the community of Modoc. The area provides a launching ramp and picnic facilities and was originally developed as a concession area. Because of wind and wave problems, boat storage docks were severely damaged and the marina operation was forced into bankruptcy. The area has potential for expansion, provided visitation increases sufficiently to justify the investment. The area is popular for bank fishing and provides boat access to good fishing waters.

(2) Visitation in 1980 is recorded as 27,197.

f. Hamilton Branch State Park, Site No. 8.

(1) This 713-acre area was being developed under the "712" program and includes 200 camp pads with water, electricity, tables, grills, garbage pits, trash receptacles, and pit latrines. Additional facilities include four shower washhouses, two comfort stations, picnic areas, two launching ramps, two trailer dump stations, and paved access and circulation roads. The area is located approximately 8 miles up the Savannah River from the dam. Access is via U.S. Highway 221. The park offers room for expansion of all facilities and could accommodate cabins. However, it is operated in conjunction with Baker Creek and Hickory Knob Parks, and it is expected that it will be utilized primarily for camping.

(2) Operating agency is South Carolina Department of Parks, Recreation, and Tourism.

(3) Visitation for 1980 is recorded as 123,002.

g. Parksville Wayside, Site No. 9.

(1) This 59-acre area is located approximately 9-12 miles up the Savannah River from the dam. Access to the area is by a State secondary road which intersects with U.S. Highway 221 at Parksville. The area contains eight camp pads with tables, grills, garbage pits, and trash receptacles. There are four pit latrines to serve the camp area, and a drinking fountain is centrally located in the camp area. There is a waterborne comfort station located near the picnic areas. A paved launching ramp provides boat access to excellent fishing waters nearby. Access and circulation roads are paved and there is adequate parking adjacent to the ramp and a picnic shelter. It is a popular fishing area and is extensively used for swimming during the warmer period of the year. An area across a cove and fronting on Highway 221 has been outgranted to McCormick County and developed as a picnic area. The county has provided a picnic shelter, tables, and paved parking. Future plans include waterborne restroom facilities and a pedestrian causeway to a nearby island on which an observation platform is to be built.

(2) Recorded visitation for 1980 was 101,572.

h. Dordon Creek West, Site No. 11.

(1) This area is located approximately 11 miles up Savannah River from the dam. Access is by a paved secondary State road that intersects with U.S. Highway 221, approximately 3 1/2 miles north of Parksville. The area contains a paved launching ramp and parking area, picnic area, well with hand pump, and pit latrines. The area is a popular access point for fishing, and expansion is recommended by enlarging the picnic area.

(2) Visitation for 1980 was recorded at 29,527.

i. Clarks Hill Marina (Fishing Village), Site No. 13.

(1) This 50-acre concession area is located approximately 13 1/2 miles up Savannah River from the dam. Access is provided by a paved State secondary road which intersects with U.S. Highway 221, at Plum Branch. Complete marina services are provided including open and covered boat storage, repair shops, motor repairs, fishing tackle and bait sales, short order snack bar, restaurant, fuel sales, rental cottages, transient trailer sites, camping area, boat and motor rentals, fishing dock, and miscellaneous services. A public launching ramp is available.

(2) This area is operated by Clarks Hill Marina, Inc., Plum Branch, South Carolina.

(3) Visitation for 1980 was recorded as 111,161.

j. Haw Creek Tent and Trailer Camp, Site No. 16.

(1) This 86-acre area is located approximately 15 1/2 miles up Savannah River from the dam. The facilities provided include 28 camp pads, each with table, garbage pit, grill, trash receptacle, and pit latrines and a waterborne shower washhouse building. Other development includes unpaved access and circulation roads, a well with hand pump, and a paved launching ramp. It is well suited as a camping area and there is room for expansion.

(2) Visitation for 1980 was recorded as 30,913.

k. Chamberlain Ferry, South Carolina, Site No. 17.

(1) This 69-acre area is located approximately 16 1/2 miles up the Savannah River from the dam. Development includes a paved launching ramp, picnic facilities, and a well with hand pump. Access road is unpaved. This area provides boating access to excellent fishing waters and is heavily used during the fishing season.

(2) Visitation for 1980 was recorded as 8,888.

l. Baker Creek State Park, Site No. 18.

(1) This area containing 1,271 acres is located up the South Carolina Little River 18 miles from the dam. Development includes camping areas, picnic facilities, boat ramps, beach house with swimming beach, a tackle shop for sale of bait, tackle, and refreshments, and a Welcome Center located in the area formerly designated as Site 119, McCormick. Access to the main portion of the park is from U.S. Highway 378. Paved access and circulation roads serve the area. The Welcome Center is located on U.S. Highway 378 at Little River. A water and electrical system serve the campsites and picnic areas. There is room in the area for considerable expansion and enlargement of facilities.

(2) The area is managed by the South Carolina Department of Parks, Recreation, and Tourism.

(3) Visitation for 1980 was recorded as 84,018.

m. LeRoys Ferry, Site No. 22.

(1) This 92-acre area is located approximately 27 miles up Savannah River from the dam. Access is provided from a State secondary road which intersects with State Highway 81 at the community of Willington. Development within the area consists of a paved access road, paved circulation roads, a paved launching ramp, picnic facilities, a vault latrine, and 10 campsites.

(2) Visitation for 1980 was recorded as 13,696.

n. Corley, Site No. 24.

(1) This 9-acre area is located up the South Carolina Little River approximately 18 miles from the dam. It is situated directly opposite Baker Creek State Park. Access is by an unpaved road from U.S. Highway 378. The area has been developed only for picnicking and is lightly used. Since the development of Baker Creek State Park, it generally is used only as overflow for picnicking facilities and for bank fishing.

(2) Visitation for 1980 was recorded as 1,895.

o. Savannah Wayside, Site No. 28 (known as McCormick in Master Plan).

(1) This 79-acre area is located approximately 19 miles up Savannah River from the dam and is at the Highway 378 crossing of the river. Access is by paved road from Highway 378. Development includes a picnic area with picnic shelter, a well with hand pump, and a paved boat launching ramp. The circulation road to the launching ramp is not paved. The area is popular as an access point for fishing both by bank and by boat. This area is situated directly opposite Elijah Clark State Park and serves as an overflow picnic area for that facility.

(2) Visitation for 1980 was recorded as 38,571.

p. Hickory Knob State Park, Site No. 30.

(1) This area contains 1,204 acres and is located approximately 22 miles up Savannah River from the dam. The area is operated by the State of South Carolina Department of Parks, Recreation, and Tourism. The area is developed as a resort park with a lodge containing dining facilities, conference facilities, motel-type rooms, duplex rental cabins, picnic areas, playgrounds, stables, a show barn for horse and dog shows, launching ramp, and boat dock facilities. The area is served by central water and sewage disposal systems. Additional development includes lighted tennis courts, equestrian areas, a personnel barracks for employees, and a camping area. Access is via South Carolina State Highway 6 by paved road. Access and circulation roads are paved.

