DRAFT

ENVIRONMENTAL IMPACT STATEMENT

NORTH FULTON COUNTY, GEORGIA

WPC-GA. 189

and

NORTHEAST COBB COUNTY, GEORGIA

WPC-GA. 173

ENVIRONMENTAL PROTECTION AGENCY

REGION IV

1421 PEACHTREE STREET, N. E.

ATLANTA, GEORGIA 30309

July 6, 1973

ENVIRONMENTAL PROTECTION AGENCY

REGION IV

1421 Peachtree St., N.E., Atlanta, Georgia 30309

July 6, 1973

Mr. Paul DeFalco, Jr.
Environmemtal Protection Agency, Region IX
100 California Street
San Francisco, Cal. 94111

Dear Mr. DeFalco:

Enclosed is the draft environmental impact statement on North Fulton County, Georgia, WPC-Ga. 189, and Northeast Cobb County, Georgia, WPC-Ga. 173.

Any comments you may have on this statement should be sent within 30 days of the date of this letter to

Sheppard N. Moore
Chief, EIS Branch
Environmental Protection Agency
Region IV
1421 Peachtree Street, N. E.
Atlanta, Georgia 30309

A public hearing will be held on this draft EIS at the Roswell High School, 1331 Alpharetta Road, Roswell, Georgia on July 21, 1973. The hearing will begin at 10:00 a.m. with registration opening at 9:00 a.m. Those persons wishing to address EPA will be called upon to speak in the order of registration.

Sincerely,

Jack E. Ravan
Regional Administrator

NOTICE OF PUBLIC HEARING

You are hereby notified that a public hearing will be held at 10:00 a.m. on July 21, 1973 at the Roswell High School, 1331 Alpharetta Road, Roswell, Georgia. This will be a public hearing to present and receive comments on the Draft Environmental Impact Statement, North Fulton County, Georgia. The proposed action consists of major expansions to an existing sewerage system. The hearing is being conducted jointly by the

Environmental Protection Division
Georgia Department of Natural Resources
47 Trinity Avenue, S. W.
Atlanta, Georgia 30334

Telephone: 404/656-4713

and

U. S. Environmental Protection Agency
Region IV
1421 Peachtree Street, N. E.
Atlanta, Georgia 30309

Telephone: 404/526-5415

The hearing will be called to order at 10:00 a.m. and will continue until those persons who have registered to speak have been heard. A Registration Desk will be set up at the hearing room and any person who wishes to present a statement shall be required to personally enter his or her name in the registration book provided for that purpose. Persons may begin to register at 9:00 a.m. All persons will be called to speak in the order in which they have registered.

Anyone may present data, make a statement, or offer a viewpoint or argument either orally or in writing. Lengthy statements containing considerable technical or economic data shall be submitted in writing for the official record. Oral statements should be concise to permit everyone an opportunity to be heard. Hearing participants will not be subject to questioning from the audience but may be questioned by the hearing officer for clarification of technical points or to develop better understanding of statements. The hearing will be recorded and transcribed by an official court reporter and the record of the hearing will be included in the final environmental impact statement. Statements, supplements to statements, or briefs, may be submitted within 15 calendar days following the date of the hearing. Such information should be mailed to:

Sheppard N. Moore, Chief
Environmental Impact Statements Staff
U. S. Environmental Protection Agency
1421 Peachtree Street, N. E.
Atlanta, Georgia 30309

The North Fulton County project file is available for inspection by any interested party at the Georgia Department of Natural Resources, Environmental Protection Division offices, Room 609, State Health Building, 47 Trinity Avenue, Atlanta, Georgia.

The draft environmental impact statement shall serve as an outline for discussion. Copies of this draft are also available for inspection at the following locations during office hours:

Environmental Protection Agency
Region IV
1421 Peachtree St., N. E.
Atlanta, Georgia (Phone: 526-5415)

Office of the Clerk to Commission
Mr. Frank Fling
Fulton County Administration Building - Room 407
165 Central Avenue, S. W.
Atlanta, Georgia 30303 (572-2791)

Office of the Director of Public Works
Fulton County Administration Building - Room 300
165 Central Avenue, S. W.
Atlanta, Georgia 30303 (572-2271)

Alpharetta Public Library
15 Academy Street
Alpharetta, Georgia (475-6821)

Sandy Springs Public Library
395 Mt. Vernon Highway
Sandy Springs, Georgia (255-4085)

Smith Memorial Library
973 Alpharetta Road
Roswell, Georgia (993-6511)

To be published July 1, 1973 and July 15, 1973.

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

NORTH FULTON COUNTY, GEORGIA

WPC-Ga. 189

and

NORTHEAST COBB COUNTY, GEORGIA

WPC-Ga. 173

Environmental Protection Agency
Region IV
1421 Peachtree Street, N. E.
Atlanta, Georgia 30309

July 6, 1973

Approved by:

Regional Administrator   July 2, 1973
Date

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

APPENDIX

LIST OF FIGURES

LIST OF TABLES

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

NORTH FULTON COUNTY, GEORGIA

WPC-Ga. 189

and

NORTHEAST COBB COUNTY, GEORGIA

WPC-Ga. 173

INTRODUCTION

This Draft Environmental Impact Statement (EIS) has been prepared pursuant to the National Environmental Policy Act (NEPA) of 1969 which directs the responsible Federal agency to develop EIS's in accordance with guidelines set forth by the President's Council on Environmental Quality (CEQ) on all major actions which have a significant impact on the quality of the human environment.

For purposes of this Environmental Impact Statement, EPA, Region IV, Atlanta, Georgia, is the "Responsible Federal Agency" as required by NEPA.

To insure that the public is kept fully informed regarding this action, and that it participates to the fullest extent in the agency's decision making process, this Draft EIS is being circulated for a 45-day review as required by the CEQ guidelines published in the Federal Register dated May 2, 1973.

In addition, Federal, State and local agencies with collateral interests in, special expertise, or jurisdiction by law, are being solicited for formal comment to aid EPA in its decision making.

This EIS is based on currently available data and information and does not dictate the ultimate solution to water quality management for the area. Pollution abatement and precaution is an ongoing endeavor where State and local government have prime responsibility.

However, irrespective of prevailing statutory and regulatory actions and imposition on treatment and disposal of municipal wastewater, NEPA mandates a full disclosure of all reasonable alternatives and their suspected, anticipated, and otherwise identifiable environmental impacts. Necessarily, alternative actions which may mitigate adverse primary or secondary impacts discussed in this EIS may fall outside the implicit regulatory and enforcement authority of the EPA.

EPA, Region IV, published on December 14, 1972, a Negative Declaration and Environmental Appraisal on the Big Creek Water Pollution Control Facility which is a part of the sewerage system for which funds will be available pending compliance with NEPA. This action has allowed the applicant to proceed with construction of that facility to meet a pressing water pollution abatement need.

This Impact Statement addresses a proposed plan for providing collection and treatment of domestic sewage in parts of north Fulton County and northeast Cobb County, Georgia and possible alternatives to that plan. The main question is this: Given the fact that north Fulton County and northeast Cobb County are going to develop residentially and commercially, what is the best method for collecting and treating domestic sewage? Although the secondary effects of development are discussed, EPA does not have the authority to limit land development or dictate the type of land development. The discussion of secondary effects (primarily storm runoff) is presented so that State and local government can make plans for minimizing the future environmental impacts of urban development.

This Environmental Impact Statement covers projects which are proposed for (1) additional sewering of the approximate middle third of the 87,000 acres of north Fulton County, (2) a contiguous area of 10,900 acres in Cobb County, and (3) sewers for areas south of the Chattahoochee River (north

Fulton County being north of the river), including approximately 2,800 acres in the River Ridge area and approximately 1,700 acres in DeKalb County.

These projects which include interceptor sewers, pump stations, and force mains, are components of a plan by Fulton County to sewer all of north Fulton County, contiguous areas, and the River Ridge area. Also included are two interceptors to be constructed by Cobb County.

The sewerage facilities discussed in this statement either have been awarded grant funds under WPC-Ga. 189, Fulton County, WPC-Ga. 173, Cobb County, or are proposed for future funding. Authorization by EPA to proceed with construction of the sewerage projects will not be made until a minimum of 30 days has elapsed from the log date of filing of the Final EIS with the President's Council on Environmental Quality. Grant funds released thereupon will be applied to the projects as approved and/or modified in the Final EIS.

CHAPTER I

SUMMARY

(X) DRAFT ENVIRONMENTAL IMPACT STATEMENT

( ) FINAL ENVIRONMENTAL IMPACT STATEMENT

Environmental Protection Agency, Region IV, Atlanta, Georgia

1. Name of Action

Administrative Action (X)

Legislative Action ( )

2. The proposed action consists of expansions to an existing sewerage system. Some of the projects have been awarded a grant under the existing project numbers WPC-Ga.-189, Fulton County, and WPC-Ga.-173, Cobb County; funding of the remaining projects are proposed as future grant applications.

The projects which have been awarded grant funds consist of (1) interceptor sewers and (2) pumping stations and force mains for river crossings. Projects proposed for funding consists of interceptor sewers and expansions to the existing Big Creek sewage treatment plant in north Fulton County.

The present system in north Fulton County consists of interceptor sewers, collection lines and a 1.1 mgd secondary treatment plant utilizing the activated sludge process. A contract has been awarded for construction of an initial 6.0 mgd module to be built as needed.

3. The beneficial effect of the proposed action is the protection of public health and welfare. Sanitary sewage will be treated by modern wastewater collection and treatment techniques prior to discharge to the Chattahoochee River, which is used for public water supply and extensive water-based recreation. The sewerage program will help protect the high water quality of the Chattahoochee River, upstream of Atlanta, Georgia that would be affected by wastewater discharges from the project area. This will (1) protect the river's aesthetic and recreational values; (2) help it to meet its present classification of "drinking water supply," upstream of Atlanta; (3) protect the water quality of the tributaries to the river so that the standards for the classification of "fish and wildlife" may be met [the 1972 Amendments of the Federal Water Pollution Control Act (FWPCA) require a minimum stream classification of "fish and wildlife"]; and (4) prevent further degradation of the Chattahoochee River below Atlanta due to the potential sewage flow from the north Fulton County and Cobb County area.

The primary adverse consequence of the proposed action is the stimulation of the "secondary effects" caused by urban development. The effects are: (1) urban runoff and stream pollution, (2) soil erosion and sedimentation, and (3) reduction of the aesthetic values of the Chattahoochee River corridor. The effects of development on water quality are only poorly understood. However, modeling efforts in this EIS show that degradation will occur and that the slug effect of runoff from man-made impervious surfaces could cause a temporary violation of water quality standards in the Chattahoochee River and adjacent streams.

Other adverse effects which will result are those related to actual construction of the facilities. These include removal of vegetation, short-term erosion and siltation, noise, dust, and inconvenience to some area residents.

It should be understood that the areas covered by these projects are going to develop with or without a regional sewer system unless State or local governments implement stricter land use controls and constraints. Numerous examples both within Georgia and elsewhere in EPA, Region IV indicate that similar urban areas have developed without a regional sewer system through the use of septic tanks, lagoons, and small factory-made sewage treatment plants. The funded projects will eliminate the use and need of lagoons, package plants and septic tanks in the affected areas.

4. Alternatives considered are:

Alternative No. 1 - No Action

Alternative No. 2 - Projects as Proposed

Alternative No. 3 - A Sewage Treatment Plant for Alpharetta

Alternative No. 4 - A Sewer Design for 1990 Versus a Design for the Ultimate Population

5. The following U. S. Senators and U. S. Representatives, Federal, State and local agencies, have been requested to comment on this Draft:

U. S. SENATORS

Honorable Herman Talmadge
U. S. Senate
347 Old Senate Office Building
Washington, D. C. 20510

Honorable Sam Nunn
U. S. Senate
3331 Senate Office Building
Washington, D. C. 20510

U. S. REPRESENTATIVES

Mr. Andrew Young
1533 Longworth House Office Building
Washington, D. C. 20515

Mr. John W. Davis
1728 Longworth Office Building
Washington, D. C. 20515

Mr. Ben Blackburn
1024 Longworth House Office Building
Washington, D. C. 20515

STATE AGENCIES

Honorable Jimmy Carter
Governor of the State of Georgia
State Capitol
Atlanta, Georgia 30334

Mr. R. S. Howard, Jr., Director
Environmental Protection Division
Department of Natural Resources
47 Trinity Avenue, S. W.
Atlanta, Georgia 30334

Mr. James T. McIntyre, Jr., Director
Office of Planning & Budget
270 Washington Street, S. W.
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Atlanta, Georgia 30334

FEDERAL AGENCIES

Mr. Charles Bartlett
State Conservationist
Soil Conservation Service
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Athens, Georgia 30601

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Regional Administrator
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Atlanta, Georgia 30323

Mr. Bruce Blanchard
Environmental Project Review
Office of the Secretary
U. S. Department of the Interior
Washington, D. C. 20240

Mr. Herschel Bryant
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900 Peachtree Street, N. E.
Atlanta, Georgia 30309

Mr. Pat Choate, Regional Director
Economic Development Administration
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Atlanta, Georgia 30309

Commander
Seventh Coast Guard District
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51 Southwest First Avenue
Miami, Florida 33130

Mr. Herbert F. DeSimone
Assistant Secretary for Environment and Urban Systems
Department of Transportation
Washington, D. C. 20590

Division Engineer
South Atlantic Division
U. S. Corps of Engineers
Title Building, 30 Pryor St., S. W.
Atlanta, Georgia 30303

Dr. Merlin D. DuVal
Assistant Secretary for
Health and Science Affairs
Department of Health, Education
and Welfare
North Building
Washington, D. C. 20202

Mr. Kenneth E. Grant,
Administrator, Soil Conservation
Service
U. S. Department of Agriculture
Washington, D. C. 20250

Mr. Frank J. Groschelle, Regional
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Education and Welfare
50 7th Street, N. E.
Atlanta, Georgia 30323

Mr. Maurice Kinslow
Regional Director
Food and Drug Administration
60 8th Street, N. E.
Atlanta, Georgia 30309

National Oceanographic and
Atmospheric Administration
6000 Executive Boulevard
Rockville, Mayland 20850

Col. J. B. Newman
Executive Director of Civil Works
Office of the Chief of Engineers
U. S. Corps of Engineers
Washington, D. C. 20314

Mr. T. A. Schlapfer, Regional Forester
U. S. Forest Service
1720 Peachtree Road
Atlanta, Georgia 30309

Colonel Howard L. Strohecker
District Engineer
Savannah District
U. S. Corps of Engineers
P. O. Box 889
Savannah, Georgia 31402

LOCAL AGENCIES

Mr. Harry West, Director
Atlanta Regional Commission
910 Equitable Building
Atlanta, Georgia 30303

Mr. Robert L. Sutton, Jr.
County Engineer
Cobb County Engineering Dept.
P. O. Box 649
Marietta, Georgia 30060

Mr. Bud Cameron
DeKalb Water and Sewer Department
P. O. Box 1087
Decatur, Georgia 30030

Mr. Howard Frandsen
Assistant Director of
Public Works and Chief Engineer
Fulton County
Room 300
Fulton County Administration Bldg.
165 Central Avenue, S. W.
Atlanta, Georgia 30303

6. This Statement was made available to the Council on Environmental Quality and the Public on July 6, 1973.

CHAPTER II

BACKGROUND

A. Projects Covered by This EIS

The subject projects are part of a proposed sewerage system for all of the north Fulton County area which includes (1) all of north Fulton County, (2) the Sandy Springs area, (3) a portion of northwest DeKalb County, and (4) northeast Cobb County. This Environmental Impact Statement covers proposed projects which would be an extension of existing facilities constructed under WPC-Ga. 189, Fulton County, and WPC-Ga. 173, Cobb County, and are in the area tributary to the existing Big Creek Sewage Treatment Plant or in the Sandy Springs area; these areas are shown in Figures 1 and 2.

B. Drainage Basins

The north Fulton County area is divided into two major drainage basins. The northern part of the area drains into the Etowah River, while the southern part drains into the Chattahoochee River Basin. The applicable sub-basins, which are tributaries to the Big Creek Treatment Plant or to Cobb County's Chattahoochee River Treatment Plant, are listed below and shown in Figure 2.