(2) Visitation for 1980 was recorded as 205,282.

q. Mt. Carmel, Site No. 32.

(1) This area contains 151 acres and is located approximately 30 miles up Savannah River from the dam. Development includes 12 campsites with table, grill, garbage pit, trash receptacles, and pit latrines. Access is via state secondary paved road from Mt. Carmel. A paved launching ramp and picnic facility is included in the area. Water is supplied by a well with a hand pump. Additional development

under construction is installation of an electric pump, and shower washhouses. This area is heavily used throughout the year especially during spring and winter fishing.

(2) Visitation for 1980 was recorded as 69,399.

r. Mt. Pleasant, Site No. 33.

(1) This area contains 33 acres and is located approximately 33 miles up Savannah River from the dam. The area serves primarily as a fishing access point and development includes a paved boat ramp, picnic facilities, and restrooms. Access is by paved state secondary road intersecting with the road to the Mt. Carmel area.

(2) Visitation for 1980 was recorded as 22,957.

s. Calhoun Falls Park, Site No. 35.

(1) This 60-acre area is located approximately 35 miles up Savannah River from the dam. The area is leased to the City of Calhoun Falls, South Carolina. Access is by paved State secondary road intersecting with State Highway 7. Development thus far has all been provided by the Corps of Engineers and includes picnic facilities, a well with hand pump, restrooms, and a paved launching ramp.

(2) Visitation for 1980 was recorded as 20,254.

t. Morrahs, Site No. 36.

(1) This area contains 45 acres and is located approximately 34 miles up Savannah River from the dam on a peninsula between Savannah River and Broad River. Access is provided by a paved State secondary road which intersects with Georgia State Highway 72, the Elberton-Calhoun Falls Highway. A secondary road also connects this road with Georgia Highway 79, the Lincolnton-Elberton Road. Development in the area consists of paved access and circulation roads, paved parking areas, picnic facilities, and a paved launching ramp. The area is utilized primarily as a fishing access point and is located approximately 1 mile from Bobby Brown State Park.

(2) Visitation for 1980 was recorded as 25,644.

u. Bobby Brown State Park, Site No. 37.

(1) This area contains 704 acres and is located approximately 33 miles up Savannah River from the dam at the confluence of Savannah River and Broad River. Development includes campgrounds with water-borne shower washhouses, picnic areas, a boat ramp, swimming pool,

playgrounds, picnic shelters, nature trail, refreshment sales center, and rental boats. Areas are designed for group camping, but are not developed. The steepness of the terrain limits development in certain portions of the area to that which can be placed on high land and is not water based. Access is by State secondary road.

(2) The area is operated by Georgia Department of Natural Resources, Division of State Parks.

(3) Visitation for 1980 was recorded as 78,057.

v. Broad River Tent and Trailer Camp, Site No. 40.

(1) This area contains 31 acres and is located up the Broad River approximately 35 miles from the dam. Development includes 13 campsites with picnic table, grill, garbage pit, trash receptacle, pit latrine, paved access and circulation roads, a two-lane boat launching ramp, a well with a hand pump, and a paved parking area. Access is from Georgia State Highway 79.

(2) Visitation for 1980 was recorded as 78,739.

w. Pistol Creek, Site No. 42.

(1) This 174-acre area is located approximately 32 miles up Savannah River at Pistol Creek. Access is by an unpaved road intersecting with Georgia Highway 79. Development consists of a picnic area and a paved boat launching ramp. The area provides adequate room for enlargement of the picnic facilities and/or development for camping.

(2) Visitation for 1980 was recorded as 15,337.

x. Gill Point, Site No. 44.

(1) This 19-acre area is located up Pistol Creek approximately 32 miles from the dam. Facilities include a boat launching ramp, restrooms, and a picnic area. The area provides boating access for visitors and for owners of cottage lots in the Pistol Creek Subdivision. Access is by a paved road intersecting with Georgia Highway 79 at Rhodes Store.

(2) Visitation for 1980 was recorded as 45,303.

aa. Graball, Site No. 47.

(1) This area contains 54 acres and is located approximately 31 miles up Savannah River from the dam. Development consists of a small picnic area. Access is by an unpaved road beginning at the end of Georgia Highway 44 which also provides access to Hesters Ferry (Site No. 48).

(2) Visitation for 1980 was recorded as 521.

bb. Hesters Ferry, Site No. 48.

(1) This area contains 213 acres and is located approximately 28 miles up Savannah River from the dam. Development to date includes 26 individual campsites, each with picnic table, grill, trash can, garbage pit, pit latrine, a picnic area, a well with a hand pump, and a boat ramp. Access is by an unpaved road beginning at the end of Georgia Highway 44.

(2) Visitation for 1980 was recorded as 19,611.

cc. Fishing Creek Ramp, Site No. 52.

(1) This area contains 44 acres and is located up Fishing Creek approximately 28 miles from the dam. Facilities include a paved launching ramp and restrooms. The area provides boating access to excellent fishing waters in the Fishing Creek area. Access is provided by an unpaved road intersecting with Georgia Highway 79.

(2) Visitation for 1980 was recorded as 4,346.

dd. Murry Creek Park, Site No. 54.

(1) This area contains 631 acres and is located approximately 24 miles up Savannah River from the dam. Existing facilities include a picnic area, a camp area, restrooms, and a paved boat ramp. Also contained within the area is an operational airstrip used by the Resource Management Section in mosquito control operations. Access is provided by an unpaved road intersecting with Georgia Highway 79. The area was designated for development under the "712" Program as a State park. Presently, the area serves as a free camping area with 10 sites.

(2) Visitation for 1980 was recorded as 13,043.

ee. Murry Creek Tent and Trailer Camp, Site No. 55.

(1) This area contains 47 acres and is located approximately 23 miles up Savannah River from the dam. Development includes 17 campsites, each with a picnic table, grill, pit latrine, garbage pit, a trash can, a well with a hand pump, and a paved launching ramp. Access is from a paved road intersecting with both Georgia Highway 79 and U.S. Highway 378.

(2) Visitation for 1980 was recorded as 21,798.

ff. Elijah Clark State Park, Site No. 56.

(1) This area contains 467 acres and is located approximately 19 miles up Savannah River from the dam. Development includes camping areas, rental cottages and mobile homes, picnic areas, playgrounds, a beach, museum, refreshment sales, rental boats, miniature golf, assembly building, and picnic shelters. The area is heavily utilized. Development of other State parks in the nearby region has relieved a great deal of the pressure from this park. Access is from a paved road intersecting with U.S. Highway 378 at Savannah River.

(2) The park is operated by the Georgia Department of Natural Resources, Division of Parks and Historic Sites.