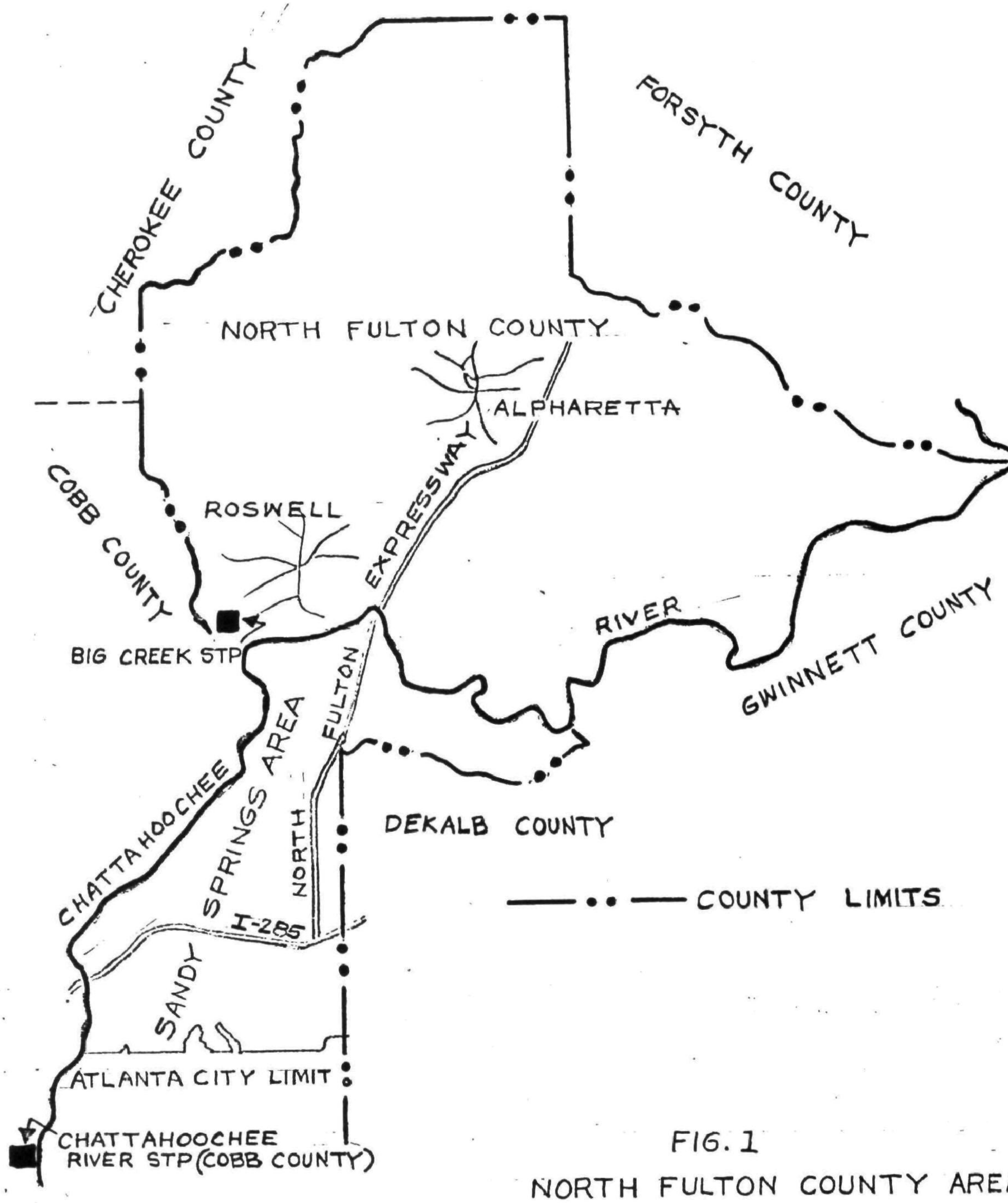

FIG. 1
NORTH FULTON COUNTY AREA

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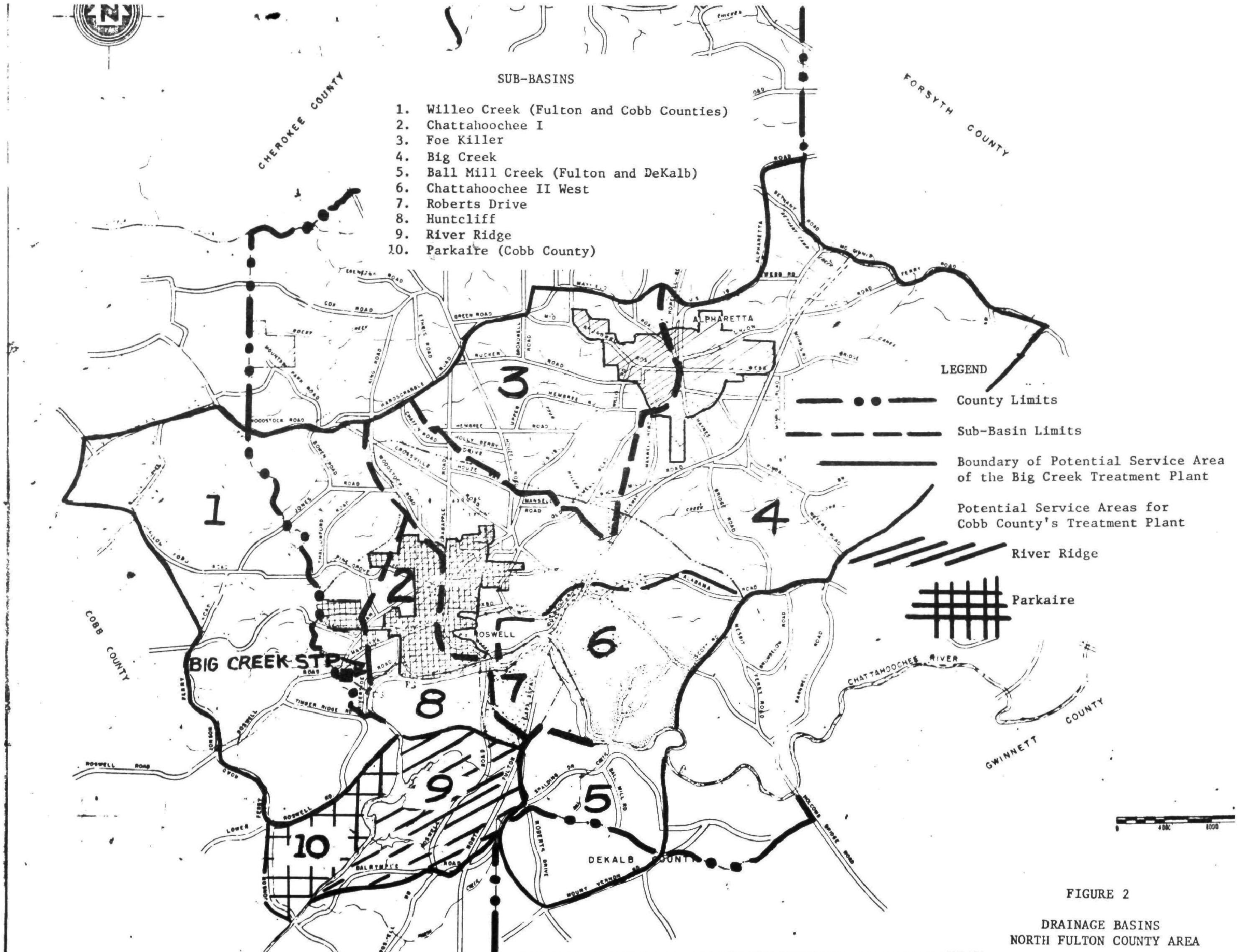


FIGURE 2

DRAINAGE BASINS
NORTH FULTON COUNTY AREA

Big Creek sub-basins	Sandy Springs sub-basin	Parkaire sub-basin (Cobb County)
Willeo Creek (Fulton and Cobb Counties)	River Ridge	
Chattahoochee I		
Foe Killer Creek		
Big Creek		
Chattahoochee II West		
Ball Mill Creek (Fulton and DeKalb Counties)		
Roberts Drive		
Huntcliff		

In addition to their Fulton County acreage, Ball Mill and Willeo Creek sub-basins receive flow from contiguous areas located in Cobb and DeKalb Counties, respectively. Since the natural drainage is through Fulton County, sewage from these contiguous areas was considered in the proposed sewage treatment plan.

There are two incorporated municipalities in the Big Creek sub-basin: Alpharetta and Roswell. The Sandy Springs area is unincorporated.

C. General Description of The Area

Land: Eighty-five to ninety percent of the total area is presently in agricultural and forestry uses. The agricultural land is used for dairy, livestock, poultry, and row crop farming. Some of the timber land is used for pulp wooding with pine as the main species. The forested area along the streams produces a wide variety of hardwood species, i.e. oak, hickory, birch, poplar, etc. Much of the flood-plain area has been in cultivation at some time. The majority of the land is characterized by gently rolling hills with elevations ranging from 800 feet along the river in the River Ridge area to 1,280 feet near the Cherokee County line.

The rainfall is abundant, averaging about 52 inches per year. As a consequence of this rainfall, annual runoff is approximately 16 inches.

The Chattahoochee River: The Chattahoochee River is the dominant water course of the north Fulton area. It has widths of 150 to 200 feet with a river bed width averaging 60 feet. Average flow of the river is 2,500 cfs (cubic feet per second), with a record drought flow of 350 cfs. The water quality in the north Fulton County area is rated high with dissolved oxygen being approximately 7 mg/l (milligrams per liter) and fecal coliform counts rarely exceeding 1000/100 ml (milliliters) at the Atlanta water supply intake.

The river begins in the North Georgia mountains, becomes a main lake (Lake Lanier, formed by Buford Dam) northeast of Fulton County, flows in a southwesterly direction forming the southern boundary of north Fulton County and eventually finds its way into the Gulf of Mexico.

A stretch of the river with considerable aesthetic attraction and high water quality is from Buford Dam downstream for a distance of 48 miles where it enters the Atlanta region and water quality drastically deteriorates. This 48-mile stretch of the river and adjacent land, known as the Chattahoochee River Corridor, is characterized by rapids and lazy waters, sheer cliffs, rock outcrops, and undisturbed forested hills.

Major uses of the river along the corridor are water supply and recreation. The counties of Gwinnett, DeKalb, Cobb and Fulton (Fulton County acquires water from Atlanta) and the City of Atlanta obtain raw water from the Chattahoochee within the corridor.

D. Existing Water Supply and Sewerage Facilities

Water Supply Facilities: There are three sources of water for the homes in the north Fulton County area: the north Fulton County water system, the Roswell water system, and private wells. The north Fulton County system consists of approximately eighty-five miles of water main. Water for this system, which is distributed throughout the County, is purchased by Fulton County from the city of Atlanta. Atlanta owns and operates its treatment facilities and draws water from the Chattahoochee River. The Roswell water system consists of a treatment plant, which receives water from Big Creek, and a distribution system which serves the city of Roswell and a portion of the county in the Roswell vicinity. The north Fulton County and the Roswell systems provide a basis to serve approximately eighty-five percent (85%) of the County. Homes in the unincorporated areas not using either of the two systems described above rely on individual or small group wells.

The City of Alpharetta has a water distribution system while purchasing its water requirements from Fulton County.

Roswell's Water Supply: Roswell treats approximately 700,000 gpd (gallons per day) of raw water while purchasing approximately 100,000--200,000 gpd from Fulton County. Recommendations from the consultant for Roswell for meeting future needs include: (1) increasing the capacity of its present water treatment plant, (2) constructing a new plant, (3) buying water from Fulton or Cobb County, (4) formation of a joint authority which would include representatives from Roswell, Alpharetta, and unincorporated areas of Fulton County. These recommendations could result in continued use of Big Creek or use of the Chattahoochee River as a source of raw water. Sewage treatment plant locations upstream of Roswell's present water supply intake could have some effect on this water supply resulting in a need for a high degree of sewage treatment. This effect will not occur if Roswell decides to draw its water from the Chattahoochee River above the mouth of Big Creek.

Sewerage Facilities: The existing sewerage facilities are shown in Figure 4. The Big Creek interceptor sewer, which discharges into the Big Creek water pollution control plant, runs along the Chattahoochee River to Big Creek, and then along Big Creek north of Holcomb Bridge Road. The two pumping stations located at the end of the Big Creek interceptor sewer lift the sewage into the treatment plant. A trunk sewer extends north up Hog Wallow Creek on the east side of Roswell.

An additional trunk sewer extends from the Big Creek sewer running in an easterly direction, parallel to the Chattahoochee River serving the Martin's Landing area and homes along Riverside Drive. The Roberts Drive interceptor is located on the south side of the river, extending from the North Fulton Expressway to Roswell Road, the point at which the sewage is pumped to the sewer on the north side of the river.

Roswell has completed Phase I of its collection system which serves basically the east side of the city via the existing 24-inch interceptor sewer which extends from the existing Big Creek Treatment Plant along the river, up Big Creek to Holcomb Bridge Road. Construction of Phase II, to service the west side of Roswell has been planned.

The existing 1.1 mgd (million gallons per day) activated sludge Big Creek Treatment Plant is the only major treatment facility in the north Fulton County area. The plant site consists of approximately 40 acres bounded on the north by Roswell-Marietta Road and on the west by Willeo Creek. The property is densely wooded around its perimeter and intermittently throughout largely by mature pine trees. The existing and proposed water pollution control plant site is, for the most part, in the low, flat, cleared land abutting the creek. The nearest proposed structure to the Roswell-Marietta Road site is at a distance of 600 feet, and blocked from view from the road by trees and hills.

Willeo Creek, into which the existing sewage treatment plant effluent discharges, flows perennially to the Chattahoochee River. It varies in width from 15 to 40 feet with clay bottom and meanders through a low, scrubby swamp area for about a mile, where it meets Little Willeo Creek and Willeo Road, and continues a few hundred feet to the Chattahoochee River.

The Environmental Protection Agency has approved a grant, plans, and specifications for an addition to the existing Big Creek Treatment Plant. The addition, for which a negative declaration was written and a contract awarded, will increase the capacity of the plant by 6.0 mgd. The plant will utilize the activated sludge process and will include, (1) an outfall line direct to the Chattahoochee River, (2) a diffuser at the end of the outfall line, and (3) dual chlorination facilities.

Incident to this expansion will be the modification of a lift station at Willeo Road and the Chattahoochee River to increase the peaking capacity of the existing main trunk sewer entering the plant at 8 mgd. This will not require additional pipe capacity.

Upon completion of the 6 mgd expansion, the existing 1.1 mgd plant and 6 mgd expansion will operate as two facilities.

If the effluent from the existing and proposed treatment plant is discharged to Willeo Creek, there would be a real possibility of nutrient buildup in the lower reaches of the Creek. Consequently the effluent will be combined for chlorination and discharged through the outfall line and a diffuser to the Chattahoochee River, a distance of approximately 5,000 feet.

Sludge from the combined 7.1 mgd treatment facility will be dried in sludge drying beds and disposed of at the county sanitary landfill.

E. Activities of Federal, State, and Local Government Agencies

The uses of the Chattahoochee River are many, ranging from recreational to commercial. It serves as a source of freshwater supply for numerous communities, the greatest user being the Atlanta metropolitan area. Above this area the River is used for recreational purposes as well as a source of drinking water. Immediately below this area the water quality is degraded as it receives sewage, storm water runoff, and industrial pollutants, and carries these downstream. However, farther downriver the use once again is raw water supply for the city of LaGrange.

During the Enforcement Conference on the Chattahoochee, the charge was established that one entity will not have to pay the environmental costs incurred by another, the emphasis being on point sources of pollution such as sewerage treatment plants and industrial discharges.

In conformity with the principles set forth at the Enforcement Conference, north Fulton County must do its share in maintaining the quality of the Chattahoochee River as the area urbanizes. Activities at various levels of government are briefly discussed in the following pages to bring attention to those actions designed to protect the quality of the

Chattahoochee River and adjacent land in the North Fulton County area.

Atlanta Regional Commission (ARC). Section 2 of Act 5, Georgia Laws 1971, created the Atlanta Regional Commission (ARC) to provide policy direction for the solution of common problems through short-and long-range comprehensive planning. In planning for the Atlanta area, ARC has made a study of the Chattahoochee River Corrider and published the results in a report entitled the Chattahoochee Corridor Study. The report includes a comprehensive land use plan with development standards and recommended acquisition of public lands.

The basic objective of the plan is to minimize the adverse impact of urban development on the Chattahoochee Corridor by reducing the potential for urban runoff, erosion, and siltation. The plan recommends public purchase of approximately 6,000 acres of park land and open space. The sites range from islands of less than one acre to a major park containing almost 2,200 acres and stretching six miles along the Chattahoochee in Gwinnett and Forsyth Counties.

The development standards are divided into two areas: countywide recommendations and recommendations for the river corridor which pertain to the land within 2,000 feet on either side of the river. The countywide recommendations for soil erosion, sediment control, and land development plans are given because some pollutants from outside the Corridor eventually find their way into the river. Development standards for the Corridor include general standards and standards for river buffer, flood hazard, and voluntary protection zones.

Bureau of Outdoor Recreation (BOR) In April 1972, the Bureau of Outdoor Recreation completed a study and analysis of the Chattahoochee River and adjacent lands beginning at Buford Dam and ending 48 miles downstream. The results were put in a report entitled Chattahoochee Recreation Study Area. The report presents a concept plan with two objectives: provision for public outdoor recreation use of the river and protection of the unique values and quality of the river environment. A land use plan along the Chattahoochee River Corridor with recommendations for acquisition, development, and implementation is included in the report.

The land use plan provides needed public parks, recreation, and open spaces to balance urban development and population growth. During the past five years, Metropolitan Atlanta has grown and changed substantially. From 1961 to 1967, about 90 square miles of vacant and rural land were developed for various urban purposes.

Table I (below) shows trends in land use for the five-county metropolitan region.

TABLE I

LAND-USE CHANGES 1/

FIVE COUNTY METRO AREA

Land Use	Square Miles 1961	1967	1968
Rural or vacant	1,424	1,288	892
Residential	147	244	467
Industrial	23	30	56
Other--Urban	130	162	309

1/ Atlanta Regional Metropolitan Planning Commission, 1970

Change in land use has started in the Chattahoochee Corridor. Riverbank land use is shown in Table II (below) for the 48 miles on each bank.

TABLE II

Use	Miles	Percent of Total
Open Space	75.59	78
Residential	9.20	9
Apartment	.01	1/
Commerical	7.98	8
Public	1.67	2
Private--Other	1.74	2
	96.19	2/

1/ Less than one percent
2/ Do not total because of rounding

The shortage of developed recreational lands in the Atlanta metropolitan area in 1969 was nearly 16,000 acres; up from 10,000 acres in 1960 (based on a minimum standard of 18 acres per 1,000 population). The BOR plan provides for open space and recreatonal areas to reduce the recreational lands shortage and provides protection of the unique value and quality of the river environment.

In its initial stages the BOR study was part of a nation-wide program for developing several national parks in or near large urban areas. As such, massive Federal funding or assistance was being considered. The price tag for implementing the recommendations of the Draft Chattahoochee Recreation Study Area is 85 million dollars. However, the BOR has now reversed itself and withdrawn the previous recommendation for Federal funding and turned the plan over to local government for State and local implementation and financing. This action has essentially left the original BOR draft report as simply a "good idea" with little realistic hope for full implementation.

Fulton County Department of Planning. The Fulton County Department of Planning prepared a preliminary Operational Plan (January, 1971) for north Fulton County. North Fulton was divided into three planning areas (shown in Figure 3):

Hopewell, State Bridge, and Holcomb. A summary of the *Operational Plan* is given below and in Table III. Statistics within the corporate limits of Roswell and Alpharetta were excluded.

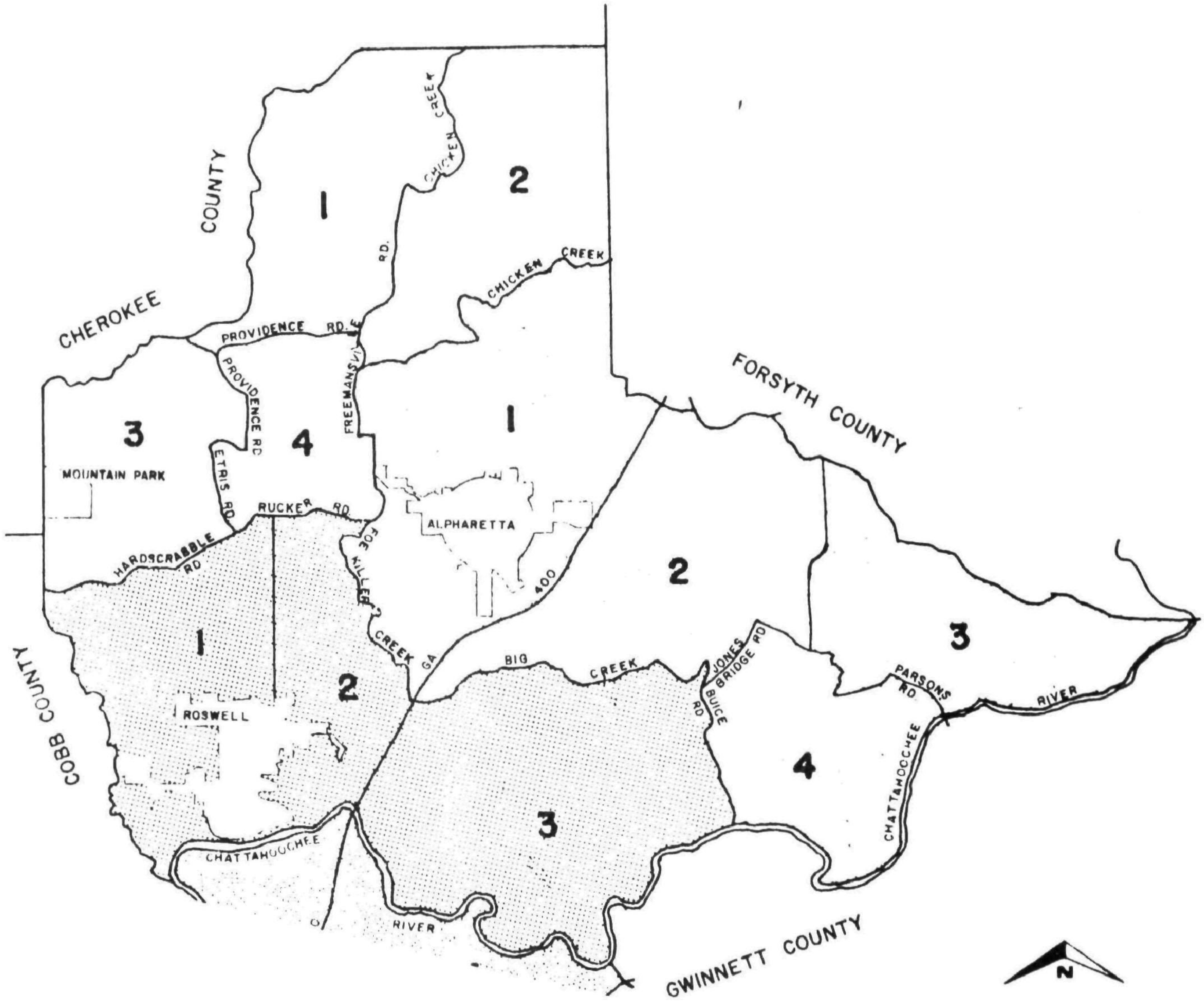
Hopewell: Contains only four percent of the unincorporated population of north Fulton County. All the residential units are single family. The Hopewell planning area is designated as the "secondary development area" of north Fulton, where development will be characterized as low density of a rural nature with 0--1.0 units per acre.

State Bridge: Three percent of the land area has been designated "diversified activities" in the *Operational Plan*. This land lies on either side of the North Fulton Expressway and is for use of apartments, shopping centers, etc. The 1970 population of this area was 246 percent greater than the 1960 population, while Alpharetta's population approximately doubled from 1,349 to 2,455. The Alpharetta growth was probably due to annexation, 700 acres have been annexed since 1965. At present (January 1971) there are no multiple family homes outside the city limits. In the future, approximately 50 percent of the construction will be for multiple family units.

Holcomb: Only one percent of this area had been rezoned from AG-1 up to 1960. By September 1970, this figure had increased to 9 percent; one-half of this increase is due to zoning for the Martin's Landing area. All apartment zoning has occurred since January 1970; this being in the Roswell community. In the future, 50 percent of the construction will be for multiple family units. The operational plan for the Holcomb area proposes the use of 1,500 acres for a Chattahoochee River front. No intense recreational development was considered. However, the plan expressed that it is hoped the natural scenic beauty of the Chattahoochee may be retained available for public use.

PLANNING AREAS AND COMMUNITIES

NORTHERN FULTON COUNTY, GEORGIA



LEGEND

Planning Area

Hopewell
1 BIRMINGHAM
2 THOMPSON
3 LITTLE RIVER
4 CRABAPPLE

Holcomb
1 GREENWAY
2 ROSWELL
3 NEW TOWN

State Bridge
1 ALPHARETTA
2 OCEE
3 SHAKERAG
4 MEDLOCK

FIG. 3

TABLE III

Summary of Preliminary Operational Plan, January 1971

Fulton County Department of Planning

Planning Area	Present Population	Projected Population	Total Acres	Percent Rezoned From AG-1	Major Land Use (%)			Major Proposed Land Use		
					AG-1	Sing.Fam.	Others	Sing.Fam.	Multi.Fam.	Others
Hopewell[1/]	3,253	1978 3,840 1988 5,750	25,000	- 0 -	95	4		(See discussion on the Hopewell planning area)		
State Bridge[2/]	3,600	1980 12,800 1990 28,000	35,000	1	94	2	2 (Parks & Recreation)	91	- 0 -	5 (Parks, Recreation & Open Space) 3 (Diversified Activities)
Holcomb	5,000	1980 30,000 1990 62,000	23,000	9	93	5		86	2	8 (Park, Recreation & Open Space)

1/ Statistical information for the planning area excludes all land within the city of Roswell's corporate limits.

2/ Statistical information for the planning area excludes all land within the city of Alpharetta's corporate limits.

Metropolitan River Protection Act: This Act, passed by the 1973 General Assembly of the State of Georgia, is applicable to the Chattahoochee River corridor (all land within 2,000 feet of the River from Buford Dam to Peachtree Creek). The purpose of the Act is to require special regulations for development within the Corridor for protection of public water supplies. Also, the purpose of the Act is to provide a method whereby certain political subdivisions may utilize the police power of the State in protecting public water supplies and preventing floods and flood damage, to control erosion, siltation, and density of development. A land and water use plan, with regulations, will be prepared by the metropolitan area planning and development commission; for the Atlanta SMSA, this is the ARC.

Pending adoption of the plan as to each political subdivision, it shall be unlawful for any persons to erect, maintain, deposit, clear or excavate, so as to adversely affect the efficiency or capacity of the water-course or floodplain, or increase runoff, erosion or water pollution. After adoption of the plan or any portion thereof, the actions by persons are unlawful if they are inconsistent or incompatible with the plan or any portions thereof.

Exemptions from the Act include the following:

"Any land or water use or project which, on the effective date of this Act, is approved, pending or is completed, actually under construction or which is zoned for such use and where expenditures in excess of $2,500.00 have been made in preparation for construction in accordance with such zoning, provided, however, that the construction of the project is actually commenced within thirty-six (36) months of the effective date of this Act; otherwise, a certificate for the project must be obtained pursuant to this Act."

F. Population Projections

The population projections for north Fulton County, made by the consultants for Fulton County, were considered excessive by some people. EPA made projections covering the area that would contribute flow to the Big Creek Treatment Plant. The consultants' figures for this area were 181,278 for 1990 and 355,793 for the ultimate population. The estimates by EPA were 152,750 for 1990 and 344,000 for the ultimate population. These figures being relatively close, the consultants' estimates are acceptable.

EPA's population projections were developed in the following manner. In the urban portions, the population projections prepared by consulting firms under contract to Roswell and Alpharetta were used. For the non-urban portion, population projections developed by the Fulton County Department of Planning were used as shown in the Operational Plans, previously discussed in <u>Chapter II, Background</u>. The "ultimate" population numbers are based upon the map development plans for and by north Fulton and Sandy Springs which distributed the non-urban part of North Fulton County as of September 1972 among land uses. The following population densities were used:

3.5 persons/acre - single family 0-1 units/acre

9.0 persons/acre - single family 1-4 units/acre

36.0 persons/acre - multi family

Thus the "ultimate" populations assume a future development along the lines set out in the Operational Plan (for land use) prepared by the Fulton County Department of Planning.

In the River Ridge area, which will contribute flow to the Morgan Falls interceptor on the west side of the Chattahoochee River, EPA's population projection was 19,000 for year 1990 and 20,000 for the ultimate projection. The consultants' projection for the ultimate population was based on approximately 22 people per acre resulting in a population of 59,730. Before a final sewer design is approved, the differences in the population projection for the River Ridge area will have to be reconciled.

CHAPTER III

ALTERNATIVES

General

Any alternative for meeting the sewer service needs of the areas under consideration must take into account the following objectives as far as sewerage facilities are applicable: (1) preventing violation of water quality standards and (2) protection of public health and welfare.

The objective of minimizing "secondary effects" which accompany the population growth of an area--due to the desire of people to live in that area, relatively constrained development, lack of land use planning, and construction of roads, water supply and sewerage facilities--is a function of local government.

Present Constraints to Alternatives

Sewage Treatment: The present system of water quality standards does not address phosphates, nitrates, viruses, heavy metals, pesticides, and synthetic materials. In the past several years nutrients have been recognized as a pollutant contributing to the potential eutrophication of a body of water. Considering the former, it is recognized by the State of Georgia and the Environmental Protection Agency that nutrients are a potential problem in large impoundments on the Chattahoochee River. A case in point is depicted in a recently published joint EPA-State study on the Jackson Lake of South River, which revealed that the impoundment at Lake Jackson is in a state of eutrophication due primarily to sewage and combined sewage-storm water overflow from the Atlanta metro area into the South River Basin.

A mathematical model of the Chattahoochee River is being developed jointly by the State, EPA, and outside consultants. This is a tool which can be used to predict the effects on water quality from future projected wastewater sources being discharged to a river. With this tool a decision on the type and degree of treatment necessary to meet future established water quality standards can be made.

There are dozens of advanced waste treatment techniques, processes, and combinations thereof. Almost all of them follow some conventional secondary process primarily because the conventional treatment process has been historically proven effective in the efficient removal of the first 85-90 percent of the pollutants (solids, BOD, COD, coliform bacteria). It is important to note that with removal of solids comes elimination of some degree of nutrients, heavy metals, pesticides, and synthetic materials which, if present in the sewage, are absorbed, adsorbed, or otherwise adhered to solids or are themselves solid material.

The difficulty in sewage treatment beyond the secondary level is the removal of the remaining BOD, SS, coliform bacteria, nutrients, and other pollutants in solution and the high costs associated with it. The widely acclaimed Lake Tahoe tertiary facility is simply one type of advanced waste treatment designed for a 99 plus percent removal of BOD, SS, coliform bacteria, and phosphates (nitrates were removed on a pilot basis--not continuous). Capital cost of the complete treatment facility (exclusive of collectors, outfall, and interceptor sewers) was 210 percent greater than the conventional activated sludge process (which was the first phase of the Tahoe Facility) and 239 percent greater than the conventional activated sludge facility for operation and maintenance.

Treatment Systems

The systems available for sewage treatment are septic tanks, small collection and treatment systems, and a large collection and treatment system. The use of septic tanks eliminates the need for a collection system; however, they do not offer sufficient protection of public health in an urban or suburban situation. Individual family units malfunction resulting in pollution potential. Septic tanks are not considered suitable for multi-family units or commercial developments.

Alternative No. 1 - No Action

Treatment Facilities: Table IV gives the estimated sewage flow to the Big Creek Treatment Plant by 1980. The existing capacity of the plant is 1.1 mgd. The contract award has been approved for construction of a 6.0 mgd addition to the plant. With the estimates shown in the table, the Big Creek Treatment Plant capacity of 7.1 mgd (the sum of 6.0 mgd and 1.1 mgd) will slightly exceed the estimated 1980 flow. On this basis, treatment capacity for all of the tributary areas is adequate through 1980. The secondary activated sludge process used at the treatment plant can produce an effluent which, when discharged to the river, will not violate the "drinking water" classification of the Chattahoochee River.

Sewer Lines; The capacities of the existing sewer lines carrying sewage into the Big Creek Treatment Plant are inadequate for the 1980 population projections. To do nothing would result in the continued use of (a) existing septic tanks, (b) oxidation ponds by Alpharetta, and (c) existing sewer lines; also, additional units of septic tanks and small sewage treatment plants will be constructed as the population increases to serve subdivisions, apartment complexes and shopping centers.

The sub-basins in this Statement, excluding River Ridge, had a 1970 population of 25,230; the 1980 and 1990 projections, made

TABLE IV

Big Creek WPCP 1980 Service*

Area	Acres	Density People/Acre	Estimated Population Served	Estimated Waste Water mgd
Roswell	1,000	5	5,000	0.5
Roberts Drive	600	10	6,000	0.6
N. Fulton - Holcomb Br.	2,000	10	20,000	2.0
Ball Mill (DeKalb)	1,655	6	10,000	1.0
Ball Mill (Fulton)	2,000	3	6,000	0.6
Martin Landing	1,400	3	4,200	0.4
N. Fulton Expressway Strip	2,000	5	10,000	1.0
Alpharetta	500	4	2,000	0.2
1/2 of Remainder of Basin	12,055	0.5	6,000	0.6
Total	23,210	Avg.-3.0	69,200	6.9

*Assuming expansion of sewer system to serve areas in DeKalb, Cobb and additional areas in Fulton.

by EPA, are 78,350 and 152,750 respectively. As these population projections are approached, treatment by septic tanks and package plants will result in endangerment of public health and reduction of water quality below the established standards for the Chattahoochee River, along the corridor and its tributaries. Odors from these facilities, including oxidation pond, will reduce the quality of the environment.

Alternative No. 2 - Projects as Proposed

Construction of the proposed facilities would result in one sewage treatment plant for the area (excluding the River Ridge and Parkaire sewage flow which would go to a Cobb County treatment facility) and construction of interceptors as shown in Figure 4. The interceptor sizing was based on the consulting engineer's projection for the ultimate population. The individual projects are described below.

A. Proposed Projects Which Have Recived Grant Offers Under WPC-Ga-189

Morgan Falls Pumping Station (PS) and Force Main (FM): These facilities, which are located downstream of Morgan Falls Dam, will facilitate pumping sewage contributed by the Sullivan's Creek and Pitts Road interceptors from the east bank to the west bank of the Chattahoochee. The flow will be discharged to the Morgan

Falls interceptor. The original proposal contemplated extending the Sullivan's Creek interceptor,(previously River Ridge, Phase I and II) downstream, paralleling the river on the east side. The sewage would be transported to the Marsh Creek interceptor at Marsh Creek and then into the Marsh Creek pumping station and pumped across the river into interceptor sewers for transport to Cobb County's Chattahoochee River Sewage Treatment Plant.

Opposition to the construction on the east side arose because of the resulting appreciable reduction of the aesthetic and environmental values of the east bank of the Chattahoochee. The east bank between Morgan Falls Dam and Marsh Creek is characterized by a narrow flood plain, and in some areas, rock cliffs that rise 40 to 50 feet vertically from the river's edge. Consequently, construction of a large interceptor sewer would be quite destructive to the natural terrain unless extensive tunneling were employed during construction. The terrain of the west bank of the river in this area (Cobb County side) is more suitable for sewer construction since there is a wide flood plain with only limited vegetation. This area is discussed in more detail under the project description for the Morgan Falls Interceptor.

Sullivan's Creek Interceptor (formerly River Ridge Phase I and II): This project consists of an interceptor extending from

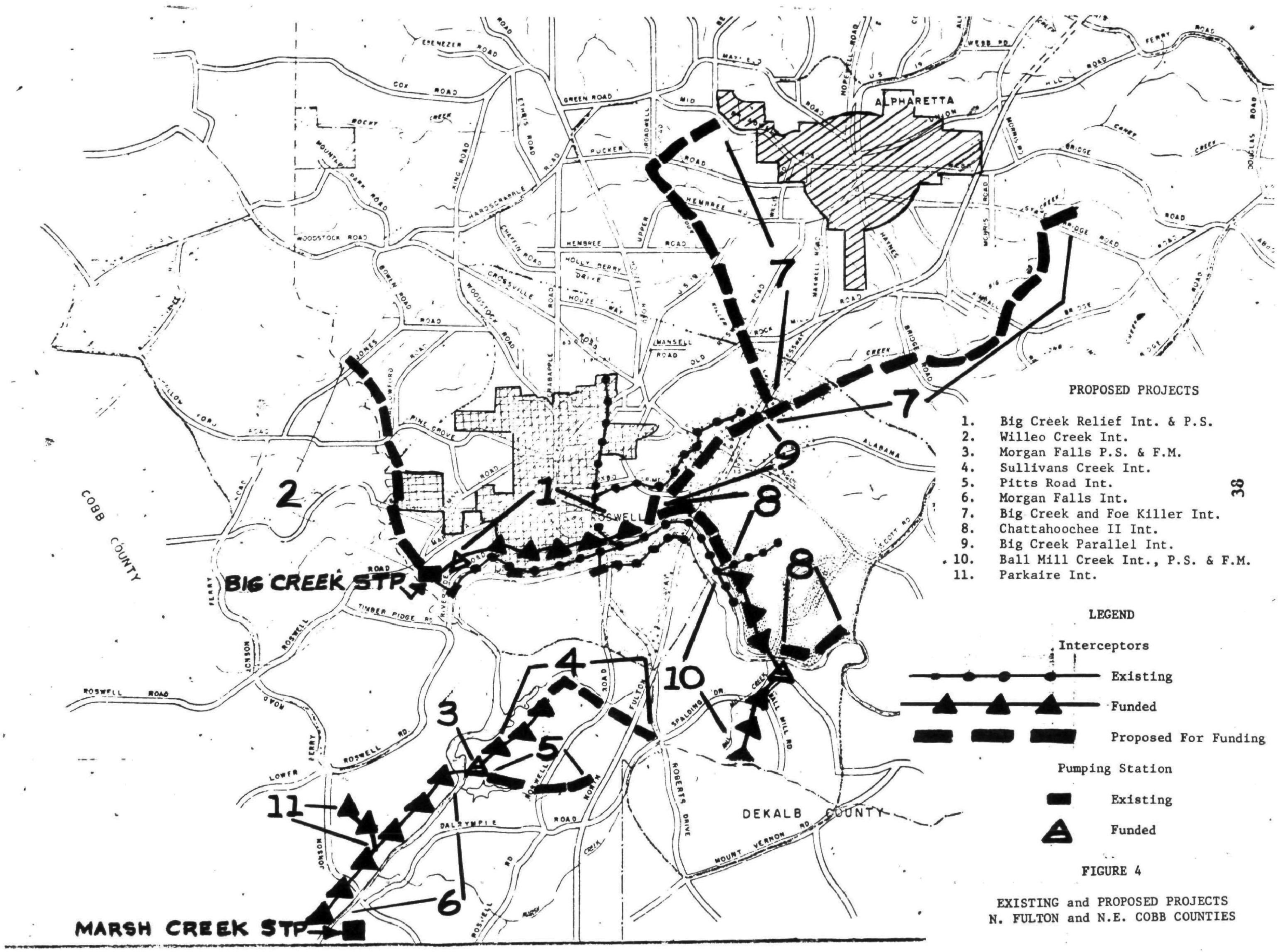


FIGURE 4

EXISTING and PROPOSED PROJECTS
N. FULTON and N.E. COBB COUNTIES

the planned pumping station downstream from Morgan Falls Dam, to serve the Sullivan's Creek area of the River Ridge sub-basin. This area is generally bordered on the south by Morgan Falls Road, on the north by Hightower Trail, and on the east and west by Roberts Road and the Chattahoochee River, respectively.