(3) Visitation for 1980 was recorded as 184,018.

gg. Parkway, Site No. 57.

(1) This area contains 34 acres and is located approximately 19 miles up Savannah River from the dam. The area has two access entries from U.S. Highway 378 and provides picnic facilities, a picnic shelter, restrooms, and a paved launching ramp. The area is popular as a fishing access point and serves as an overflow area for Elijah Clark State Park.

(2) Visitation for 1980 was recorded as 15,974.

hh. Lincolnton, Site No. 59.

(1) This 87-acre area is located approximately 18 miles up Savannah River and Soap creek from the dam. Development includes picnic facilities, restrooms, and a paved boat ramp. Entry into the area is from U.S. Highway 378.

(2) Visitation for 1980 was recorded as 28,914.

ii. Soap Creek Lodge, Site No. 60.

(1) This concession area operated by Mr. Toye E. Hill contains 32 acres and is located approximately 17 1/2 miles up Savannah River and Soap Creek from the dam. Facilities include open and covered boat storage, fuel sales, rental boats and motors, tackle and bait sales, short order restaurant, rental cottages, transient trailer sites, camping area, fishing dock, a public ramp, and miscellaneous services. The location of the concession above a low bridge on Soap Creek at the crossing of Georgia Highway 220 has handicapped the use of the area by large boatowners.

(2) Visitation for 1980 was recorded as 92,867.

jj. Chamberlains Ferry, Georgia, Site No. 63.

(1) This area contains 14 acres and is located approximately 15 miles up Savannah River from the dam. Development in the area includes picnic facilities, restrooms, a well with hand pump, and a boat ramp. Access is by a paved road intersecting with Georgia Highway 220. The area serves primarily as a fishing access point for nearby waters and is used locally for swimming.

(2) Visitation for 1980 was recorded as 8,888.

kk. Bussey Point, Site 71.

(1) This area contains 2,386 acres and is designated as a wilderness area. It is located at the confluence of the Savannah River and Georgia Little River. Minimum access is provided with unpaved roads throughout the area which are closed during the period from 31 May to 1 September. A camp area with 10 individual sites, each with a picnic table, pit latrine, and trash receptacle, is located on the river on a prominent point. A picnic area with an Adirondack shelter and picnic tables is located slightly further upstream on another point. These areas are accessible to the public only by water. The area is used extensively for hunting during the regular hunting season and hopefully will be used for hiking, nature study, and general enjoyment of a large untouched area by the visiting public. While the timber growth is not virgin, it is large second growth and has been untouched since the acquisition of the property by the Corps of Engineers. Such an area is unique in this vicinity. Access to the area is provided by a county road, partially paved, from the community of Double Branches. The area is approximately 4 miles up Savannah River from the dam. The Corps, Georgia Department of Natural Resources, Georgia Wild Turkey Federation, and National Wild Turkey Federation cooperate in managing the area for wild turkey restoration.

(2) Visitation for 1980 was recorded as 5,040.

ll. Mosley Creek, Site No. 72.

(1) This area contains 137 acres and is located approximately 7 miles up Savannah River and Little River, Georgia, from the dam. Development includes a camping area with 15 individual campsites, each equipped with a picnic table, grill, trash receptacle, garbage pit, pit latrine, a well with hand pump, picnic area, and a paved boat ramp. Access is provided by an unpaved road from Double Branches Community.

(2) Visitation for 1980 was reported as 16,783.

mm. Double Branches, Site No. 73.

(1) This area contains 10 acres and is located up the Georgia Little River and Cherokee River approximately 9 miles from the dam. The area is used primarily as an access point to fishing waters by adjacent cottage lot owners and the visiting public. Development includes only a paved boat ramp and unpaved access road.

(2) Visitation for 1980 was reported as 19,566.

nn. 220, Site No. 74.

(1) The area contains 18 acres and is located up the Georgia Little River and Cherokee Creek approximately 10 miles from the dam. Access is provided by a paved unnumbered road leading from Georgia 47 to the Double Branches Community. The area provides an access point for bank fishing. Development consists only of pit latrines and trash receptacles.

(2) No estimates of visitation are made.

oo. Lincoln County Wayside, Site No. 76.

(1) This area is outgranted to the Georgia Department of Transportation and contains 68 acres, located up the Georgia Little River approximately 9 miles from the dam. Access is off Georgia Highway 47 at Prices Bridge. Development includes picnic areas, restrooms, and a paved boat ramp. The area is extensively used as an access area to fishing waters by boat and for bank fishing.

(2) The area is operated by the Georgia Department of Transportation, Highway Department.

(3) Visitation for 1980 was reported as 49,926.

pp. Leathersville, Site No. 78.

(1) The area contains 23 acres and is located up the Georgia Little River approximately 11 miles from the dam. Development includes picnic facilities, a well with hand pump, and a paved boat ramp. The area is well used as an access point for fishing in nearby waters and for seasonal hunting. Access is provided by an unpaved road intersecting with Georgia Highway 220.

(2) Visitation for 1980 was reported as 17,699.

qq. Grays Creek, Site No. 79.

(1) This area contains 130 acres and is located approximately 11 miles up Savannah River and Little River, Georgia, from the dam. It is located directly across Grays Creek from Site 78, Leathersville. Development to date is a paved boat ramp and restrooms. Principal access is by a paved road and an unpaved section from the community of Woodlawn on Georgia Highway 220. The area is used to provide access to fishing waters and to hunting areas nearby.

(2) Visitation for 1980 was reported as 7,220.

rr. Clay Hill Tent and Trailer Camp, Site No. 81.

(1) This area contains 65 acres and is located approximately 13 miles up Savannah River and Little River, Georgia, from the dam. Access is provided by a paved road from the community of Amity. The area is developed for camping and contains 19 individual campsites, each with picnic table, grill, trash receptacle, garbage pit, pit latrine, a paved boat ramp, a well with hand pump, and paved access road.

(2) Visitation for 1980 was reported as 42,212.

ss. Amity, Site No. 84.

(1) This area contains 103 acres and is located up the Georgia Little River approximately 15 miles from the dam. The unpaved access road intersects with a paved road which in turn intersects with Georgia Highway 43 near Raysville Bridge. Development includes a picnic area, restrooms, and a paved launching ramp.

(2) Visitation for 1980 was reported as 11,054.

tt. Smith Mill, Site No. 85.

(1) This area which has been enlarged to contain 333 acres is outgranted to Wilkes County, Georgia, and is operated as Holiday Shores. It is located up the Georgia Little River approximately 18 miles at Kemp Creek. Development to date, by the Corps of Engineers, consists of a picnic area, a paved launching ramp, well with hand pump, and restrooms. Additional development by the County includes camping areas and additional restrooms. An extensive development plan has been approved and programmed by the County to include camping areas, picnic facilities, and rental cottages. Principal access is provided by a paved county highway intersecting with an unnumbered county road near Prices Chapel.