Big Creek Relief Interceptor and Pumping Station: A gravity sewer and pumping station, which will collect and carry all sewage from the Roswell Road-Chattahoochee River intersection to the Big Creek Treatment Plant, will replace three existing pumping stations and sections of sewer, located in the same general area. The originally proposed size of 60 inches has been increased to 72 inches. This increase in capacity will replace the Huntcliff sewer which was proposed for construction on the south side of the river, and would have received flows from the Roberts Drive and Ball Mill drainage areas. This change was made partly because of comments on the environmental assessment statement for construction of sewers on the south side of the river.

Ball Mill Creek Interceptor, Pumping Station, and Force Main: The interceptor begins in the upstream section of Ball Mill Creek, parallels the Creek, and at the Chattahoochee River connects to the pumping station and force main which extends across the

Chattahoochee. On the north side of the river the interceptor parallels Riverside Road, ending at Seven Branch. The section of the interceptor on the north side of the river was originally located on the south side ending at the now existing Roberts Drive interceptor. Acreage along the south side of the river includes a Baptist campground and 200 acres of land termed the "Woodall Tract." A major portion of the tract was on the priority list of the State Heritage Trust Committee for acquisition and presentation by the State of Georgia. Opposition to construction of the interceptor on the south side, expressed at the county public hearing on their environmental assessment statement, prompted the change in sewer line location to the north side of the Chattahoochee River.

B. Projects which have Received Grant Offers Under WPC-GA-173.

Morgan Falls Interceptor: The project consists of an interceptor to be constructed by Cobb County which will serve the subbasins of River Ridge and Parkaire (Cobb County). Fulton County will utilize part of the carrying capacity of the sewer and participate in the costs as applicable. The sewer line will be located on the west side of the river, extending from the Morgan Falls force main to the Sope Creek interceptor. The sewage will be treated at the Chattahoochee River Treatment Plant of Cobb

County. Use of the Morgan Falls interceptor is an alternate to construction of an interceptor on the east side of the Chattahoochee, ending at the existing Marsh Creek Plant which will be abandoned in the future. At this time, the sewage would be pumped across the river to the Sope Creek interceptor. The east side location of the sewer was not chosen because of the existing aesthetic and environmental value of the east bank of the Chattahoochee.

The Morgan Falls Interceptor, which will be constructed on the west side of, and parallel to, the Chattahoochee River, will traverse five archeological sites. Four of these sites are prehistoric villages, parts of which date as early as 2000 B.C.; this information is known from evidence found on the surface. The fifth site is a weir or fish trap for which no known methods exist for obtaining a date of origin. Since all present evidence comes from surface collections and no subsoil tests have been carried out, the entire extent of archeological data potentially endangered is unknown.

In order to avoid further controversy, delay in construction, and to secure the scientific data and recover cultural remains which would otherwise be destroyed, preconstruction exploration of the five aforementioned sites will have to be conducted.

Beyond the archeological considerations, there are those factors of geology, such as sedimentary history and formation of particular levee systems, which have never been given valid, in-depth research that is badly needed in view of continued impact on flood plain areas in North America. Additionally, there exists also the possibility of gathering critical data on ancient climatic changes, present quality of ground water entering the river, and related fields of inquiry.

Costs of the archeological and geological exploration would be approximately $10,000 and $3,000, respectively.

C. Projects Proposed for Future Funding

Big Creek Parallel Interceptor: The project consists of a sewer which is an extension of the Big Creek relief interceptor from the river to Holcomb Bridge Road; it eliminates the need to parallel the existing sewer through the Big Creek gorge.

Big Creek and Foe Killer Interceptors: These interceptors will serve the Big Creek and Foe Killer Basins within Fulton County. The sewers will serve the city of Alpharetta, the eastern half of the city of Roswell, and the development taking place along the North Fulton Expressway.

Willeo Creek Interceptor: An interceptor to serve the Willeo Creek basin which consists of approximately 3,500 acres in Fulton County, and approximately 9,000 acres in Cobb County.

Chattahoochee II Interceptor: This interceptor will be constructed in two sections: Section I and Section II. Section I, as proposed would parallel Riverside Road from the end of the Ball Mill Creek interceptor to junction with the Big Creek parallel interceptor. Section II would extend east from the Ball Mill Creek pump station for a distance of approximately 6,000 feet.

Pitts Road Interceptor: This project is proposed to serve the southern half of the River Ridge sub-basin.

Big Creek Sewage Treatment Plant Expansions: The proposal for expansion of the treatment facilities at the Big Creek Plant includes a second and a third increase in capacity of 6.0 mgd each (the first addition is discussed in the section, Existing Water Supply and Sewerage Facilities). The proposal contemplates use of the activated sludge process and would include microscreens and phophorus removal as needed. An incinerator is planned for treatment of waste activated sludge, with construction being concurrent with the second 6.0 mgd expansion.

TABLE V

ESTIMATED COST

Alternative No. 2 - Projects As Proposed

Contract	Estimated Total Project Cost
WPC-Ga. 189	
Big Creek Relief Sewer and Pump Station	$ 3,924,000
Ball Mill Creek Int., P.S. & F.M.	1,240,000
Morgan Falls P.S. & F. M.	636,000
Sullivan's Creek Int. Sewers	553,000
Total	$ 5,353,000
WPC-Ga. 173	
Parkaire Outfall	$ 85,000
Morgan Falls Int. (Marsh Creek to Parkaire O.F.)	646,000
Morgan Falls Int. (Park Ave. O.F. to Morgan Falls F.M.)	315,000
Total	$ 1,046,000
Proposed for Future Funding	
Big Creek Parallel Int.	$ 949,000
Big Creek & Foe Killer Creek Int.	3,572,000
Willeo Creek Int.	1,301,000
Chattahoochee II West (Sections I & II)	651,000
Pitts Road Int.	635,000
Big Creek STP (Expansion No.s 1 & 2)	12,500,000
Total	$19,608,000

Alternative No. 3 - A Sewage Treatment Plant for Alpharetta

This alternative consists of the existing Big Creek Treatment Plant and a second treatment facility located on Big Creek. The existing plant would serve Roswell and surrounding areas and areas along the corridor. The second treatment plant would serve Alpharetta, Foe Killer Creek sub-basin, and upstream areas of the Big Creek sub-basin.

Many arrangements of plants to serve Alpharetta can be used due to the drainage pattern, as shown in Figure 7, by the creeks which begin in the core area of the city and disperse radially, ending at Foe Killer Creek or Big Creek.

A plant site "A" was originally considered because (1) it could receive flow from Alpharetta without the use of many pumping stations, (2) it could treat flow from the area along the North Fulton Expressway, thus deleting the necessity for construction of package plants in this area, and (3) if a site were chosen relatively close to the core area of Alpharetta septic tanks and package plants would be used in the surrounding areas.

Site "A" was eventually rejected because the Foe Killer sub-basin would be left without sewage facilities and thus would have to be treated at Big Creek. Site "B" was chosen to replace site "A"; thus site ("B") would serve all of the service area of Site "A" and the Foe Killer sub-basin.

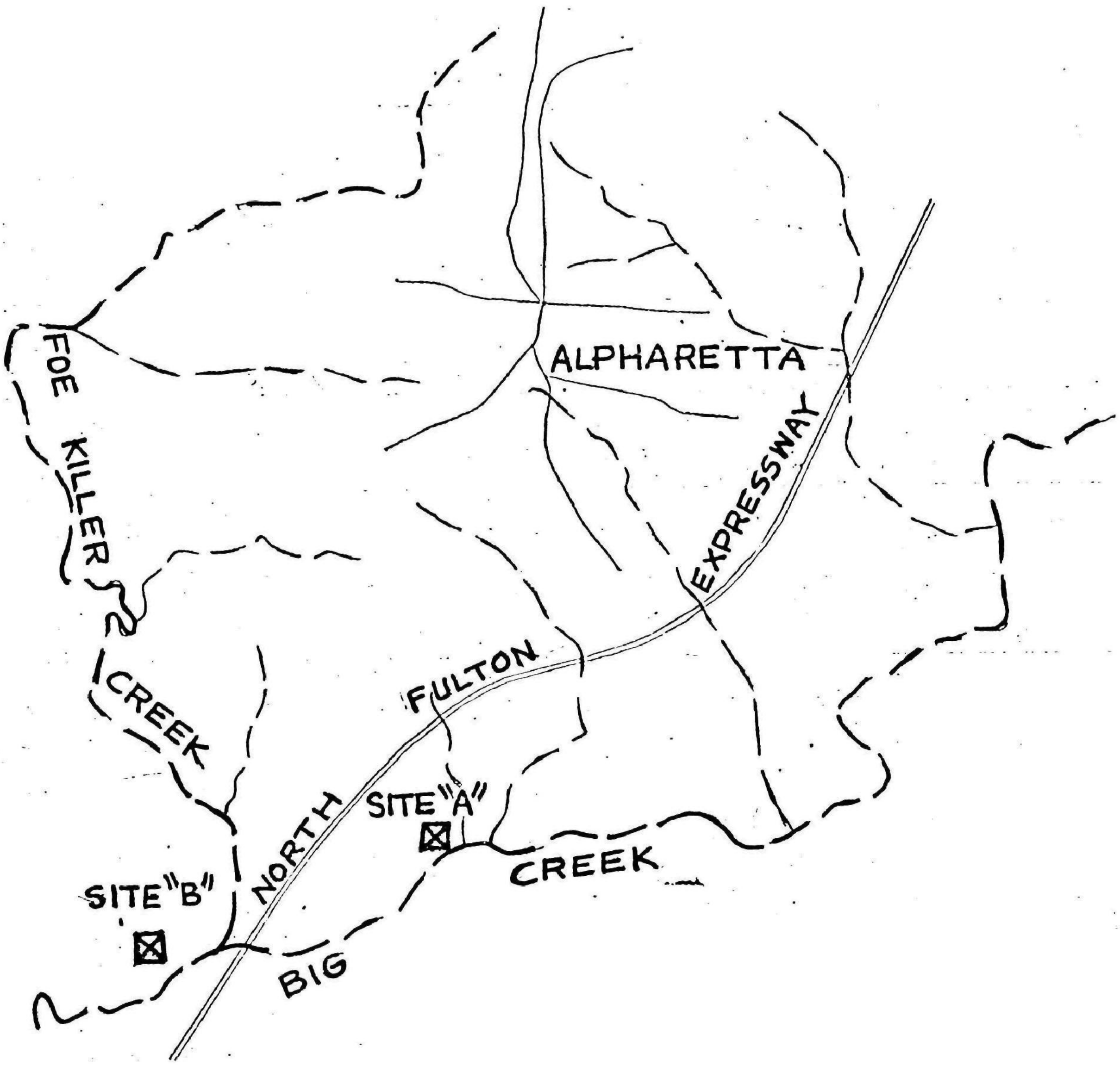


Figure 5
DRAINAGE PATTERN
CORE AREA OF ALPHARETTA

An analysis of the effect of the effluent from a plant on site "A" was conducted before site "B" was chosen; considering the effluent discharge and available stream flow data, advanced waste treatment of the sewage would be necessary in order to meet the standards for a stream classification of "fish and wildlife." Based on the same criteria, advanced waste treatment would also be needed for a plant located on site "B".

Treatment at a plant on site "B" would cost approximately twice the cost of treatment at the Big Creek plant. Also, land acquisition would be required for a new plant, the water supply of Roswell would be compromised, and any forthcoming flexibility in treatment systems would be reduced.

Alternative No. 4 - A Sewer Design for 1990 Versus a Design for the Ultimate Population

This alternative would include the sewerage facilities as proposed with the exception of designing the Big Creek Relief Interceptor for the 1990 population projection and in 1990 constructing an additional interceptor such that the total capacity of the interceptors will be adequate for the ultimate population.

The existing 30-inch line to the plant has a capacity of 6.35 mgd (based on a minimum acceptable velocity of two feet per second). In order to meet the required capacity of the 1990 projection of approximately 182,000 people, a 42-inch diameter pipe will have to be installed. In 1990, an additional pipeline of 54-inch diameter would have to be installed assuming the existing 30-inch line is operable. If this line is not efficiently operable due to deterioration, a 60-inch pipeline will have to be installed--this 60-inch pipe was assumed in making costs comparison.

In making a cost comparison of (1) installing a sewer for 1990 capacity and then adding an additional sewer in 1990 for ultimate capacity, or (2) installing a 72-inch sewer initially; an interest rate of six percent was assumed. The present worth cost of (1) would be $1,659,840.00, the cost of (2) would be $2,122.626.00.

This comparison does not take into account the yearly inflationary escalation in construction costs that has been prevalent during the last few years. Nor does this comparison consider the increased environmental disruption and clearing of additional trees and vegetation which will accompany the construction of a parallel sewer at a later date. Since much of the routing of the Big Creek relief sewer will follow an existing roadway or traverse fields and therefore require only limited clearing, it is recommended that the County follow alternative No. 4 as noted in (1) above at a savings of approximately $462,786.00. This recommendation is subject to reconsideration if a valid economic analysis prior to construction is submitted in favor of a different alternative.

Because of the environmental concerns related to the construction of the other interceptor sewers proposed (clearing, siltation, noise, etc.) and significantly smaller potential savings, the alternative of using parallel sewers (one now and another in 1990) for providing ultimate capacity for the other sewers included in this Impact Statement, is not recommended. However, this alternative will be reconsidered at such time as new grant applications are submitted for the sewers now proposed for future funding.

CHAPTER IV

ENVIRONMENTAL EFFECTS OF THE PROPOSED PROJECTS

I. ADVERSE EFFECTS

A. Construction

The environmental areas affected by construction are listed below.

1. Disruption of traffic.
2. Creation of the by-products of noise and dust.
3. Damage to land from erosion due to exposed soils.
4. Damage to stream banks, streams, and stream beds due to sedimentation and siltation as consequence of exposed soils, excavated material, and stormwater runoff.
5. Removal of trees, vegetation, and other natural resources.

Disruption of traffic, noise, and dust are unavoidable consequences of construction; the only alternative being no action. These consequences are temporary and control measures can be utilized.

The effects of excavation, erosion, stormwater runoff, sedimentation, and siltation can be minimized by the following construction specifications:

The constructor shall use construction techniques to minimize erosion, siltation, and sedimentation. The techniques will include:

- Backfilling of trenches continuously to minimize the length of open ditch and excavated material.
- Removal of excess excavated material to a proper disposal area away from the streams.
- Restoration of disturbed surface areas to their previous condition as soon as practicable.
- Use of temporary measures to prevent loss of topsoil and direct or indirect pollution of the streams and land through soil erosion or sedimentation.

The removal of trees and vegetation along the right-of-way are unavoidable and only vegetation that will allow servicing of the sewers can be regrown. Potential damage to trees, vegetation, and other natural resources can be reduced by the following construction specification:

> The contractor shall keep his operations within those areas bounded by easement and necessary for construction activity. Only those trees and other

natural resources of the site shall be removed as approved in the construction operations.

B. Effects of Sewerage Facilities

Treatment plants and sewers, among other public facilities, undeniably have an effect on the natural and social resources of an area. North Fulton County has the basic water supply system and roads for growth; these facilities will be complimented by the proposed sewer projects to affect the environment in the following areas:

1. Irretrievable use of materials, through construction, and the use of fuel by construction equipment. The major materials are sand, cement, and steel.
2. Foreclosure of options for future land use due to the land used by treatment facilities, with accompanying buffer zones, and sewer line rights-of-way for the length of the sewers.
3. Land use changes will occur through (a) rate of land development, (b) density of development, and (c) conversion of open spaces and aesthetic areas to other uses.
4. Decrease in land and water quality due to erosion, sedimentation, siltation, and urban runoff as consequences of land development facilitated in part by public facilities (water supply, roads, and sewerage facilities).

The intensity of the effects in areas 1 and 2 cannot be avoided. After sound engineering design and economical construction practices have been determined, the only alternative or mitigating measure is "no action". Discussion of areas 3 and 4 . is given in this section under the sub-headings of Land Use Changes, Soil Erosion, and Urban Runoff.

Land Use Changes: Land use changes can have a positive or negative effect on the environmental, social, and economical well-being of the north Fulton County area. Calculation of the amount of change due to sewering is most difficult to make. Even without public sewers, given the premise that sewage must be adequately treated, developers will provide their own treatment facilities. Also, the desirability of the populace to locate in a given area contributes to development. However, an overall increase in development is consistent with sewering and is not a largely problematic phenomenon.

Although sewering affects land use, EPA is not authorized to determine or evaluate land use plans. The criteria of EPA's participation is water quality demands. Mechanisms for controlling land use for the public welfare and private property rights of landowners must be provided by (1) the State of Georgia, (2) Fulton County, and (3) the cities of Roswell and

Alpharetta must provide the necessary land use controls.

Soil Erosion: A recognition of and solution to soil erosion with resulting sedimentation and siltation is necessary in the Fulton County area due to heavy development activity. Sediment deposition in urban areas is as much an environmental blight as badly paved and littered streets. Erosion reduces home and land values as does the resulting sedimentation. Also, sediments fill ditches and clog storm sewers, resulting in varying degrees of flooding.

A paragraph from the ARC Corridor Study, which quantifies soil erosion, is as follows:

> "During construction when the soil is stripped of vegetative cover, erosion presents the greatest problem. Tonnages of sediment from an acre of ground under construction may be 20,000--40,000 times greater than the amount eroded from farmlands over the same period. Sediment yield is also far greater for an urbanized than a non-urbanized basin (200--500 tons per square mile per year on the average."

The suspended and settleable solids in a body of water (rivers, creeks, etc.) transport other pollutants by acting as a mobile substance to which pollutants attach themselves. Settleable solids damage biological structures, bring organisms, and clog respiratory organs. High suspended solids concentrations reduce the transparency of water inhibiting the transmission of light required for photosynthesis and interferes with the predator-prey relationship.

Land erosion, which is most likely to be most severe during urban construction, will occur during more stabilized times. Control measures during any time of land use activity should include soil erosion and sediment control ordinances and regulations, administered by local governments, and field practices during land use changes to check or minimize erosion and to check sedimentation and siltration.

Soil erosion and sedimentation control ordinances and regulations may include the following principles:

- Development should be fitted to topography, soils, and vegetative cover to minimize potential erosion.
- Minimize the time of soil exposure.
- Minimize speed and control flow of downstream water.
- Maximize the preservation of trees and vegetation.

The standards required to realize the principles can vary with location. The counties of Cobb and Gwinnett have adopted ordinances and regulations for erosion control. Similar criteria are also given in the ARC Study.

Field practices for realization of the principles and standards may be catagorized into two types: Mechanical and vegetative. Mechanical practices include: land grading, bench terraces, storm sewers, lined channels, and sediment basins. Vegetative measures include: mulching and permanent cover. During construction, these practices may be designed for temporary use.

One obstacle to protecting the natural and man-made environment from erosion and subsequent phenomena is the generally undefinable political and institutional restraints. Fulton County and the cities of Roswell and Alpharetta must overcome this obstacle.

C. THE EFFECTS OF URBAN RUNOFF IN NORTH FULTON COUNTY

In order to assess the environmental impact of urban development in the North Fulton County area, partially resulting from the EPA funding of interceptor sewer lines, the following detailed runoff project has been developed. Eight drainage basins were defined, and both quantities of contaminants and total amounts of water resulting from street runoff were compared for the existing population and for 1990 population projections developed by EPA.

A definite deterioration of water quality in the Chattahoochee River is projected for the simultaneous critical conditions of:

- minimum water releases from Buford Dam upstream, and
- a localized storm washing off accumulated street contaminants without the benefit of dilution by more widespread runoff.

Based on these projections, a case is made for the development of two impoundments to contain the contaminated "first flush" runoff from frequently occurring small storms for subsequent discharge to secondary treatment facilities. Acreages were determined for the eight drainage basins and the anticipated miles of curb and percent imperviousness were calculated based on population per acre. The regression equations used are:

$$C = 423.7-420.8\ (0.8797)^{P} \quad \text{and} \quad I = 91.32-64.34\ (0.9309)^{P}$$

where C = ft. of curb/acre, I = % imperviousness and P = population/acre.

These equations resulted from analysis by Graham, Costello and Mallon of 32 census tracts (30,000 acres) in the metropolitan Washington area and should be representative of any high density area near a major city.

Contaminants associated with this area come from air pollution fallout, tree leaves, litter, animal droppings, metals from corroding car parts and cans, etc.; petroleum products, building materials and decomposition of surface materials. Most of the deposits wash off during the early stage of a storm and quickly enter streams unless impounded. The URS Research Company recently completed an EPA funded study of 12 major U.S. cities, including Atlanta, to determine contaminant quantities per curb mile and results from that study were used to calculate quantities for the contiguous area.

The amount of contaminants was derived from coefficients of lbs/curb mile of the various parameters measured in the Atlanta portion of the study multiplied by the total number of curb miles projected through the regression equation cited above. A study by Black, Crow and Eidsness, Inc., of Atlanta, Georgia, covering storm and combined sewers provided information on storm events intensity, duration and frequency for the Atlanta area.

The segments to follow discuss alternatives for handling runoff water quality problems and precautions to observe in preparing for increased flooding potential.

Water Quality Effects

Previous studies indicate that:

- 80% of the total buildup of contaminants on street surfaces will be complete within a 24-hour antecedent dry period,

- 90% of contaminant washoff will occur during the first 15 minutes of the storm, and

- dissolved oxygen of the entire runoff will be at saturation or above (D.O.=7.3(+) mg/l).

The Chattahoochee River is expected to be classed as a recreation stream in 1990 with minimal discharges into it; reaeration characteristics are good in the river upstream from this area. At the onset of a storm event it is reasonable to project:

- a low summer flow of 1250 cfs,

- a D.O. level of 7.3(+) mg/l, and

- background BOD_5 of 1.0 mg/l.

The following water quality effects are based on the runoff of the first 15 minutes of a two-hour storm with an intensity of 0.25 inches/hour.

Table 3 shows that for "Case 1 - Effect of Runoff of Each Area Individually on the River" the untreated runoff for Big Creek is the most significant, resulting in a net oxygen demand on the river of 4.4 mg/l. The projected "Net River D.O." values are hypothetical, based on the assumptions that rainfall-runoff only results from a single basin at a time and that the entire runoff and residual river BOD_5 would have to be satisfied by the D.O. carried by the combined runoff and river flow. A negligible oxygen demand on the river is projected if standard secondary treatment (90% BOD_5 removal) were performed.

A somewhat more realistic case is the sequential inflow to the Chattahoochee River of all eight areas grouped as shown in "Case 2" on Table 3. The resulting oxygen demand on the river would be 5.4 mg/l. An identical demand is projected if all runoff were collected by storm sewers and discharged at a single point.

Two impoundments located in the Big Creek and Willeo Creek areas with capacities of 525 and 255 acre-feet would contain 80% of the total runoff from a storm of 0.25 inches for two hours; treatment and discharge could be accomplished over a later period of time. These impoundments would require 25 to 50 acres each and cost approximately $100,000.00 each (based on Gwinnett County cost data for similar construction). The retained runoff could be pumped into the proposed Big Creek plant at slack times thereby incurring only small additional charges. An additional benefit would be the retention of relatively high solids, nutrients and fecal coliform concentrations along with some flood alleviation.

Since approximately 82% of the total Chattahoochee River flow at this time would be from this area (5863 cfs va (5863 + 1250) cfs) the weighted average concentrations of all contaminants must be considered for their significance to the downstream Atlanta water supply. The cadmium concentration of 8 ppb is close to the Public Health limit for drinking water and the lead concentration is about four times the allowable limit. The concentrations of contaminants in the runoff slug and in the river after dilution by the projected low river flow are given in Table 4.

Flooding Effects

The development and increased population density of the total area will cause a 17.3% increase in amount of runoff water in 1990 as compared to 1970. This is caused by previously highly absorbant areas becoming impervious as streets, roofs and paved parking. Individual areas vary from a 3% increase in Willeo Creek to a 68% increase in Huntcliff. Only three areas present possible problems:

- Big Creek (16%),
- Foe Killer (19%), and
- Willeo Creek (3%)..

Big Creek drainage will have to transport not only the Big Creek area runoff but also Foe Killer runoff to the Chattahoochee River, and Table 1B indicates that by 1990 a storm event greater than the two year recurrence interval will possibly increase considerably the elevation of the defined flood plain perimeter as required by the National Flood Insurance Act of 1968. A storm event with a five year recurrence interval or greater in the Willeo Creek area could also create flooding problems because this entire area drains only through the single channel (also called Willeo Creek). The remaining areas appear to offer good direct drainage into the Chattahoochee River. The rainfall records for Fulton County indicate that storms of greater than two hours duration tend to be less intensive than the two hour storm and therefore have no greater flooding potential for this particular area. Impoundments for flood alleviation only could not be economically justified; however, flood control can add some economic justification for the impoundments discussed in the Water Quality Section. New flood plain designations for these three areas should be identified and a complete ban placed on flood plain construction by strong laws. The 100 year return period flood with 1990 runoff characteristics should be used as the reference for planning.

A procedural writeup in the appendix gives a step by step method for calculations along with charts, tables and bibliography.

TABLE 1A - NORMAL STORM

THE MOST FREQUENT TYPE OF ATLANTA AREA STORM HAS A RAINFALL INTENSITY OF .25 INCHES/HOUR AND A DURATION TIME OF 2 HOURS

Comparative Effects 1990 vs 1970	Big Creek	Foe Killer	Willeo Creek	Chatt. 1	Chatt. 2	Hunt-cliff	Roberts Drive	Ball Mill	Total* Area
1. Acres 1970 & 1990	22089	7529	12762	2020	3966	1062	819	3766	54013
2. Population 1970	8100	2600	3590	5400	500	1690	250	3100	25230
Population 1990	49500	20000	7800	31300	13400	16750	4500	9500	152750
Population/acre 1970	.4	.3	.3	2.7	.1	1.6	.3	.8	.5
Population/acre 1990	2.2	2.7	.6	15.5	3.4	15.8	5.5	2.5	2.8
3. Miles of curb 1970	93	30	43	48	7	16	3	32	272
Miles of curb 1990	452	177	84	140	113	74	33	85	1158
4. Impervious ac(90% RO) 70	5252	1782	2982	688	896	313	192	977	13083
Impervious ac(90% RO) 90	7126	2559	3184	1383	1463	732	365	1259	18070
5. Total RO ac-ft 1970	335	114	192	37	59	18	12	59	825
Total RO ac-ft 1990	389	136	198	57	75	30	17	68	969
6. Rate of RO,CFS 1970	2024	688	1160	221	355	108	75	359	4990
Rate of RO,CFS 1990	2352	824	1195	343	454	181	105	409	5863

TABLE 1B - MAJOR STORMS (ATLANTA)

*See Items 1,2,3 & 4 of Table 1A for area conditions.
All storms of 2 hour duration and return period are specified as RP.

Flooding Effects 1990	Big Creek	Foe Killer	Willeo Creek	Chatt. 1	Chatt. 2	Hunt-cliff	Roberts Drive	Ball Mill	Total* Area
RP=2 yrs,intensity 1"/hr									
Total RO Acre-Ft. 1990	1555	545	790	227	300	120	69	270	3876
Rate of RO-CFS 1990	9406	3297	4781	1372	1817	725	419	1635	23452
RP=5 yrs,intensity 1.4"/hr									
Total RO Acre-Ft. 1990	2177	763	1106	318	421	168	97	378	5427
Rate of RO-CFS 1990	13168	4616	6894	1921	2544	1015	587	2289	32832
RP=10yrs,intensity 1.6"/hr									
Total RO Acre-Ft. 1990	2488	872	1264	363	481	192	111	432	6202
Rate of RO-CFS 1990	15049	5276	7650	2195	2907	1159	671	2616	37523
RP=25 yrs,intensity 1.8"/hr									
Total RO Acre-Ft. 1990	2798	981	1423	408	541	216	125	486	6977
Rate of RO-CFS 1990	16931	5935	8606	2470	3271	1304	754	2943	42213
RP=50 yrs,intensity 2"/hr									
Total RO Acre-Ft. 1990	3109	1090	1581	454	601	240	139	540	7753
Rate of RO-CFS 1990	18812	6594	9562	2744	3634	1449	838	3269	46904
RP=100 yrs,intensity 2.2"/hr									
Total RO Acre-Ft. 1990	3420	1199	1739	499	661	264	152	594	8528
Rate of RO-CFS 1990	20693	7254	10519	3018	3998	1594	922	3596	51594
% increase 1990 vs 1970	16	20	3	55	28	68	40	14	17.3

*This is a floating point total.

TABLE 2 - RUNOFF QUALITY
CONTAMINANT QUANTITIES AND CONCENTRATIONS - INITIAL 15 MINUTES
OF A NORMAL STORM EVENT OF .25 INCHES PER HOUR INTENSITY

Contaminant	Big Creek	Foe Killer	Willeo Creek	Chatt. 1	Chatt. 2	Hunt-cliff	Roberts Drive	Ball Mill	Total* Area
BOD5, lbs. 1970	186	60	86	96	15	32	6	64	545
BOD5, lbs. 1990	903	355	167	280	227	148	67	170	2320
BOD5, mg/l 1970	1.47	1.40	1.19	6.92	.65	4.81	1.27	2.86	1.75
BOD5, mg/l 1990	6.15	6.89	2.24	13.10	7.99	13.10	10.20	6.66	6.33
COD, lbs. '70	1227	398	568	631	96	214	39	424	3600
COD, lbs. '90	5962	2340	1104	1850	1500	977	441	1120	15300
COD, mg/l '70	9.71	9.25	7.84	45.70	4.31	31.80	8.37	18.90	11.50
COD, mg/l '90	40.61	45.47	14.80	86.30	52.70	86.40	67.50	44.00	41.80
Tot. Solids, lbs. '70	39973	12950	18502	20600	3120	6970	1270	13800	117000
Tot. Solids, lbs. '90	194207	76235	35968	60200	48700	31800	14400	36500	498000
Tot. Solids, mg/l '70	316	301	256	1490	140	1030	273	616	376
Tot. Solids, mg/l '90	1323	1481	482	2810	1720	2810	2200	1430	1360
Fec. Coli.,cnt(x10^{10}) '70	27.0	8.7	12.5	13.9	2.1	4.7	.9	9.3	79.0
Fec. Coli.,cnt(x10^{10}) '90	131.0	51.4	24.3	40.6	32.8	1.5	9.7	24.6	336.0
Fec. Coli.,cnt/100ml '70	470	448	380	2211	209	1539	406	916	559
Fec. Coli.,cnt/100ml '90	1967	2202	717	4180	2553	4184	3269	2130	2023
Phosphates, lbs. '70	24	8	11	12	2	4	1	8	71
Phosphates, lbs. '90	117	46	22	36	30	19	9	22	301
Phosphates, mg/l '70	.19	.18	.15	.90	.08	.63	.17	.37	.23
Phosphates, mg/l '90	.80	.90	.29	1.70	1.04	1.70	1.33	.87	.82
Kjeldahl Nitrogen, lbs '70	46	15	22	24	4	8	1	16	136
Kjeldahl Nitrogen, lbs '90	226	89	42	70	57	37	17	43	579
Kjeldahl Nitrogen,mg/l '70	.37	.35	.30	1.73	.16	1.20	.32	.72	.44
Kjeldahl Nitrogen,mg/l '90	1.54	1.72	.56	3.27	2.00	3.27	2.56	1.67	1.58
Copper, lbs. '70	6.1	2.0	2.8	3.2	.5	1.1	.2	2.1	18.0
Copper, lbs. '90	29.8	11.7	5.5	9.2	7.5	4.9	2.2	5.6	76.4
Copper, mg/l '70	.05	.05	.04	.23	.02	.16	.04	.09	.06
Copper, mg/l '90	.20	.23	.07	.43	.26	.43	.34	.22	.21
Lead, lbs '70	7.2	2.3	3.3	3.7	.6	1.3	.2	2.5	21.0
Lead, lbs '90	34.8	13.7	6.4	10.8	8.7	5.7	2.6	6.5	89.2
Lead, mg/l '70	.06	.05	.05	.27	.03	.19	.05	.11	.07
Lead, mg/l '90	.24	.27	.09	.50	.31	.50	.39	.26	.24
Mercury, lbs '70	2.1	.69	.99	1.10	.17	.37	.07	.74	6.3
Mercury, lbs '90	10.4	4.08	1.92	3.22	2.61	1.70	.77	1.95	26.60
Mercury, mg/l '70	.017	.016	.014	.080	.007	.055	.015	.033	.020
Mercury, mg/l '90	.071	.079	.026	.150	.092	.151	.118	.077	.073
Cadmium, lbs '70	.29	.09	.13	.15	.02	.05	.01	.10	.85
Cadmium, lbs '90	1.40	.55	.26	.43	.35	.23	.10	.26	3.59
Cadmium, mg/l '70	.002	.002	.002	.011	.001	.007	.002	.004	.003
Cadmium, mg/l '90	.010	.011	.003	.020	.012	.020	.016	.010	.010

*This is a floating point weighted total.

TABLE 2 - CONTINUED
NOTE: UNITS OF CONCENTRATIONS ARE NOT UNIFORM

Contaminant	Big Creek	Foe Killer	Willeo Creek	Chatt. 1	Chatt. 2	Hunt-cliff	Roberts Drive	Ball Mill	Total* Area
Vol. Solids, lbs. 1970	1670	542	775	861	130	292	53	578	4900
Vol. Solids, lbs. 1990	8130	3190	1510	2520	2040	1330	602	1530	20800
Vol. Solids, mg/l 1970	13.2	12.6	10.7	62.3	5.9	43.3	11.4	25.8	15.7
Vol. Solids, mg/l 1990	55.4	62.0	20.2	118.0	71.9	118.0	92.0	60.0	57.0
Tot. Coli.,cnt($x10^{10}$) '70	297	96	138	153	23	52	9	103	872
Tot. Coli.,cnt($x10^{10}$) '90	1450	567	268	448	362	237	107	272	3710
Tot. Coli.,cnt/100 ml '70	5191	4944	4192	24402	2305	16976	4475	10102	6169
Tot. Coli.,cnt/100 ml '90	21703	24303	7907	46122	28176	46163	36069	23498	22324
Nitrates, lbs. '70	2.23	.72	1.03	1.15	.17	.39	.07	.77	6.54
Nitrates, lbs. '90	10.80	4.25	2.01	3.36	2.72	1.78	.80	2.04	27.80
Nitrates, mg/l '70	.018	.017	.014	.083	.008	.058	.015	.034	.021
Nitrates, mg/l '90	.074	.083	.027	.157	.096	.157	.123	.080	.076
Zinc, lbs. '70	10.20	3.31	4.73	5.26	.80	1.78	.33	3.53	30.00
Zinc, lbs. '90	49.70	19.50	9.20	15.40	12.50	8.14	3.68	9.35	127.00
Zinc, mg/l '70	.081	.077	.065	.380	.036	.265	.070	.158	.096
Zinc, mg/l '90	.338	.379	.123	.719	.439	.720	.562	.366	.348
Nickel, lbs. '70	1.95	.63	.90	1.00	.15	.34	.06	.68	5.72
Nickel, lbs. '90	9.48	3.72	1.76	2.94	2.38	1.55	.70	1.78	24.30
Nickel, mg/l '70	.016	.015	.013	.073	.007	.051	.013	.030	.018
Nickel, mg/l '90	.065	.072	.024	.137	.084	.137	.107	.070	.067
Chromium, lbs. '70	1.02	.33	.47	.53	.08	.18	.03	.35	3.00
Chromium, lbs. '90	4.97	1.95	.92	1.54	1.25	.81	.37	.94	12.70
Chromium, mg/l '70	.008	.008	.007	.038	.004	.027	.007	.016	.010
Chromium, mg/l '90	.034	.038	.012	.072	.044	.072	.056	.037	.035
Dieldrin, lbs. '70	.0022	.0007	.0010	.0012	.0002	.0004	.0001	.0008	.0065
Dieldrin, lbs. '90	.0108	.0043	.0020	.0034	.0027	.0018	.0008	.0020	.0278
Dieldrin, ug/l '70	.0177	.0168	.0143	0830	.0078	.0578	.0152	.0344	.0210
Dieldrin, ug/l '90	.0738	.0827	.0269	.1570	.0959	.1570	.1230	.0799	.0759
PCB, lbs. '70	.0060	.0020	.0028	.0031	.0005	.0011	.0002	.0021	.0177
PCB, lbs. '90	.0294	.0115	.0054	.0091	.0074	.0048	.0022	.0055	.0753
PCB, ug/l '70	.0478	.0455	.0386	.2250	.0212	.1560	.0412	.0931	.0568
PCB, ug/l '90	.2000	.2240	.0729	.4250	.2600	.4250	.3320	.2170	.2060
DDD, lbs. '70	.0032	.0010	.0015	.0016	.0002	.0006	.0001	.0011	.0093
DDD, lbs. '90	.0154	.0060	.0028	.0048	.0039	.0025	.0011	.0029	.0394
DDD, ug/l '70	.0250	.0238	.0202	.1180	.0111	.0818	.0216	.0487	.0297
DDD, ug/l '90	.1050	.1170	.0381	.2220	.1360	.2220	.1740	.1130	.1080
P, P-DDT, lbs '70	.0012	.0004	.0006	.0006	.0001	.0002	.00004	.0004	.0035
P, P-DDT, lbs '90	.0059	.0023	.0011	.0018	.0015	.0010	.00044	.0011	.0151
P, P-DDT, ug/l '70	.0096	.0091	.0077	.0450	.0043	.0313	.0083	.0186	.0114
P, P-DDT, ug/l '90	.0400	.0448	.0146	.0850	.0519	.0851	.0665	.0433	.0411

*This is a floating point weighted total.