(2) The area is operated by Wilkes County, Georgia.

(3) Visitation for 1980 was reported as 2,599.

uu. Big Hart Park, Site No. 87.

(1) This area contains 451 acres and is located up the Georgia Little River and Hart Creek approximately 17 miles from the dam. Access is provided by a paved county road intersecting with U.S. Highway 78. Three types of development are within the area. First is a picnic area with a well and a paved launching ramp. An adjacent peninsula is developed for camping with 15 individual campsites, each with picnic table, grill, trash receptacle, pit latrine, and garbage pit. A second well with hand pump serves this area. The third area

is a group camping area with accommodations for 16 tent groups, vault latrine, well with hand pump, an activity field, nature trail, and gated access road. The area provides adequate room for enlarging all facilities. The area is adjacent to the managed hunt area outgranted to the Georgia Department of Natural Resources, Division of Game and Fish and attracts large numbers of hunters during hunting season.

(2) Visitation for 1980 was reported as 67,183.

vv. Raysville Bridge, Site No. 88.

(1) This area contains 101 acres and is located up the Georgia Little River approximately 15 miles from the dam, at the crossing of Georgia Highway 43. Two forms of development are included in the area and are separated by a wooded portion of the tract. A picnic area with a paved access road entering from Georgia Highway 43, with a paved boat ramp is located nearest the bridge. A paved access road from the highway leads into a camping area containing 28 individual campsites, each with a picnic table, grill, pit privy, trash receptacle, and garbage pit. A well with hand pump serves this area.

(2) Visitation for 1980 was reported as 44,479.

ww. Raysville Marina, Site No. 89.

This area contains 25 acres and is located up the Georgia Little River approximately 15 1/2 miles at the crossing of Georgia Highway 43. Access is provided by an unpaved road from Georgia Highway 43. Facilities thus far include rental docks, fueling dock, bait and tackle sales shack, a public launching ramp, and picnic areas. The site is ideally located to provide services to fishermen, campers in the Raysville Tent and Trailer Area, users of the picnic facilities, and boaters.

(2) The area is operated by Charles and Miriam Clark.

(3) Visitation for 1980 was reported as 25,648.

xx. Germany Creek, West, Site No. 90.

(1) This area contains 12 acres and is located up the Georgia Little River and Germany Creek approximately 15 miles from the dam. This is an access point and contains picnic facilities and an unpaved launching ramp.

(2) Visitation for 1980 was reported as 51,785.

yy. Winfield Tent and Trailer Camp, Site No. 93.

(1) This area contains 99 acres and is located up the Georgia Little River approximately 12 miles from the dam. The area is developed for camping with 22 individual campsites, each consisting of a picnic table, pit latrine, grill, trash receptacle, wet garbage pit, a well with hand pump, and a paved boat ramp. Access is provided at the end of a paved road intersecting with an unnumbered county road at the community of Winfield.

(2) Visitation for 1980 was reported as 50,602.

zz. Mistletoe State Park, Site No. 94.

(1) This area contains 2,032 acres and is located up the Georgia Little River and Cliatt Creek approximately 10 miles from the dam. Development occupies less than 1/2 of the area and includes camping areas, picnic areas, a beach, beach house, a tackle shop, playgrounds, rental cottages, group shelters, boat ramps, nature trails, and wild-life viewing areas. Access is by paved road leading from the community of Winfield. Since its development, this area has rapidly increased in visitation and now is the second most heavily used State park on the lake. Paved circulation roads serve the area and a central water and sewage disposal system are provided.

(2) The area is operated by the Georgia Department of Natural Resources, Division of Parks and Historic Sites.

(3) Visitation for 1980 was reported as 207,509.

aaa. Little River Sportsman's Camp, Site No. 95.

(1) This concession area contains 86 acres and is located up the Georgia Little River at Prices Bridge approximately 8 miles from the dam. Complete marina service is provided, including open and covered boat storage, a boat storage building with service to and from the water, fuel sales, boat and motor rentals, bait and tackle sales, short order snack restaurant, rental cottages, transient trailer sites, campsites, public ramp, and miscellaneous services. The area is heavily used. It is an extremely popular area as an access point for fishing trips. Guide service is available if requested. Access is by a paved road from the community of Leah.

(2) This area is operated by Little River Marina, Inc., with Thomas and Rosenell Shaw as owners and managers.

(3) Visitation for 1980 was reported as 163,517.

bbb. Columbia County Wayside, Site No. 96.

(1) This 7-acre area is located up the Georgia Little River at Ragesville Bridge approximately 8 miles from the dam. The area is outgranted to the Georgia Department of Transportation and contains picnic facilities and restrooms. The area is popular with fishermen, picnickers, and swimmers. Access is from Georgia Highway 47.

(2) The area is operated by the Georgia Department of Transportation Highway Department.

(3) Visitation for 1980 was reported as 12,867.

ccc. Ridge Road Picnic Area, Site No. 97.

(1) This area contains 46 acres and is located approximately 4 miles up Savannah River from the dam. Development includes picnic facilities, restrooms, drinking water, and a boat ramp. The visitation is high throughout the summer months and the boat ramp is open to the public during the summer. Access is by a paved road intersecting with Georgia Highway 104 at the community of Leah.

(2) Visitation for 1980 was reported as 10,278.

ddd. Ridge Road Tent and Trailer Area, Site No. 98.

(1) This area contains 59 acres and is located approximately 4 miles up Savannah River from the dam adjacent to the Ridge Road Picnic Area. Development includes 50 individual campsites, each with picnic table, grill, trash receptacle, garbage pit, pit privy, a shower washhouse, trailer dumping station, paved access and circulation roads, and a supplementary well with hand pump. Access is provided by a paved road intersecting with Georgia Highway 104 at Leah.

(2) Visitation for 1980 was reported as 28,986.

eee. Keg Creek, Site No. 100.

(1) This area contains 20 acres and is located up Keg Creek at the crossing of Georgia Highway 104 approximately 6 miles from the dam. Facilities provided include a paved boat launching ramp, picnic area, and restrooms. The area around the bridge is extensively used for bank fishing, and for fishing from boats at night.

(2) Visitation for 1980 was reported as 27,506.

fff. Wildwood Park, Site No. 101.

(1) This area contains 991 acres and is located up Keg Creek approximately 5 miles from the dam. Facilities include camping and picnic areas, picnic shelters, comfort stations, a beach, beach house, refreshment stand, and a boat launching ramp. Access is by paved road from Georgia Highway 104.

(2) The area is operated by Columbia County, Georgia, under sub-lease from the Georgia Department of Natural Resources, Division of Parks and Historic Sites.

(3) Visitation for 1980 was reported as 109,222.

ggg. Petersburg Tent and Trailer Camp, Site No. 102.