TABLE 3 - CHATTAHOOCHEE RIVER WATER QUALITY - DISSOLVED OXYGEN 1990

Conditions: (1) Guaranteed low flow 1250 cfs, (2) Background river BOD_5 = 1.0 mg/l & D.O. = 7.3 mg/l, (3) Storm intensity .25 inches/hour - first 15 min runoff effect only.

CASE 1 - Effect of Runoff of Each Area Individually on the River

	Inflow (DO=7.3)		No Treatment of Runoff		Secondary(90%) Treatment of Runoff	
Area	CFS	BOD_5	Comb. BOD_5	Net River D.O.*	Comb. BOD_5	Net River D.O.*
Big Creek	2352	6.15	4.4	Final 2.9	.8	Final 6.5
Foe Killer	824	6.89	3.3	Final 4.0	.9	Final 6.4
Willeo Creek	1195	2.24	1.6	Final 5.7	.6	Final 6.7
Chatt. 1	343	13.10	3.6	Final 3.7	1.1	Final 6.2
Chatt. 2	454	7.99	2.9	Final 4.4	.9	Final 6.4
Huntcliff	181	13.10	2.5	Final 4.8	1.0	Final 6.3
Roberts Dr.	105	10.20	1.7	Final 5.6	1.0	Final 6.3
Ball Mall	409	6.66	2.4	Final 4.9	.9	Final 6.4
CASE 2 - Effect of Runoff by Sequential Injection from Logically Grouped Areas						
1. Ball Mill	409	6.66	2.4	4.9	.9	6.4
2. Chatt. 2	454	7.99	3.6	3.7	.9	6.4
3. Roberts Dr	105	10.20	3.9	3.4	.9	6.4
4. Big Creek & Foe Killer	3176	6.34	5.3	2.0	.7	6.6
5. Huntcliff	181	13.10	5.6	1.7	.8	6.5
6. Chatt. 1 & Willeo Cr.	1538	4.66	5.4	Final 1.9	.7	Final 6.6
CASE 3 - Effect of Runoff from Entire Area Injected at a Single Point						
Total Area	5863	6.33	5.4	Final 1.9	.7	Final 6.6

*Hypothetical, based on assumptions stated in text.

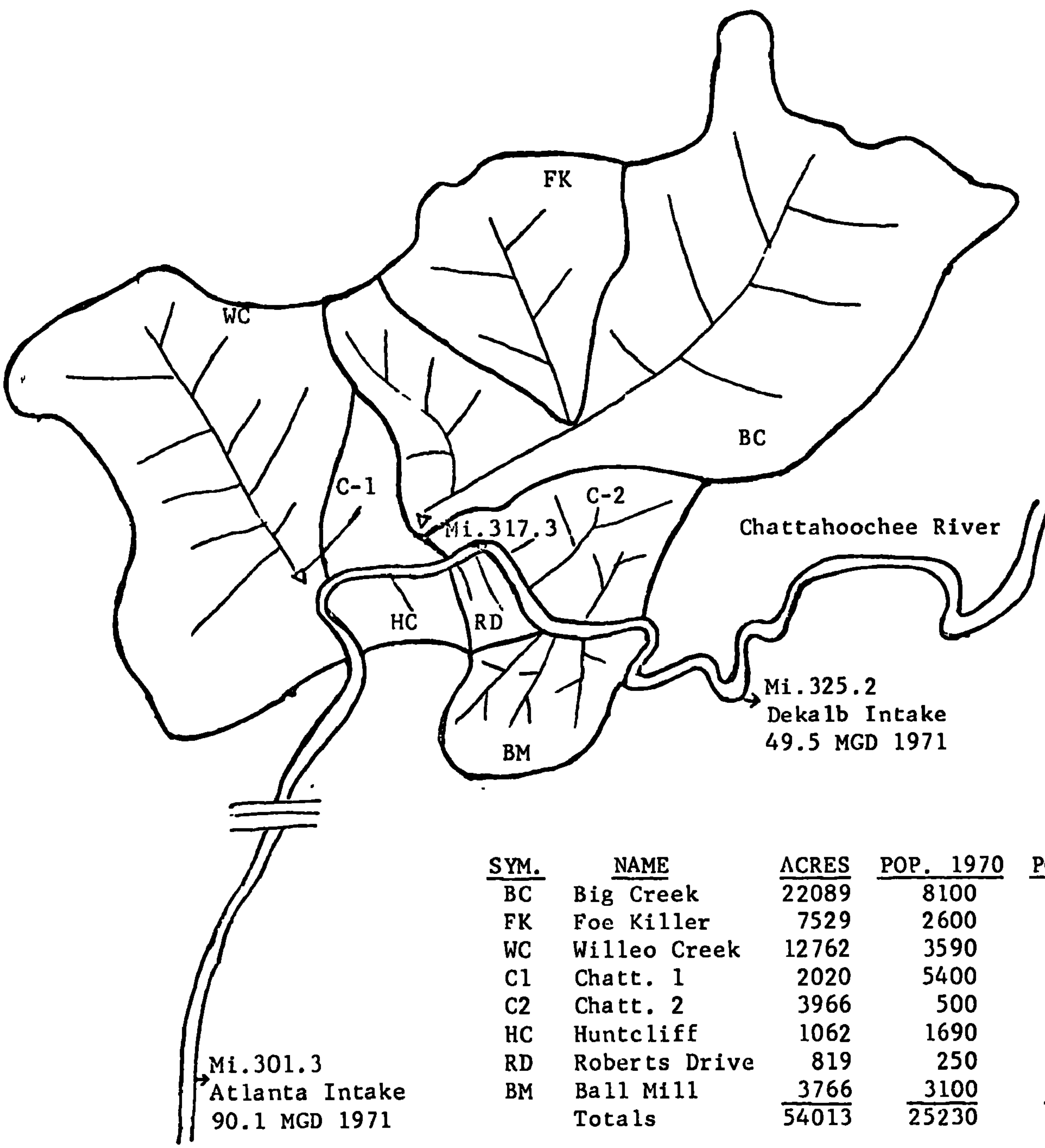
TABLE 4 - CHATTAHOOCHEE RIVER CONCENTRATIONS 1990

CONTAMINANTS OTHER THAN DISSOLVED OXYGEN - NO TREATMENT

Conditions: Guaranteed low flow 1250 cfs and zero river concentrations.

	Total Runoff = 5863 cfs		Flow = 7113 cfs
Contaminant	Amt.	RO Concentration	River Concentration
COD, lbs	15300	41.80 mg/l	34.50 mg/l
Total Solids, lbs	498000	1360 mg/l	1120 mg/l
Volatile Solids, lbs.	20800	57 mg/l	47 mg/l
Total Coliforms-cnt.	3710×10^{10}	22324/100ml	18400/100ml
Fecal Coliforms-cnt.	336×10^{10}	2023/100ml	1670/100ml
Phosphates, lbs	301	.82 mg/l	.67 mg/l
Kjeldahl Nitrogen, lbs	579	1.58 mg/l	1.30 mg/l
Nitrates, lbs.	27.8	.076 mg/l	.063 mg/l
Copper, lbs	76.4	.21 mg/l	.17 mg/l
Lead, lbs.	89.2	.24 mg/l	.20 mg/l
Mercury, lbs.	26.6	.073 mg/l	.060 mg/l
Cadmium, lbs.	3.6	.010 mg/l	.008 mg/l
Zinc, lbs	127	.348 mg/l	.287 mg/l
Nickel, lbs.	24.3	.067 mg/l	.055 mg/l
Chromium, lbs.	12.7	.035 mg/l	.029 mg/l
Dieldrin, lbs.	.0278	.0759 ug/l	.0626 ug/l
PCB, lbs	.0753	.2060 ug/l	.1700 ug/l
DDD, lbs	.0394	.1080 ug/l	.0890 ug/l
P,P-DDT, lbs	.0151	.0411 ug/l	.0339 ug/l

NORTH FULTON COUNTY (ATLANTA) DRAINAGE AREAS WITH POTENTIAL IMPOUNDMENTS



SYM.	NAME	ACRES	POP. 1970	POP. 1990
BC	Big Creek	22089	8100	49500
FK	Foe Killer	7529	2600	20000
WC	Willeo Creek	12762	3590	7800
C1	Chatt. 1	2020	5400	31300
C2	Chatt. 2	3966	500	13400
HC	Huntcliff	1062	1690	16750
RD	Roberts Drive	819	250	4500
BM	Ball Mill	3766	3100	9500
	Totals	54013	25230	152750

△ Potential Impoundments

D. Buffer Zones

The proposed alignment of the interceptors in the corridor run between Riverside Drive and the Chattahoochee River from approximately one (1) mile upstream of the Ball Mill Creek force main river crossing to the pumping station for the Big Creek Treatment Plant. The sewers involved are (1) Chattahoochee II, (2) Ball Mill - north of the river, and (3) Big Creek Relief Interceptors. A buffer zone along the river is required to protect and enhance the recreational and environmental values in this section of the corridor. The following conditions apply for this interceptor alignment:

1. As recommended by ARC and BOR, the alignment should provide an undisturbed buffer of 150 feet - measured from the edge of the river to the nearest construction right-of-way.

2. Where sections along the river cannot accommodate the 150-foot buffer, representatives from applicable Federal and State agencies will be consulted for advice to insure design and construction techniques employed are compatible with the preservation of the natural environment immediately adjacent to construction rights-of-way.

II. BENEFICIAL EFFECTS

A. Water Quality

The Chattahoochee River above Peachtree Creek in Atlanta is classified under the approved Georgia "Water Use Classification and Water Quality Standards" as "Drinking Water Supply." It is also designated by the State Game and Fish Commission as a trout stream. The treated sewage effluent will not violate this standard. Criteria for the three pertinent water quality parameters as set forth in the standards are:

a. Bacteria: fecal coliform not to exceed a geometric mean of 1000 per 100 ml based on at least four samples taken over a 30-day period and not to exceed a maximum of 4,000 per 100 ml.

b. Dissolved Oxygen: A daily average of 6.0 mg/l and no less than 5.0 mg/l at all times for waters designated as trout streams by the State Game and Fish Commission.

c. Temperature: Not to exceed 90° F. .... In streams designated as trout or small mouth bass waters by the

State Game and Fish Commission, there shall be no elevation or depression of natural stream temperatures.

Bacteria: Background data for the Chattahoochee River over the past several years shows a marked reduction of fecal coliform numbers in the river. For example, in 1965 measurements at U. S. 19 and at Morgan Falls reveal a mean monthly E. Coli of 5713 and 2093 respectively. (STORET) Grab-samples taken by the Atlanta Water Works from January through May of 1972 show that fecal coliform counts rarely exceed 1000/100 ml. Of 39 samples taken at the DeKalb County Raw Water Intake, HY 19, Morgan Falls, and the Cobb County Intake over the five-month period, no sample exceeded 4000 per 100 ml established by the standard for the "fresh water supply" use classification (the highest count was 3900 per 100 ml at Morgan Falls).

It is noted that the Chattahoochee River receives recreational use by people of all ages in the form of tubing, rafting, and canoeing. These usages, which often result in water contact, command a higher bacterial standard than "fresh water supply" where treatment and disinfection preceded ingestion. Bacteria kill can be achieved so that the quality of the sewage effluent itself meets the "fresh water supply" classification.

Dissolved Oxygen: A dissolved oxygen sag analysis was conducted to determine the effects of the 6 mgd and proposed ultimate 18 mgd sewage effluent on the Chattahoochee River. In summary, the discharge of 6 mgd of sewage effluent will have a nominal effect on the receiving stream. Certain basic assumptions had to be made to determine the effect of 6 mgd of sewage effluent on the Chattahoochee River. These are the low flow conditions in the river; the river temperature; the reaeration capacity of the river; the background water quality of the Chattahoochee River.

The most conservative values for low temperature and reaeration capacity were selected. It was assumed that there is no significant tributary flow into the Chattahoochee River between Willeo Creek and the Atlanta Raw Water Intake. Also, it was assumed that there are no point sources of pollution between the two points. Although existing water quality data of the area indicate heavy pollution from Sope and Rottenwood Creeks, and the Marsh Creek Sewage Treatment Plant is discharging into the river, these conditions will soon be alleviated on completion of the Cobb County Interceptor and sewage treatment plant construction.

Computations clearly show that D.O. levels in the Chattahoochee River after mix will not fall below 6 mg/l below the discharge of 6 mgd. Similarly, the discharge of 18 mgd of treated sewage effluent will cause D.O. levels to depress only as low as 5.5 mg/l. A very localized depression of oxygen concentrations is anticipated at the point of discharge due to the low oxygen concentration in the sewage effluent (2 mg/l D.O.). This concentration, on which the analysis was based, can be achieved on a continuous basis by mechanical inducement of oxygen into the effluent or by adequate and reliable operation and maintenance of the system as designed. The zone of mix may be minimized by proper location of the point of discharge in the river and by engineering to enhance dispersion of the effluent.

Temperature: A mass balance analysis was conducted to determine the effect of the 6 mgd and proposed utlimate 18 mgd sewage effluent on ambient temperatures in the Chattahoochee River.

Flow from Plant	Temperature Rise in Water
6 mgd	0.5°F
18 mgd	1.25°F

The above data was generated by the analysis using low flow conditions in the river (500 cfs) and an estimated sewage effluent temperature range of 72°F to 79°F.

B. Summary

The construction of sewerage facilities will be a measure to preclude a decrease in water quality due to the continuing increase in population. The facilities will eliminate the need for septic tanks and package plants. Physical and chemical water quality of the affected sections of the Chattahoochee River and other streams can be preserved. Public health as affected by sewage treatment can be protected. Sewers in combination with other public facilities and an operating land use plan, with responsible zoning and permits, will provide for orderly growth and protection of aesthetic areas, open spaces, ecological communities, and social well being of the area.

CHAPTER V

RELATIONSHIPS BETWEEN LOCAL SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM MAINTENANCE OR ENHANCEMENT OF THE ENVIRONMENT

The participation by EPA in funding of the proposed projects is based on the objectives of long-term maintenance and enhancement of the water quality of the affected streams and protection of the public health, which is affected by sewerage facilities. Short-term solutions for transport and treatment of sewage is unacceptable if the eventual costs of sewerage works are higher in terms of capital costs, damage to the environment, water quality, and public health; and inflexibility in sewerage systems.

While the sewer lines may seem, by some people, to be over designed, the overall projected rapid growth of the area requires sewer sizes greater than necessary for the next 10 to 15 years, as pointed out in Alternative No. 4. The rapid growth will occur with or without the project or small sewer lines, this being so because of the desire by many people to live in the Atlanta area and specifically in the North Fulton County area. As mentioned in the section, Population Projections, the projections for River Ridge by EPA and the consultants for Fulton County must be reconciled. Population projections for projects proposed for future funding will be checked at the appropriate time for populations based on the latest land use plans and trends.

CHAPTER VI

COMMENTS

A public hearing was held in the Fulton County Commission Chambers on December 9, 1971, to offer the public an opportunity to express opinions concerning plans for sewerage facilities in the north Fulton County area. The major issues were (1) strong objections from environmental groups regarding the original location of the Ball Mill Creek interceptor sewer along the river and the River Ridge interceptor sewer below Morgan Falls Dam, (2) the population projections made by the consultants for Fulton County and used to size the sewers, and (3) the seemingly lack of consideration of any relationship between sewers, development, land use plans, and urban runoff and water quality. The first major issue noted above has been resolved by major realignment of the proposed sewers. This was a direct result of the public hearing on the Environmental Assessment Statement and comments on the Assessment Statement by the Atlanta Regional Commission.

EPA cannot dictate, approve, or disapprove land use plans or development. These matters are functions of the State of Georgia, Fulton, DeKalb, and Cobb Counties, and the cities of Roswell and Alpharetta. The discussion by EPA on urban runoff and water quality is presented so that the general consequence of the runoff on water quality in the north Fulton area can be known. The areas covered by the proposed projects will develop with or without a regional system, and the consequences of development will occur according to State and local governments land use controls and constraints. The projects proposed are offered as a method to transport and treat sewage with the funded projects meeting immediate needs. The alternative is the use of lagoons, package plants, and septic tanks.

Subject to the restrictions and requirements noted in this Impact Statement, the proposed facilities are recommended as proposed.

APPENDIX A

URBAN RUNOFF COMPUTATIONS

A SIMPLIFIED FORTRAN IV PROGRAM AND PROCEDURE FOR DEVELOPING CONTAMINANT CONCENTRATIONS AND FLOOD WATER QUANTITIES FOR SPECIFIC RAINFALL EVENTS

By

Howard A. True

David W. Hill

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June 1973

Environmental Protection Agency

Surveillance and Analysis Division

Athens, Georgia

A RUDIMENTARY METHOD FOR CALCULATING URBAN AREA RUNOFF QUANTITIES AND CONTAMINANT CONCENTRATIONS

by

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Surveillance and Analysis Division
Athens, Georgia

Urban storm water runoff is becoming of increasing concern because of both pollutional aspects of small, frequent storms and flooding from large, infrequent storms. This paper presents a simple method and a short computer program to approximate both water quality and quantity resulting from a given rainfall event on an urban area.

This work combines the research efforts by many people in a single approach to an elusive problem. The procedure, although very useful, is not "the last word" in urban runoff projections. It is presented in considerable detail so that others may use it as is or make modifications to fit particular circumstances.

The process calculates population per acre from input data and this key value is used to calculate curb miles and impervious acres through use of the following regression equations:

$$C = 423.7 - 420.8\ (0.8797)^P \qquad \underline{6}/$$

C = specific curb length in ft/acre

P = population/acre

* Range of data $44 \leq C \leq 715 \qquad 0.55 \leq P \leq 83.8$

$$I = 91.32 - 69.34\ (0.9309)^P \qquad \underline{6}/$$

I = imperviousness in percent

P = population/acre

* Range of data $13 \leq I \leq 98 \qquad 0.55 \leq P \leq 83.8$

* From thirty-two census tracts within the metropolitan Washington, D. C. area. Imagery was flown in June 1970 by NASA for the U. S. Geological Survey as part of the census cities program. Total area was 30,000 acres (12,150 ha).

The rational method[7] was used for runoff rate and quantity calculations for each sub-division of the total area. This method determines the runoff in cubic feet per second at the point of concentration as follows:

$$Q = C\ I\ A$$

Q = runoff in cubic feet per second from a given area.

I = intensity of rainfall in inches per hour for a duration equal to the time of concentration.

C = a coefficient representing the ratio of runoff to rainfall.

A = the drainage area in acres.

NOTE: Exhibits 5 and 6 provide information for this calculation.

Contaminant quantities and concentrations are now calculated for report purposes. These reports display the required numbers for analysis of flooding effects, input to a stream quality model or for simple calculations of slug effects on stream quality. Exhibits 1, 2 and 3 cover a hypothetical area for use in understanding the process and Exhibit 4 supplies the contaminant factors available at this time.

The user is referred to the section entitled "The Effects of Urban Runoff in North Fulton County" for a full fledged analysis based on computations from use of this process.

PROCEDURE FOR CALCULATING URBAN RUNOFF QUANTITIES AND QUALITY

1. Obtain a map of the area in question.

2. Sub-divide the area for calculations and locate the receiving body of water.

3. Determine the acreage of each sub-area.

4. Obtain population of each sub-area for a reference year (e.g. 1970).

5. Project population for each sub-area (e.g. 1990).

6. Carefully review EPA-R2-72-081 "Water Pollution Aspects of Street Surface Contaminants", Sartor & Boyd, URS Research Co., San Mato, Calif., 11/72.

7. Select contaminant factors from Table C-2 pp. 189-190 of the publication stated in 6. Selected values should be from nearest city or the weighted average can be used if desired.

8. Review write-up "Estimation of Imperviousness and Specific Curb Length for Forecasting Stormwater Quality and Quantity", Graham, Costello & Mallon, Metro Wash., D.C. Council of Governments, 3/20/73 or use population oriented regression equations included in the FORTRAN program attached.

9. Punch a set of 40 factor cards as illustrated later in this writeup.

10. Punch a set of area features cards and a total area card for the reference year and projection year. See text for instructions.

11. Punch a storm event card for each storm size desired. See text for instructions. See text for possible sources of storm information.

12. The factor cards are used for all runs; however, two runs are made independently with area feature decks to allow a weighted total report to be produced by the computer. For water quality reports a single normal storm event card will be used in both runs (e.g. 1970 and 1990); however, additional storm event cards for return years of 2, 5, 10, 25, 50 and 100 (from rainfall-intensity-duration-frequency curves) can be added to get flood reports in the same runs.

13. Computing time requirement is approximately 0.2 second per report on an IBM 370/155. Time in seconds = 3 + (no. of storm cds. x no. of area cds. x0.2).

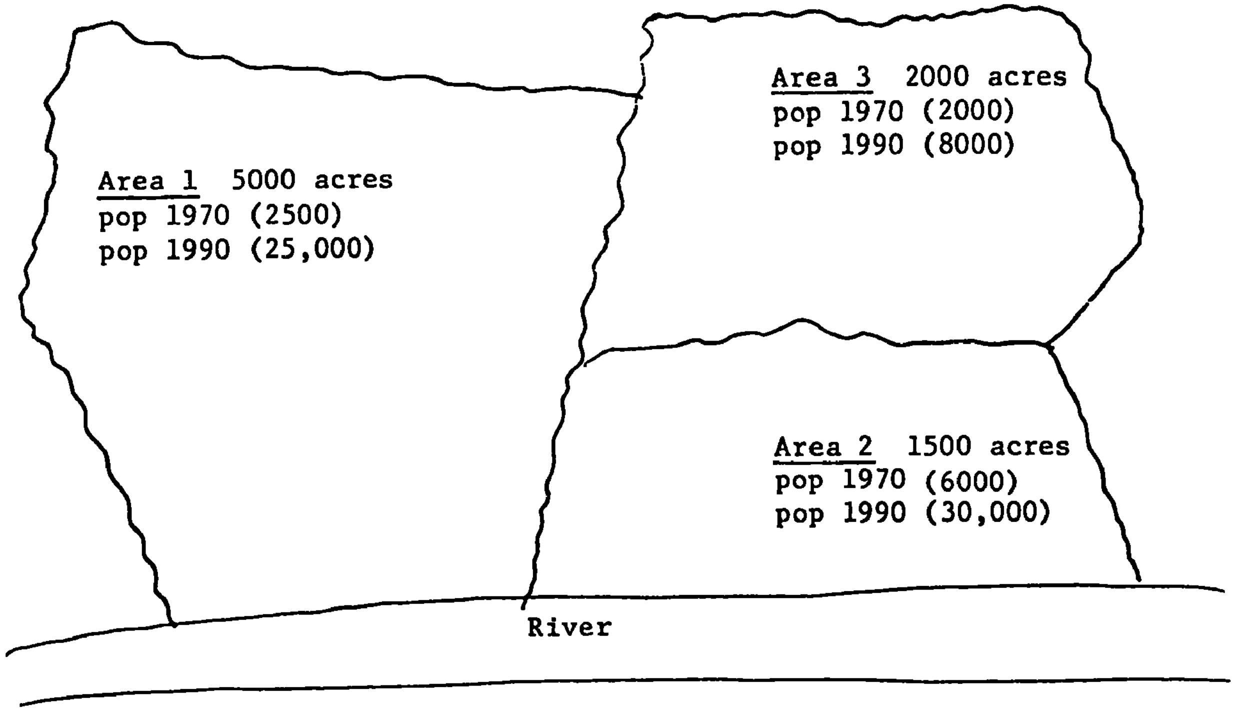
14. Factor cards 1 through 10 are reserved for common water quality parameters with cards 5 and 6 reserved exclusively for coliforms. Factor cards 11 through 19 are for nutrients, cards 20-29 for metals and cards 30-40 for pesticides. All 40 cards are required although as few or as many as needed are punched with contaminant information.

15. The E format is used principally in the area report because of wide range of magnitudes to be encountered.

16. The present limit of 20 identifiable area cards and 1 total area card can be expanded through minor program changes. These cards are held in arrays for application of multiple storm events.

17. The final step is the manual extraction of calculated values to develop tables and graphs to support a narrative statement concerning water quality effects on a receiving water body and flooding effects within an area or area group.

DEMONSTRATION RUNOFF AREA



INFORMATION COVERING DEMONSTRATION AREA #1
RETURN YEARS = 0

POPULATION-1970	2500.0
POP. DENSITY/ACRE	0.5
AREA ACRES	5000.0
MILES OF CURB	27.5
% IMPERVIOUSNESS	24.4
IMPERVIOUS ACRES	1220.9
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	463.7
RUNOFF ACRE-FT.	76.6
RUNOFF CU. FT.	3338367.0
R.O. C.F. 15 MIN.	417295.8

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BODS	0.200E+01	0.550E+02	0.190E+01	
COD	0.132E+02	0.363E+03	0.125E+02	
TOTAL SOLIDS	0.430E+03	0.116E+05	0.409E+03	
VOLATILE SOLIDS	0.180E+02	0.495E+03	0.171E+02	
TOTAL COLIFORMS	0.320E+11	0.879E+12		6697.7
FECAL COLIFORMS	0.290E+10	0.797E+11		607.0
NUTRIENTS				
PHOSPHATES	0.260E+00	0.715E+01	0.247E+00	
KJELDAHL NITROGEN	0.500E+00	0.137E+02	0.475E+00	
NITRATES	0.240E-01	0.660E+00	0.228E-01	
METALS				
ZINC	0.110E+00	0.302E+01	0.104E+00	
COPPER	0.650E-01	0.181E+01	0.627E-01	
LEAD	0.770E-01	0.212E+01	0.731E-01	
NICKEL	0.210E-01	0.577E+00	0.199E-01	
MERCURY	0.230E-01	0.632E+00	0.218E-01	
CHROMIUM	0.110E-01	0.302E+00	0.104E-01	
CADMIUM	0.310E-02	0.852E-01	0.294E-02	
PESTICIDES				
DIELDRIN	0.240E-04	0.660E-03	0.228E-04	
PCB	0.650E-04	0.179E-02	0.617E-04	
BP-DDT	0.340E-04	0.934E-03	0.323E-04	
P.P-DDT	0.130E-04	0.357E-03	0.123E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

INFORMATION COVERING DEMONSTRATION AREA #1
RETURN YEARS = 0

POPULATION-1990	25000.0
POP. DENSITY/ACRE	5.0
AREA ACRES	5000.0
MILES OF CURB	191.3
% IMPERVIOUSNESS	42.8
IMPERVIOUS ACRES	2142.4
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	624.9
RUNOFF ACRE-FT.	103.3
RUNOFF CU. FT.	4499363.0
R.O. C.F. 15 MIN.	562420.2

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BODS	0.200E+01	0.383E+03	0.981E+01	
COD	0.132E+02	0.253E+04	0.647E+02	
TOTAL SOLIDS	0.430E+03	0.823E+05	0.211E+04	
VOLATILE SOLIDS	0.180E+02	0.344E+04	0.883E+02	
TOTAL COLIFORMS	0.320E+11	0.612E+13		34589.6
FECAL COLIFORMS	0.290E+10	0.555E+12		3134.7
NUTRIENTS				
PHOSPHATES	0.260E+00	0.497E+02	0.127E+01	
KJELDAHL NITROGEN	0.500E+00	0.956E+02	0.245E+01	
NITRATES	0.240E-01	0.459E+01	0.118E+00	
METALS				
ZINC	0.110E+00	0.210E+02	0.539E+00	
COPPER	0.660E-01	0.126E+02	0.324E+00	
LEAD	0.770E-01	0.147E+02	0.378E+00	
NICKEL	0.210E-01	0.402E+01	0.103E+00	
MERCURY	0.230E-01	0.440E+01	0.113E+00	
CHROMIUM	0.110E-01	0.210E+01	0.539E-01	
CADMIUM	0.310E-02	0.593E+00	0.152E-01	
PESTICIDES				
DIELDRIN	0.240E-04	0.459E-02	0.118E-03	
PCB	0.650E-04	0.124E-01	0.314E-03	
BP-DDT	0.340E-04	0.650E-02	0.167E-03	
P.P-DDT	0.130E-04	0.249E-02	0.637E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

EXHIBIT 2A

INFORMATION COVERING DEMONSTRATION AREA #2
RETURN YEARS = 0

POPULATION-1970	6000.0
POP. DENSITY/ACRE	4.0
AREA ACRES	1500.0
MILES OF CURB	48.8
% IMPERVIOUSNESS	39.2
IMPERVIOUS ACRES	588.7
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	178.0
RUNOFF ACRE-FT.	29.4
RUNOFF CU. FT.	1281805.0
R.O. C.F. 15 MIN.	160225.6

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BOD5	0.200E+01	0.976E+02	0.878E+01	
COD	0.132E+02	0.644E+03	0.579E+02	
TOTAL SOLIDS	0.430E+03	0.210E+05	0.189E+04	
VOLATILE SOLIDS	0.180E+02	0.878E+03	0.790E+02	
TOTAL COLIFORMS	0.320E+11	0.156E+13		30958.3
FECAL COLIFORMS	0.290E+10	0.141E+12		2805.6
NUTRIENTS				
PHOSPHATES	0.260E+00	0.127E+02	0.114E+01	
KJELDAHL NITROGEN	0.500E+00	0.244E+02	0.219E+01	
NITRATES	0.240E-01	0.117E+01	0.105E+00	
METALS				
ZINC	0.110E+00	0.537E+01	0.483E+00	
COPPER	0.660E-01	0.322E+01	0.290E+00	
LEAD	0.770E-01	0.376E+01	0.338E+00	
NICKEL	0.210E-01	0.102E+01	0.922E-01	
MERCURY	0.230E-01	0.112E+01	0.101E+00	
CHROMIUM	0.110E-01	0.537E+00	0.483E-01	
CADMIUM	0.310E-02	0.151E+00	0.136E-01	
PESTICIDES				
DIELDRIN	0.240E-04	0.117E-02	0.105E-03	
PCB	0.650E-04	0.317E-02	0.285E-03	
OP-DDT	0.340E-04	0.166E-02	0.149E-03	
P,P-DDT	0.130E-04	0.634E-03	0.570E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

INFORMATION COVERING DEMONSTRATION AREA #2
RETURN YEARS = 0

POPULATION-1990	30000.0
POP. DENSITY/ACRE	20.0
AREA ACRES	1500.0
MILES OF CURB	111.2
% IMPERVIOUSNESS	74.8
IMPERVIOUS ACRES	1121.4
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	271.2
RUNOFF ACRE-FT.	44.8
RUNOFF CU. FT.	1952973.0
R.O. C.F. 15 MIN.	244121.6

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BOD5	0.200E+01	0.222E+03	0.131E+02	
COD	0.132E+02	0.147E+04	0.866E+02	
TOTAL SOLIDS	0.430E+03	0.478E+05	0.282E+04	
VOLATILE SOLIDS	0.180E+02	0.200E+04	0.118E+03	
TOTAL COLIFORMS	0.320E+11	0.356E+13		46306.6
FECAL COLIFORMS	0.290E+10	0.322E+12		4196.5
NUTRIENTS				
PHOSPHATES	0.260E+00	0.289E+02	0.171E+01	
KJELDAHL NITROGEN	0.500E+00	0.556E+02	0.328E+01	
NITRATES	0.240E-01	0.267E+01	0.158E+00	
METALS				
ZINC	0.110E+00	0.122E+02	0.722E+00	
COPPER	0.660E-01	0.734E+01	0.433E+00	
LEAD	0.770E-01	0.856E+01	0.505E+00	
NICKEL	0.210E-01	0.233E+01	0.138E+00	
MERCURY	0.230E-01	0.256E+01	0.151E+00	
CHROMIUM	0.110E-01	0.122E+01	0.722E-01	
CADMIUM	0.310E-02	0.345E+00	0.203E-01	
PESTICIDES				
DIELDRIN	0.240E-04	0.267E-02	0.158E-03	
PCB	0.650E-04	0.723E-02	0.427E-03	
OP-DDT	0.340E-04	0.378E-02	0.223E-03	
P,P-DDT	0.130E-04	0.145E-02	0.853E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

EXHIBIT 2B

INFORMATION COVERING DEMONSTRATION AREA #3
RETURN YEARS = 0

POPULATION-1970	2000.0
POP. DENSITY/ACRE	1.0
AREA ACRES	2000.0
MILES OF CURB	20.3
% IMPERVIOUSNESS	26.8
IMPERVIOUS ACRES	535.4
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	193.7
RUNOFF ACRE-FT.	32.0
RUNOFF CU. FT.	1394637.0
R.O. C.F. 15 MIN.	174329.6

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BOD5	0.200E+01	0.405E+02	0.335E+01	
COD	0.132E+02	0.268E+03	0.221E+02	
TOTAL SOLIDS	0.430E+03	0.872E+04	0.721E+03	
VOLATILE SOLIDS	0.180E+02	0.365E+03	0.302E+02	
TOTAL COLIFORMS	0.320E+11	0.649E+12		11826.6
FECAL COLIFORMS	0.290E+10	0.588E+11		1071.8
NUTRIENTS				
PHOSPHATES	0.260E+00	0.527E+01	0.436E+00	
KJELDAHL NITROGEN	0.500E+00	0.101E+02	0.838E+00	
NITRATES	0.240E-01	0.487E+00	0.402E-01	
METALS				
ZINC	0.110E+00	0.223E+01	0.184E+00	
COPPER	0.660E-01	0.134E+01	0.111E+00	
LEAD	0.770E-01	0.156E+01	0.129E+00	
NICKEL	0.210E-01	0.426E+00	0.352E-01	
MERCURY	0.230E-01	0.466E+00	0.386E-01	
CHROMIUM	0.110E-01	0.223E+00	0.184E-01	
CADMIUM	0.310E-02	0.628E-01	0.520E-02	
PESTICIDES				
DIELDRIN	0.240E-04	0.487E-03	0.402E-04	
PCB	0.650E-04	0.132E-02	0.109E-03	
HP-DDT	0.340E-04	0.689E-03	0.570E-04	
P,P-DDT	0.130E-04	0.264E-03	0.218E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

INFORMATION COVERING DEMONSTRATION AREA #3
RETURN YEARS = 0

POPULATION-1990	8000.0
POP. DENSITY/ACRE	4.0
AREA ACRES	2000.0
MILES OF CURB	65.0
% IMPERVIOUSNESS	39.2
IMPERVIOUS ACRES	785.0
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	237.4
RUNOFF ACRE-FT.	39.2
RUNOFF CU. FT.	1709072.0
R.O. C.F. 15 MIN.	213634.0

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BOD5	0.200E+01	0.130E+03	0.878E+01	
COD	0.132E+02	0.858E+03	0.579E+02	
TOTAL SOLIDS	0.430E+03	0.280E+05	0.189E+04	
VOLATILE SOLIDS	0.180E+02	0.117E+04	0.790E+02	
TOTAL COLIFORMS	0.320E+11	0.208E+13		30958.3
FECAL COLIFORMS	0.290E+10	0.189E+12		2805.6
NUTRIENTS				
PHOSPHATES	0.260E+00	0.169E+02	0.114E+01	
KJELDAHL NITROGEN	0.500E+00	0.325E+02	0.219E+01	
NITRATES	0.240E-01	0.156E+01	0.105E+00	
METALS				
ZINC	0.110E+00	0.715E+01	0.483E+00	
COPPER	0.660E-01	0.429E+01	0.290E+00	
LEAD	0.770E-01	0.501E+01	0.338E+00	
NICKEL	0.210E-01	0.137E+01	0.922E-01	
MERCURY	0.230E-01	0.150E+01	0.101E+00	
CHROMIUM	0.110E-01	0.715E+00	0.483E-01	
CADMIUM	0.310E-02	0.202E+00	0.136E-01	
PESTICIDES				
DIELDRIN	0.240E-04	0.156E-02	0.105E-03	
PCB	0.650E-04	0.423E-02	0.285E-03	
HP-DDT	0.340E-04	0.221E-02	0.149E-03	
P,P-DDT	0,130E-04	0.845E-03	0.570E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

EXHIBIT 2C

INFORMATION COVERING TOTAL AREA (1 + 2 + 3) - 1970 POP.
RETURN YEARS = 0

POPULATION-1970	10500.0
POP. DENSITY/ACRE	1.2
AREA ACRES	8500.0
MILES OF CURB	96.5
% IMPERVIOUSNESS	27.6
IMPERVIOUS ACRES	2345.1
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	835.4
RUNOFF ACRE-FT.	138.1
RUNOFF CU. FT.	6014808.0
R.O. C.F. 15 MIN.	751850.9

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BOD5	0.200E+01	0.193E+03	0.370E+01	
COD	0.132E+02	0.127E+04	0.244E+02	
TOTAL SOLIDS	0.430E+03	0.415E+05	0.796E+03	
VOLATILE SOLIDS	0.180E+02	0.174E+04	0.333E+02	
TOTAL COLIFORMS	0.320E+11	0.309E+13		13057.0
FECAL COLIFORMS	0.290E+10	0.280E+12		1183.3
NUTRIENTS				
PHOSPHATES	0.260E+00	0.251E+02	0.481E+00	
KJELDAHL NITROGEN	0.500E+00	0.483E+02	0.925E+00	
NITRATES	0.240E-01	0.232E+01	0.444E-01	
METALS				
ZINC	0.110E+00	0.106E+02	0.204E+00	
COPPER	0.660E-01	0.637E+01	0.127E+00	
LEAD	0.770E-01	0.743E+01	0.143E+00	
NICKEL	0.210E-01	0.203E+01	0.389E-01	
MERCURY	0.230E-01	0.222E+01	0.426E-01	
CHROMIUM	0.110E-01	0.106E+01	0.204E-01	
CADMIUM	0.310E-02	0.299E+00	0.574E-02	
PESTICIDES				
DIELDRIN	0.240E-04	0.232E-02	0.444E-04	
PCB	0.650E-04	0.627E-02	0.120E-03	
BP-DDT	0.340E-04	0.328E-02	0.629E-04	
P,P-DDT	0.130E-04	0.125E-02	0.241E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