(1) This area contains 50 acres and is located approximately 3 miles up Savannah River and Keg Creek from the dam. Development includes 220 campsites, each with picnic table, grill, trash receptacle, garbage pit, pit privy, a well with hand pump, and a boat ramp. Access is by an unpaved road intersecting with U.S. Highway 221.

(2) Visitation for 1980 was reported as 40,135.

hhh. Old Petersburg Road, Site No. 103.

(1) This area contains 2,226 acres and is located approximately 3 miles up Savannah River from the dam and is adjacent to Site 102. Present development includes a picnic area with tables, picnic facilities, and restrooms.

(2) Visitation for 1980 was reported as 3,949.

iii. Lake Springs Marina, Site No. 104.

(1) This area is known commercially as Tradewinds and contains 180 acres. It is located approximately two miles up Savannah River from the dam. Development includes construction of roads, a fuel dock, and storage docks. Construction is actively underway and is following an approved development plan. Ultimate development would include fuel, snack, bait, and tackle sales, resort-type lodge, restaurant, cottages, transient trailer sites, campsites, an organized group camp, complete marina services, and other related services. Access is by paved road intersecting with U.S. Highway 221.

(2) The area is operated by Tradewinds Marina and Yachts Clubs, Inc.

(3) Visitation of 1980 was reported as 91,570.

jjj. Lake Springs, Site No. 105.

(1) The area contains 445 acres and is located approximately two miles up Savannah River from the dam. Facilities include picnic areas, restrooms, an overlook, nature trail, and circulation roads. Water is provided by a well with hand pump. Access is by paved road from U.S. Highway 221. Recommended future development includes enlarging the picnic facilities, installing a well with electric pump, constructing comfort stations, and paving circulation roads.

(2) Visitation for 1980 was reported as 107,399.

kkk. Clark Hill Recreation Area, Site No. 106.

(1) The area contains 121 acres and is located approximately two miles up Savannah River from the dam. Facilities include a picnic shelter, picnic tables, a waterborne comfort station, a paved access road, and a vista overlooking the lake. Access is by paved road intersecting with U.S. Highway 221.

(2) Visitation for 1980 was reported as 703.

lll. West Dam Access, Site No. 107.

(1) The area contains 22 acres and is located approximately 3/4 mile from the dam. Development includes picnic facilities, restrooms, drinking water, and a boat ramp. The area is heavily used.

(2) Visitation for 1980 was reported as 47,054.

mmm. Below Dam, Georgia, Site No. 108.

(1) The area contains 25 acres and is located on the Georgia bank immediately adjacent to the tailrace. Development includes picnic facilities, restrooms, and a boat ramp. The area provides bank fishing along the river and is heavily used during the fishing season. Access is by an unpaved road turning down river immediately at the western end of the earth embankment.

(2) Visitation for 1980 was reported as 24,781.

nnn. East Dam Overlook.

(1) This area is located on the eastern bank of the lake adjacent to the earth embankment and provides a vista for overlooking the dam.

(2) Visitation for 1980 was reported as 19,685.

ooo. West Dam Overlook.

(1) The area is adjacent to the earth embankment on the upstream side of the dam. Facilities include grassed areas and restrooms. The area is heavily used by swimmers and boaters and is an extremely popular area for young people.

(2) Visitation for 1980 was reported as 152,635.

APPENDIX E

REFERENCES

## APPENDIX E

### REFERENCES

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APPENDIX E

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APPENDIX F

PUBLIC VIEWS AND RESPONSES TO THE  
DRAFT ENVIRONMENTAL IMPACT STATEMENT



# United States Department of the Interior

## OFFICE OF THE SECRETARY

*Southeast Region / Suite 1412 / Atlanta, Ga. 30303  
Richard B. Russell Federal Building  
75 Spring Street, S. W.*

April 10, 1981

District Engineer,  
Savannah District Corps of Engineers  
P.O. Box 889  
Savannah, Georgia 31402

Dear Sir:

We have reviewed the draft environmental statement for Operation and Maintenance, Clarks Hill Lake, Savannah River, Georgia and South Carolina, and have the following comments.

### General Comments

1. The draft document is generally adequate in addressing impacts of operation on fish and wildlife resources. However, there are some points that need to be briefly, but specifically, addressed.

### Specific Comments

Page 34, paragraph 4.58

2. Alligators should be recognized as present in Clarks Hill Lake.

Page 39, paragraph 5.04

3. The discussion of dissolved oxygen concentrations in the tailwaters should be expanded to indicate the average number of days per year that the concentrations fell below 2.0 and 1.0, respectively. We also recommend that this paragraph indicate the state water quality classification for this segment of the river, and the dissolved oxygen concentration criteria for that classification.

Page 41, paragraphs 5.08-5.10

4. These paragraphs record the experimental operations to increase the dissolved oxygen levels below Clarks Hill Dam. This section should be expanded to address future operation and management plans to mitigate these detrimental

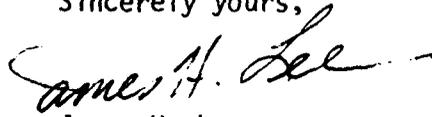
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PAGE  
7D-EC

impact and increase oxygen levels.

Thank you for the opportunity to comment on this statement.

Sincerely yours,

A handwritten signature in cursive script that reads "James H. Lee". The signature is written in dark ink and is positioned above the typed name.

James H. Lee  
Regional Environmental Officer

✓

✓

U.S. Department of the Interior  
Responses:

1. The EIS has been modified to incorporate the comments of the Department of the Interior.
2. While no endemic, breeding population of alligator is expected to be found in the Clarks Hill Lake area, appendix B has been changed to reflect this possibility.
3. & 4. Dissolved oxygen studies are now being completed at various locations on Clarks Hill Lake. These data, including the profile values, mean number of days during the year when dissolved oxygen values fall below 2.0 and 1.0 mg/l, will be made available.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV  
345 COURTLAND STREET  
ATLANTA, GEORGIA 30365

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DDC  
OP

DE  
PD  
PO-EE

April 7, 1981

4SA-EIS

Colonel Tilford Creel, USA  
District Engineer  
Corps of Engineers, Savannah District  
P. O. Box 889  
Savannah, Georgia 31402

Dear Colonel Creel:

We have reviewed the Draft Environmental Impact Statement on the operation and maintenance of Clarks Hill Lake (Georgia and South Carolina) and offer the following observations:

1.

With regard to overall environmental effects, Plan A appears superior to the other alternatives; however, improvements could be made in its operation, particularly with regard to water quality. The DEIS, Section 4.30, Page 27, states, "during the late summer and early fall months, releases may be as low as 1 to 2 ppm due to stratification," also Section 4.04, Page 39, "the releases from Clarks Hill contain low dissolved oxygen levels from July until fall turnover in late October." The EIS further indicates that 13 miles below the dam the river has only recovered to an oxygen content of 4.0 ppm. The dissolved oxygen in this section of the river could greatly be improved at comparatively minimal expense by utilizing a method recently demonstrated by the Tennessee Valley Authority at their Norris Dam. The system includes a "hub baffle" which is formed by welding baffles above the vents on the hub of the turbine. This increases suction, thereby causing more air to mix with the water. The water's oxygen content is further enhanced by supplying air through a baffle ring inside the draft tube. The combination of the "hub baffle" and draft tube ring is reputed to increase oxygen levels from 3.5 to 4.5 mg/l at a cost of about \$15,000 per unit. The system is considered to be a breakthrough in solving the problem of low dissolved oxygen below hydroelectric dams and we believe warrants your consideration for use at this facility.

On the basis of our review a rating of LO-2 was assigned, i.e., we have no significant environmental objections to this activity, but some additional information is requested.

If we can be of further assistance, feel free to call on us.

Sincerely yours,

*John E. Hagan III*  
John E. Hagan III  
Chief, EIS Branch

Rec'd EP... APR 14 1981

Response 1. U.S. Environmental Protection Agency

Hub baffles were installed on two units at Clarks Hill Dam this spring and we are testing the system in the late summer when the dissolved oxygen in the releases are low. We installed 45° hub baffles on Unit 4 and 60° hub baffles on Unit 3, which are similar in size to hub baffles installed by the Tennessee Valley Authority (TVA) at Norris Dam.

In addition, a fifth generating unit is being installed at the Hartwell Lake project. When construction of the unit is completed, we will add a baffle ring and hub baffles for testing.

Our recommendation for turbine aeration at the Richard B. Russell project will be based on the results of the Clarks Hill and Hartwell tests and additional studies being conducted by TVA and other Corps Districts. Preliminary studies indicate little or no increase in dissolved oxygen through turbine aeration when the background dissolved oxygen levels are as high as 4 to 5 ppm. This would be the case at the Russell project with the oxygen injection system in operation. Without oxygen injection, turbine aeration could not maintain 6 ppm of dissolved oxygen in the releases at the Richard B. Russell Dam.



Office of Planning and Budget  
Executive Department

Clark E. Stevens  
Director

GEORGIA STATE CLEARINGHOUSE MEMORANDUM

TO: Colonel Tilford Creel  
Dept. of the Army  
Savannah District COE  
P.O. Box 889  
Savannah, Georgia 31402

FROM: Charles H. Badger, Administrator  
Georgia State Clearinghouse  
Office of Planning and Budget

DATE: April 28, 1981

SUBJECT: RESULTS OF STATE-LEVEL REVIEW

Applicant: U.S. Army Corps of Engineers

Project: Draft EIS, Operation and Maintenance of Clarks Hill Lake, Savannah R

State Clearinghouse Control Number: GA 81-02-09-002

The State-level review of the above-referenced document has been completed. As a result of the environmental review process, the activity this document was prepared for has been found to be consistent with those State social, economic, physical goals, policies, plans, and programs with which the State is concerned.

The Department of Natural Resources has completed its review of the Draft Environmental Impact Statement (DEIS) on the operation and maintenance of Clarks Hill Lake. The Department is in general concurrence with the findings and conclusions to continue the present operation and maintenance. The Department's Historic Preservation Section (HPS) also finds that, in general, the DEIS deals comprehensively with cultural resources and their management. The HPS, however, wishes to point out that the Corps of Engineers does have the sole authority, and responsibility for, the Cultural Resource Management Program of a Corps' project. Close coordination with the Department of Interior (Interagency Archaeologist Services), the Advisory Council on Historic Preservation, and the State Historic Preservation Office is required, however, to plan and implement the Program.

270 Washington St., S. W. Atlanta, Georgia 30334

SC-EIS-4 (4/78)

Rec'd PD MAY 6 1981

SAI# GA 81-02-09-002

Page Two

April 28, 1981

The following State agencies have been offered the opportunity to review and comment on this project:

Natural Resources

Ports Authority

Office of Planning and Budget, Executive Dept.

CHB:tb

cc: Barbara Hogan, DNR

Enclosure: Comments prepared by GaPorts Authority, dated March 5, 1981.

TO: STATE CLEARINGHOUSE  
OFFICE OF PLANNING AND BUDGET  
INTERGOVERNMENTAL RELATIONS DIVISION  
270 WASHINGTON STREET, S. W.  
ATLANTA, GEORGIA 30334

FROM: NAME: FREEMAN G. CROSS, JR .  
AGENCY: GEORGIA PORTS AUTHORITY

SUBJECT: STATE-LEVEL REVIEW OF THE NEGATIVE DECLARATION/ENVIRONMENTAL  
ASSESSMENT OR DRAFT/FINAL ENVIRONMENTAL IMPACT STATEMENT  
PREPARED FOR THIS PROJECT

STATE CLEARINGHOUSE CONTROL NUMBER: GA 81-02-09-002

DATE: March 5, 1981

This project is considered to be consistent with those State social, economic, physical (goals), (policies), (objectives), (plans), and (programs), with which this organization is concerned. (Line through inappropriate word or words).

This project is recommended for further development with the following recommendations for strengthening the project (additional pages may be used for outlining the recommendations).

This project is not recommended for further development (accompanied by detail comments which explains the Division's rationale for this decision).

NO COMMENT

Response 1. Georgia State Clearinghouse

The U.S. Army Corps of Engineers will continue to maintain close ties with the appropriate state agencies, especially the Historic Preservation Section of the Department of Natural Resources and the State Historic Preservation Office, in order to continue this program at Clarks Hill Lake. The Corps of Engineers recognizes its authority and responsibility for the Cultural Resources Management Program at the lake.



STATE OF SOUTH CAROLINA

OFFICE OF THE STATE AUDITOR  
P.O. BOX 11333  
COLUMBIA  
29211

EDGAR A. VAUGHN, JR., CPA  
STATE AUDITOR  
(803) 758-3106

JESSE A. COLES, JR., PhD  
DEPUTY STATE AUDITOR  
(803) 758-3106

March 23, 1981

*y DD-C  
OP*

*FILE*

Colonel Tilford C. Creel  
District Engineer  
Savannah District, Corps of Engineers  
P.O. Box 889  
Savannah, GA 31402

Dear Colonel Creel:

Draft Environmental Impact Statement on  
Operation and Maintenance of Clarks Hill Lake

The referenced Statement has been reviewed. Enclosed are the comments from the Clarks Hill-Russell Authority for your consideration in preparing the final EIS.

Sincerely,

Elmer C. Whitten, Jr.  
A-95 Coordinator

Enclosure



J. A. McALLISTER, CHAIRMAN  
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CLARKS HILL-RUSSELL AUTHORITY  
OF SOUTH CAROLINA

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O. LEE STURKEY, GENERAL COUNSEL  
McCORMICK, SOUTH CAROLINA

J. N. WORKMAN, EXECUTIVE DIRECTOR  
P. O. DRAWER K  
McCORMICK, SOUTH CAROLINA  
TELEPHONE 803 443-2168

DRAFT ENVIRONMENTAL IMPACT STATEMENT  
FOR OPERATION AND MAINTENANCE  
OF THE CLARKS HILL LAKE

RESPONSE

The Clarks Hill-Russell Authority has reviewed the Draft Environmental Impact Statement for Operation and Maintenance of the Clarks Hill Lake and have found it to be inconsistent with Agency plans, especially as it relates to the social and economic well-being of the immediate Clarks Hill Reservoir area.

We support sound environmental practices and the sensitive treatment of the natural resources that make the Clarks Hill area so unique. However, there is a critical balance between the economic climate and environmental concerns which must be recognized. We feel that the failure to address this imbalance is a major deficiency.

As the state agency created to promote a better balance in the economic climate while preserving the environment to the maximum, we request you consider an alternative plan, whereby all lands unnecessary for Congressionally authorized project purposes be released to the private sector. This alternative would reduce the federal level of operation and maintenance responsibility without adversely affecting Congressionally authorized purposes. We consider this a viable Operations and Maintenance option and one which should be given full immediate consideration.

We respectfully request your immediate attention. Thank you.

Response 1. State Auditor, State of South Carolina

The economic concerns facing McCormick County, as well as other counties surrounding Clarks Hill Lake, are important considerations in our planning processes. One of the Corps' resource use objectives in the Master Plan is: "To work within applicable National policies and criteria for management and development of Corps water resource projects to investigate and implement alternatives for increasing contributions to the economic base of McCormick, Lincoln and Columbia counties."

The Corps shares the view that local development can help the economy of the county. However, the sale alone of additional Federal acreage will not do the job. The construction of home or industry on that acreage is what actually contributes the most to the tax base.

The Corps' primary purpose is that the Clarks Hill lands be put to their highest and best use for the general public as a whole. It will continue to periodically review and evaluate the land requirements at all of the lakes it manages. If additional lands are identified as nonessential, the Corps will consider other development plans on a case by case basis and recommend appropriate action depending on the situation at the time.



# State of South Carolina

## Office of the Governor

RICHARD W. RILEY  
GOVERNOR

OFFICE OF EXECUTIVE  
POLICY AND PROGRAMS

March 20, 1981

Colonel Tilford C. Creel, District Engineer  
Savannah District Corps of Engineers  
Post Office Box 889  
Savannah, Georgia 31402

Re: Draft Environmental Impact Statement on Operation  
and Maintenance of Clarks Hill Lake

Dear Colonel Creel:

As you know, there has been a great deal of concern on the part of local and state officials regarding the planned cessation of the practice of leasing property to private organizations for recreational purposes. We share this concern.

The elimination of the leasing program will severely restrict recreational use of the lands surrounding the lake, which are already under-utilized in the opinion of some. Although the organizations which lease property are private rather than public, they do pay fair market prices for the privilege. The existing system allows private organizations to fill, in some measure, needs which neither the state nor the federal government can afford to address. We urge you to give greater consideration to the concerns of local residents in your planning.

Thank you for the opportunity to review the draft environmental impact statement. We look forward to receiving a copy of the final statement.

Sincerely,

  
Patricia L. Jerman  
Director

PLJ/ddv

Division of Natural Resources, Post Office Box 11450, Columbia 29211

Rec'd PD MAR 23 1981

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2/27/81

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Response 1. Office of the Governor, State of South Carolina

See previous Response 1.

# South Carolina Department of Health and Environmental Control

March 17, 1981

BOARD  
William M. Wilson, Chairman  
J. Lorin Mason, Jr., M.D., Vice-Chairman  
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COMMISSIONER  
Robert S. Jackson, M.D.  
2600 Bull Street  
Columbia, S. C. 29201

Colonel Tilford C. Creel  
Savannah District, Corps of Engineers  
P.O. Box 889  
Savannah, GA 31402

DE  
DD-C  
OP  
[Handwritten initials and signatures]

RE: Draft Environmental Impact Statement, Operation and Maintenance of Clarks Hill Lake

Dear Colonel Creel:

Thank you for this opportunity to comment on the Draft EIS for Clarks Hill Lake. Overall, the document gives a clear picture of the operation of the Clarks Hill Project and the alternative strategies available for management of the lake. There are, however, areas where clarification is needed and where additional evaluation seems warranted.

1. Water quality issues have not been adequately addressed in the draft EIS. A summary of the results of the National Eutrophication Survey's lake trophic state analysis is given. However, possible management alternatives addressing the long term maintenance of current water quality, which meets class A standards as related to recreation and fish and wildlife propagation, are not discussed. The need for a long term water quality management plan for the lake should be addressed by the Corps. The plan could address problems unique to Clark Hill lake, such as potential nutrient problems, and recommend management strategies and additional standards which could supplement the current State standards. Methods to implement these standards could also be considered. I do not mean to imply that the Corps should be responsible for water quality management, but I do suggest a more thorough discussion of water quality issues.

In several portions of the document, additional information is needed for clarification of certain points. They are as follows:

Section 3.36 - Sewage Disposal Alternatives.

2. This section briefly discusses current disposal practices. It is unclear what project facilities are covered by the practice of removal for disposal in municipal treatment systems. Are all Corps facilities including the power plant, visitors center and offices, campgrounds and picnic areas handled by holding vaults? No mention is made of facilities around the lake, such as State Parks and marinas. Are these facilities handled by holding vaults, septic tanks or treatment plants which discharge to the lake or its tributaries?

Section 4.26 - Air Quality.

3. Reference is made to the "Air Pollution Control Division of the South Carolina Pollution Control Authority." The reference should read "Bureau of Air Quality Control, South Carolina Department of Health and Environmental Control."

Rec'd PD MAR 25 1981

Section 5.36 - Sewage Disposal, Environmental Consequences.

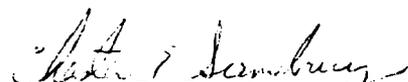
4. This section is somewhat confusing. The first sentence speaks in general terms about a type of project. The remainder of the paragraph seems to be discussing a specific project. The purpose, location and method of operation of this project are not described or discussed.

5. Appendix D. Recreation Areas of Clark Hill Lake. Several terms are used to describe waste handling facilities located at certain facilities: waterborne washhouse; pit toilets; and holding vaults. Is waste from all these types of facilities removed and disposed of in municipal treatment plants? If not, how are they managed? Also, no mention is made of sanitary facilities at commercial marinas. Are pump out facilities provided for boats with on board toilets? If septic tanks are utilized, does the Corps have specific regulations governing their use on leased project lands?

It is hoped that these questions concerning sewage disposal and development of a nutrient policy for Clark Hill Lake can be addressed in the Final Environmental Impact Statement. Again, thank you for the opportunity to comment on this matter.

If you would like to discuss these comments, please contact me at (803) 758-5496.

Sincerely,

  
Chester E. Sansbury, Director  
Environmental Analysis Division

CES/LT/ik

South Carolina Department of Health and Environmental Control  
Responses

1. A water quality study has been started for Clarks Hill. Sampling will be completed in December 1981. Its data will address the concerns of the South Carolina Department of Health and Environmental Control.

2. Paragraph 3.36: The Corps uses various waste disposal methods at Clarks Hill Lake. The powerhouse resource office and large washhouses use septic tank systems that are approved by their respective county health offices. Other campground, rest areas, and ramp restrooms are either pit latrines (approximately 400) or holding vaults (3). The holding vaults are pumped out periodically for sludge removal as are the septic tanks. The pit latrines are filled in with earth and barrels when a facility is removed. State parks, marinas, and private homes use septic tank systems and are also subject to their respective county health regulations. Effluents from any of the Corps facilities have not been found to discharge into the lake, although, the water near effluents is checked periodically for pH, temperature, DO, fecal coliforms, etc. The facility below the dam (near powerhouse) is monitored monthly for discharge and water samples are analyzed. It is not known whether effluents from non-Corps facilities on Clarks Hill Lake are monitored or not.

3. This change has been made.

4. This change has been made to reduce the confusion.

5. Appendix D: In reference to the terms used, waterborne structures (comfort stations, washhouses, etc.) use water for plumbing. A pit toilet is a deep earthen hole with no enclosing structure. A folding vault is a deep earthen lake lined with steel or concrete. Sludge is periodically pumped from the holding vaults and septic tanks and taken to treatment plants. Regarding other types of disposal, the Fort Gordon Recreation area marina (Columbia County, Georgia) is the only facility on Clarks Hill Lake with pump-out ability. As mentioned earlier, other marinas use county-approved septic tank systems. The Corps has no specific regulations regarding sewage disposal on leased lands. The counties are responsible for waste disposal on these leased lands.

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UNIVERSITY OF SOUTH CAROLINA

COLUMBIA, S. C. 29208

DE

INSTITUTE OF ARCHEOLOGY AND ANTHROPOLOGY

March 27, 1981

(803) 777-8170

Colonel Tilford C. Creel  
Department of the Army  
Corps of Engineers  
P. O. Box 889  
Savannah, GA 31402

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DDC

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PDE  
Bolin

Dear Colonel Creel:

File: CL OAM  
EIS

I am pleased to have an opportunity to comment on the Draft Environmental Impact Statement for "Operation & Maintenance of Clarks Hill Lake, Savannah River, Georgia & South Carolina." My comments, of course, will be directed only to the archeological and cultural resources statements of the draft.

Clarks Hill - OAM EIS

1. I certainly commend you for the concern with protecting and conserving the cultural resources as stated in several parts of the draft statement. Concern for the nation's cultural heritage as expressed in the several federal, state, and local laws and regulations can be effectively realized through an active cultural resource program such as the Savannah District intends to develop (page 12, 3.27). The attention to monitoring and preserving sites which are listed as major objectives of the program on pages 45 and 46 (5.24-5.30) is highly desirable. I do have some reservations, however, about conducting the "field level" of the program on "project-by-project basis" (page 45, 5.25).

2. As you know the Institute of Archeology and Anthropology has a long, continuing interest in the archeology of the Savannah River drainage basin. The initial archeology work done in 1948 and cited in compliance (page 36), unfortunately was undertaken prior to the formulation of nearly all of the current applicable legislation that now guides cultural resource assessments and recommendations. I am particularly familiar with this 1948 study since I was a part of the program of the Smithsonian Institution at that time. As I recall we only had one or two thousand dollars for that entire survey. In those times conservation of cultural resources was only beginning to be a reality and it was this river basin survey program that in essence set into motion the concept that we now call Cultural Resource Management. However the absence of a more fully developed concentration of orientation at that time in the near absence of much knowledge concerning the unique attributes of prepottery horizons and mound construction, ceramic sequences and other aspects of the prehistory of the Savannah River Basin influenced the decision to concentrate on only three of the 128 sites identified during the survey. Funds never became available for the Lake Spring site or the Rembert Mounds, even though they had been recommended.

Colonel Tilford Creel  
Page 2  
March 27, 1981

The Smithsonian report of that survey, Dr. Joseph Caldwell's publication on the mound and Carl Miller's report on the Lake Spring site, totaling less than 50 pages, are the only references concerning these archeological resources. The loss to the archeological community has been immeasurable.

3. For these reasons the importance of a continuous and active program cannot be over stressed. Of immediate concern is the vandalism of sites which are now exposed as a result of the low water level in the reservoir. Another concern is the site attrition along the shore line caused by bank erosion and seasonal fluctuations, normal and abnormal, of the lake level. These conditions did not come about by the project-specific activities, but as a total result of the lake being there.

4. I would strongly recommend that a full assessment of the current status of archeological resources in the Clark Hill Reservoir area be undertaken as soon as possible. This would be a part of the Executive Order 11593 requirements that are now codified in the Historic Preservation Act Amendments of 1980. Such an assessment should document the nature and extent of existing records and should include a shoreline survey to evaluate those records and to assess present site conditions. The information acquired from such an assessment would identify critical management and research problem areas. At least three of the research problem areas of major significance include: 1) the rare presence of black lithic raw materials which has been tentatively identified as "devitrified obsidian," 2) a high instance of early archaic occupation sites (for example Palmer, about 9,000 B.P.) and 3) the area's position near the Fall Line, which has significantly affected prehistoric and historic adaptation in this whole upper coastal area.

5. I realize that the cost of a full-scale archeological assessment of the reservoir would be a fairly large expenditure at one time. I hasten to point out, though, that such an expenditure now or in the very near future would result in a much more effective management plan and would be cost effective in the long-run. Such a survey would cost much less at one time than a project-by-project assessment over a long period of time.

I hope these comments have been helpful and I will look forward to seeing the final environmental impact statement when it is completed. Again, thank you for the opportunity to comment.

Sincerely yours,



Robert L. Stephenson  
Director and State Archeologist

RLS:dsw

cc: Mr. Charles Lee  
Mr. James Cobb  
Mr. Elmer Whitten

Response 1-5. State Archeologist, State of South Carolina

The concerns of the South Carolina State Archeologist have been met with changes made to the appropriate portions of the EIS. Unfortunately, funding limitations preclude the comprehensive surveys that might be made. The Corps of Engineers can only continue site-specific surveys as they are needed.

APPENDIX G

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