INFORMATION COVERING TOTAL AREA (1 + 2 + 3) - 1990 POP.
RETURN YEARS = 0

POPULATION-1990	63000.0
POP. DENSITY/ACRE	7.4
AREA ACRES	8500.0
MILES OF CURB	367.5
% IMPERVIOUSNESS	47.6
IMPERVIOUS ACRES	4048.7
RAIN INTENSITY	0.25
DURATION MIN.	120.0
ANN. RAINFALL IN.	48.5
ANN. SNOWFALL IN.	0.1
PRECIP. DAYS/YR.	107.0
FRZ. DAYS/YR.	73.0
RUNOFF CFS	1133.5
RUNOFF ACRE-FT.	187.4
RUNOFF CU. FT.	8161407.0
R.O. C.F. 15 MIN.	1020175.8

PARAMETER	COEFFICIENTS CNT OR LBS/CM	TOTAL LOAD CNT OR LBS	<<CONC.INIT. 15 MIN.>> MG/L*	CNT/100 ML
BOD5	0.200E+01	0.735E+03	0.104E+02	
COD	0.132E+02	0.485E+04	0.685E+02	
TOTAL SOLIDS	0.430E+03	0.158E+06	0.223E+04	
VOLATILE SOLIDS	0.180E+02	0.661E+04	0.935E+02	
TOTAL COLIFORMS	0.320E+11	0.118E+14		36633.0
FECAL COLIFORMS	0.290E+10	0.107E+13		3319.9
NUTRIENTS				
PHOSPHATES	0.260E+00	0.955E+02	0.135E+01	
KJELDAHL NITROGEN	0.500E+00	0.184E+03	0.260E+01	
NITRATES	0.240E-01	0.882E+01	0.125E+00	
METALS				
ZINC	0.110E+00	0.404E+02	0.571E+00	
COPPER	0.660E-01	0.243E+02	0.343E+00	
LEAD	0.770E-01	0.283E+02	0.400E+00	
NICKEL	0.210E-01	0.772E+01	0.109E+00	
MERCURY	0.230E-01	0.845E+01	0.119E+00	
CHROMIUM	0.110E-01	0.404E+01	0.571E-01	
CADMIUM	0.310E-02	0.114E+01	0.161E-01	
PESTICIDES				
DIELDRIN	0.240E-04	0.882E-02	0.125E-03	
PCB	0.650E-04	0.239E-01	0.338E-03	
BP-DDT	0.340E-04	0.125E-01	0.177E-03	
P,P-DDT	0.130E-04	0.478E-02	0.675E-04	

*NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MIN.

EXHIBIT 2D

INFORMATION COVERING DEMONSTRATION AREA #1

RETURN YEARS	= 2	= 5	= 10	= 25	= 50	= 100
POPULATION-1970	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0
POP. DENSITY/ACRE	0.5	0.5	0.5	0.5	0.5	0.5
AREA ACRES	5000.0	5000.0	5000.0	5000.0	5000.0	5000.0
MILES OF CURB	27.5	27.5	27.5	27.5	27.5	27.5
% IMPERVIOUSNESS	24.4	24.4	24.4	24.4	24.4	24.4
IMPERVIOUS ACRES	1220.9	1220.9	1220.9	1220.9	1220.9	1220.9
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	1854.6	2596.5	2967.4	3338.4	3709.3	4080.2
RUNOFF ACRE-FT.	306.6	429.2	490.5	551.8	613.1	674.4
RUNOFF CU. FT.	13353475.0	18694848.0	21365552.0	24036256.0	26706944.0	29377632.0
R.O. C.F. 15 MIN.	1669184.0	2336855.0	2670692.0	3004531.0	3338368.0	3672202.0

POPULATION-1990	25000.0	25000.0	25000.0	25000.0	25000.0	25000.0
POP. DENSITY/ACRE	5.0	5.0	5.0	5.0	5.0	5.0
AREA ACRES	5000.0	5000.0	5000.0	5000.0	5000.0	5000.0
MILES OF CURB	191.3	191.3	191.3	191.3	191.3	191.3
% IMPERVIOUSNESS	42.8	42.8	42.8	42.8	42.8	42.8
IMPERVIOUS ACRES	2142.4	2142.4	2142.4	2142.4	2142.4	2142.4
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	2499.6	3499.5	3999.4	4499.4	4999.3	5499.2
RUNOFF ACRE-FT.	413.2	578.4	661.1	743.7	826.3	909.0
RUNOFF CU. FT.	17997456.0	25196432.0	28795936.0	32395408.0	35994896.0	39594368.0
R.O. C.F. 15 MIN.	2249681.0	3149553.0	3599490.0	4049425.0	4499360.0	4949294.0

INFORMATION COVERING DEMONSTRATION AREA #2

POPULATION-1970	6000.0	6000.0	6000.0	6000.0	6000.0	6000.0
POP. DENSITY/ACRE	4.0	4.0	4.0	4.0	4.0	4.0
AREA ACRES	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0
MILES OF CURB	48.8	48.8	48.8	48.8	48.8	48.8
% IMPERVIOUSNESS	39.2	39.2	39.2	39.2	39.2	39.2
IMPERVIOUS ACRES	588.7	588.7	588.7	588.7	588.7	588.7
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	712.1	997.0	1139.4	1281.8	1424.2	1566.7
RUNOFF ACRE-FT.	117.7	164.8	188.3	211.9	235.4	259.0
RUNOFF CU. FT.	5127219.0	7178104.0	8203554.0	9228997.0	10254440.0	11279882.0
R.O. C.F. 15 MIN.	640902.2	897262.9	1025444.1	1153674.0	1281804.0	1409985.0

POPULATION-1990	30000.0	30000.0	30000.0	30000.0	30000.0	30000.0
POP. DENSITY/ACRE	20.0	20.0	20.0	20.0	20.0	20.0
AREA ACRES	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0
MILES OF CURB	111.2	111.2	111.2	111.2	111.2	111.2
% IMPERVIOUSNESS	74.8	74.8	74.8	74.8	74.8	74.8
IMPERVIOUS ACRES	1121.4	1121.4	1121.4	1121.4	1121.4	1121.4
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	1085.0	1519.0	1736.0	1953.0	2170.0	2387.0
RUNOFF ACRE-FT.	179.3	251.1	286.9	322.8	358.7	394.5
RUNOFF CU. FT.	7811694.0	10936645.0	12499034.0	14061403.0	15623783.0	17186160.0
R.O. C.F. 15 MIN.	976486.6	1367050.0	1562379.0	1757675.0	1952972.0	2148270.0

INFORMATION COVERING DEMONSTRATION AREA #3

RETURN YEARS	= 2	= 5	= 10	= 25	= 50	= 100
POPULATION-1970	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0
POP. DENSITY/ACRE	1.0	1.0	1.0	1.0	1.0	1.0
AREA ACRES	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0
MILES OF CURB	20.3	20.3	20.3	20.3	20.3	20.3
% IMPERVIOUSNESS	26.8	26.8	26.8	26.8	26.8	26.8
IMPERVIOUS ACRES	535.4	535.4	535.4	535.4	535.4	535.4
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	774.8	1084.7	1239.7	1394.6	1549.6	1704.6
RUNOFF ACRE-FT.	128.1	179.3	204.9	230.5	256.1	281.7
RUNOFF CU. FT.	5578551.0	7809969.0	8925684.0	10041394.0	11157104.0	12272813.0
R.O. C.F. 15 MIN.	697318.7	976246.0	1115710.0	1255174.0	1394638.0	1534101.0
POPULATION-1990	8000.0	8000.0	8000.0	8000.0	8000.0	8000.0
POP. DENSITY/ACRE	4.0	4.0	4.0	4.0	4.0	4.0
AREA ACRES	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0
MILES OF CURB	65.0	65.0	65.0	65.0	65.0	65.0
% IMPERVIOUSNESS	39.2	39.2	39.2	39.2	39.2	39.2
IMPERVIOUS ACRES	785.0	785.0	785.0	785.0	785.0	785.0
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	949.5	1329.3	1519.2	1709.1	1899.0	2088.9
RUNOFF ACRE-FT.	156.9	219.7	251.1	282.5	313.9	345.3
RUNOFF CU. FT.	6836291.0	9570805.0	10938069.0	12305325.0	13672583.0	15039829.0
R.O. C.F. 15 MIN.	854536.2	1196350.0	1367258.0	1538165.0	1709072.0	1879978.0

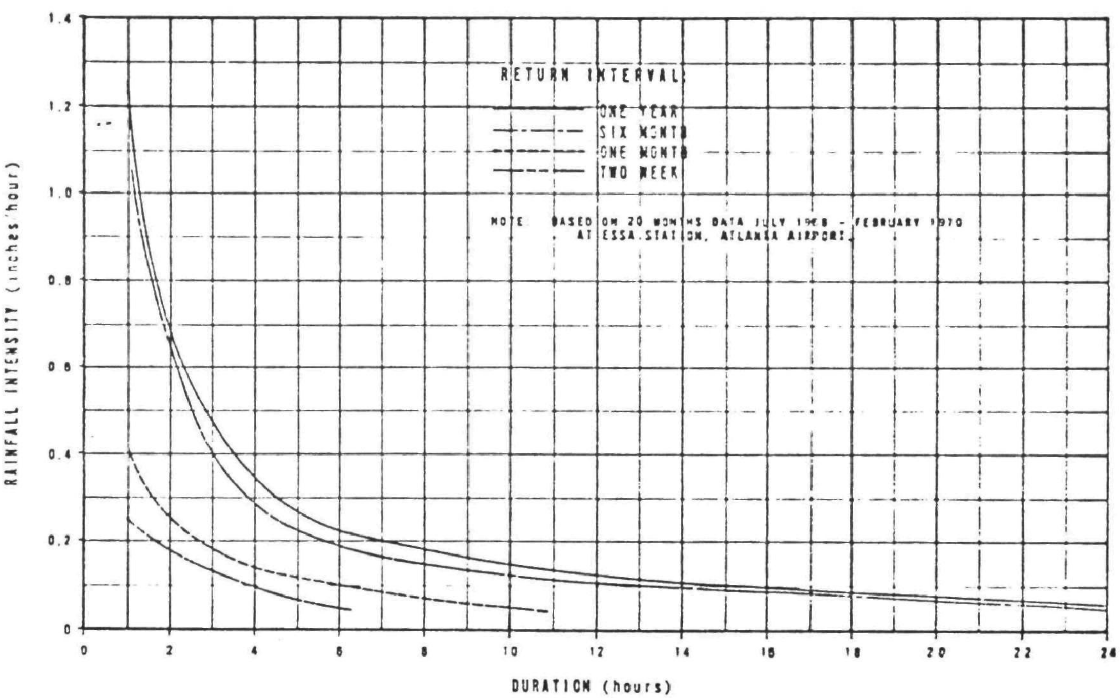
INFORMATION COVERING TOTAL AREA (1 + 2 + 3)

POPULATION-1970	10500.0	10500.0	10500.0	10500.0	10500.0	10500.0
POP. DENSITY/ACRE	1.2	1.2	1.2	1.2	1.2	1.2
AREA ACRES	8500.0	8500.0	8500.0	8500.0	8500.0	8500.0
MILES OF CURB	96.5	96.5	96.5	96.5	96.5	96.5
% IMPERVIOUSNESS	27.6	27.6	27.6	27.6	27.6	27.6
IMPERVIOUS ACRES	2345.1	2345.1	2345.1	2345.1	2345.1	2345.1
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	3341.6	4678.2	5346.5	6014.8	6683.1	7351.4
RUNOFF ACRE-FT.	552.3	773.3	883.7	994.2	1104.6	1215.1
RUNOFF CU. FT.	24059248.0	33682912.0	38494800.0	43306640.0	48118464.0	52930320.0
R.O. C.F. 15 MIN.	3007404.0	4210363.0	4011840.0	5413329.0	6014807.0	6516288.0
POPULATION-1990	63000.0	63000.0	63000.0	63000.0	63000.0	63000.0
POP. DENSITY/ACRE	7.4	7.4	7.4	7.4	7.4	7.4
AREA ACRES	8500.0	8500.0	8500.0	8500.0	8500.0	8500.0
MILES OF CURB	367.5	367.5	367.5	367.5	367.5	367.5
% IMPERVIOUSNESS	47.6	47.6	47.6	47.6	47.6	47.6
IMPERVIOUS ACRES	4048.7	4048.7	4048.7	4048.7	4048.7	4048.7
RAIN INTENSITY	1.00	1.40	1.60	1.80	2.00	2.20
DURATION MIN.	120.0	120.0	120.0	120.0	120.0	120.0
ANN. RAINFALL IN.	48.5	48.5	48.5	48.5	48.5	48.5
ANN. SNOWFALL IN.	0.1	0.1	0.1	0.1	0.1	0.1
PRECIP. DAYS/YR.	107.0	107.0	107.0	107.0	107.0	107.0
FRZ. DAYS/YR.	73.0	73.0	73.0	73.0	73.0	73.0
RUNOFF CFS	4534.1	6347.8	7254.6	8161.4	9068.2	9975.0
RUNOFF ACRE-FT.	749.4	1049.2	1199.1	1349.0	1498.9	1648.8
RUNOFF CU. FT.	32645600.0	45703555.0	52233000.0	58762144.0	65291245.0	71820336.0
R.O. C.F. 15 MIN.	4080699.0	5712981.0	6529124.0	7345267.0	8161405.0	8977540.0

Table C-2 EXHIBIT 4

QUANTITIES OF POLLUTANTS FOUND ON STREETS (lb/curb mi)

POLLUTANT	SAN JOSE-I	PHOENIX I	MIL-WAUKEE	BUCYRUS	BALTI-MORE	SAN JOSE-II	ATLANTA	TULSA	PHOENIX II	SEATTLE	NUMERICAL MEAN	AVERAGE DEVI-ATION	AD/	WEIGHTED AVERAGE
BOD_5 lb/curb mi	16	6.5	12	2.9	61	53	1.9	14	10	4.4	18	16	0.86	14
COD lb/curb mi	310	30	48	29	20	400	13	30	54	17	95	100	1.1	45
PO_4 lb/curb mi	0.70	0.22	0.27	0.25	1.0	4.5	0.26	0.54	2.6	49	1.1	1.0	0.92	1.1
NO_3 lb/curb mi	3.3	0.29	0.052	0.12	0.036	0.27	0.024	0.013	0.12	0.027	0.043	0.040	0.93	0.091
N lb/curb mi	2.1	1.5	1.4	1.2	1.9	11	0.48	0.66	2.9	0.90	2.4	1.8	0.74	2.2
Solids lb/curb mi	910	650	2700	1400	1000	6400	430	330	910	460	1500	1200	0.78	1400
Cd lb/curb mi	0.0030	-	0.0032	-	0.0026	-	-	-	-	-	0.0029	0.0002	0.069	-
Ni lb/curb mi	0.19	-	0.032	-	0.077	0.085	0.021	0.011	0.038	0.028	0.060	0.043	0.72	0.05
Pb lb/curb mi	1.9	-	1.5	-	0.47	0.90	0.077	0.030	0.12	0.50	0.68	0.60	0.88	0.57
Zn lb/curb mi	1.4	-	2.1	-	1.3	0.28	0.11	0.082	0.36	0.37	0.75	0.63	0.85	0.65
Cu lb/curb mi	0.49	-	0.59	-	0.33	0.020	0.068	0.032	0.058	0.075	0.21	0.20	0.95	0.20
Cr lb/curb mi	0.20	-	0.047	-	0.45	0.14	0.011	0.0033	0.029	0.081	0.12	0.11	0.92	0.11
Hg lb/curb mi	0.30	-	-	-	-	0.085	0.023	0.019	0.022	0.034	0.081	0.075	0.93	0.073
Total Heavy Metals lb/curb mi	4.4	-	4.3	-	2.6	1.5	0.31	0.16	.63	1.1	1.9	-	-	1.7
Total Coliforms Billion/curb mi	-	-	49	-	46	72	32	170	48	160	82	46	0.57	99
Fecal Coliforms Million/curb mi	-	-	7.0	-	12000	590	2900	31,000	2400	1900	7200	8000	1.1	5600 median value
Endrin 10^{-6} lb/curb mi	2.0	-	0	0	0	0	0	0	0	0	-	-	-	-
Dieldrin 10^{-6} lb/curb mi	11	-	10	17	3.0	27	24	24	24	27	-	-	0	24
PCB 10^{-6} lb/curb mi	1200	-	3440	650	1000	1000	65	65	65	1100	-	-	-	1100
Methoxychlor 10^{-6} lb/curb mi	0	-	8500	1600	170	0	0	0	0	0	-	-	-	-
p p-DDT 10^{-6} lb/curb mi	110	-	1.0	60	30	170	13	13	13	170	-	-	-	61
Lindane 10^{-6} lb/curb mi	17	-	3.1	0	0	0	0	0	0	0	-	-	-	-
Methyl Parathion 10^{-6} lb/curb mi	20	-	0	0	0	0	0	0	0	0	-	-	-	-
DDD 10^{-6} lb/curb mi	67	-	0.5	83	100	120	34	34	34	120		-	-	67
Total Pesticides and PCB	1400	-	12000	2400	1300	1400	140	140	140	1400	-	-	-	1300



RAINFALL INTENSITY-DURATION-FREQUENCY CURVES, ATLANTA, GEORGIA

PRECIPITATION IN INCHES ATLANTA AREA[1]

EXHIBIT 5

		1935 – 1969 Period of Record			Calendar Year 1969	
Month	Normal Total[2]	Maximum Monthly	Minimum Monthly	Maximum 24 Hours[3]	Month Total	Greatest in 24 Hours
January	4.44	10.82	1.42	3.27	2.85	1.65
February	4.51	12.77	0.99	5.67	3.20	0.71
March	5.37	11.51	2.73	4.82	4.00	1.53
April	4.47	9.86	1.45	4.26	5.70	2.69
May	3.16	7.83	0.32	5.13	7.68	4.34
June	3.83	7.52	0.74	3.14	1.00	0.43
July	4.72	11.26	1.20	5.44	2.64	1.51
August	3.60	8.69	0.88	5.05	6.12	1.79
September	3.26	7.32	0.26	5.46	3.74	1.89
October	2.44	7.53	T	3.27	1.53	0.69
November	2.96	15.72	0.41	4.11	2.67	1.44
December	4.38	9.92	1.08	3.85	3.27	1.11
Year	47.14	14.72	T	5.67	44.40	4.34

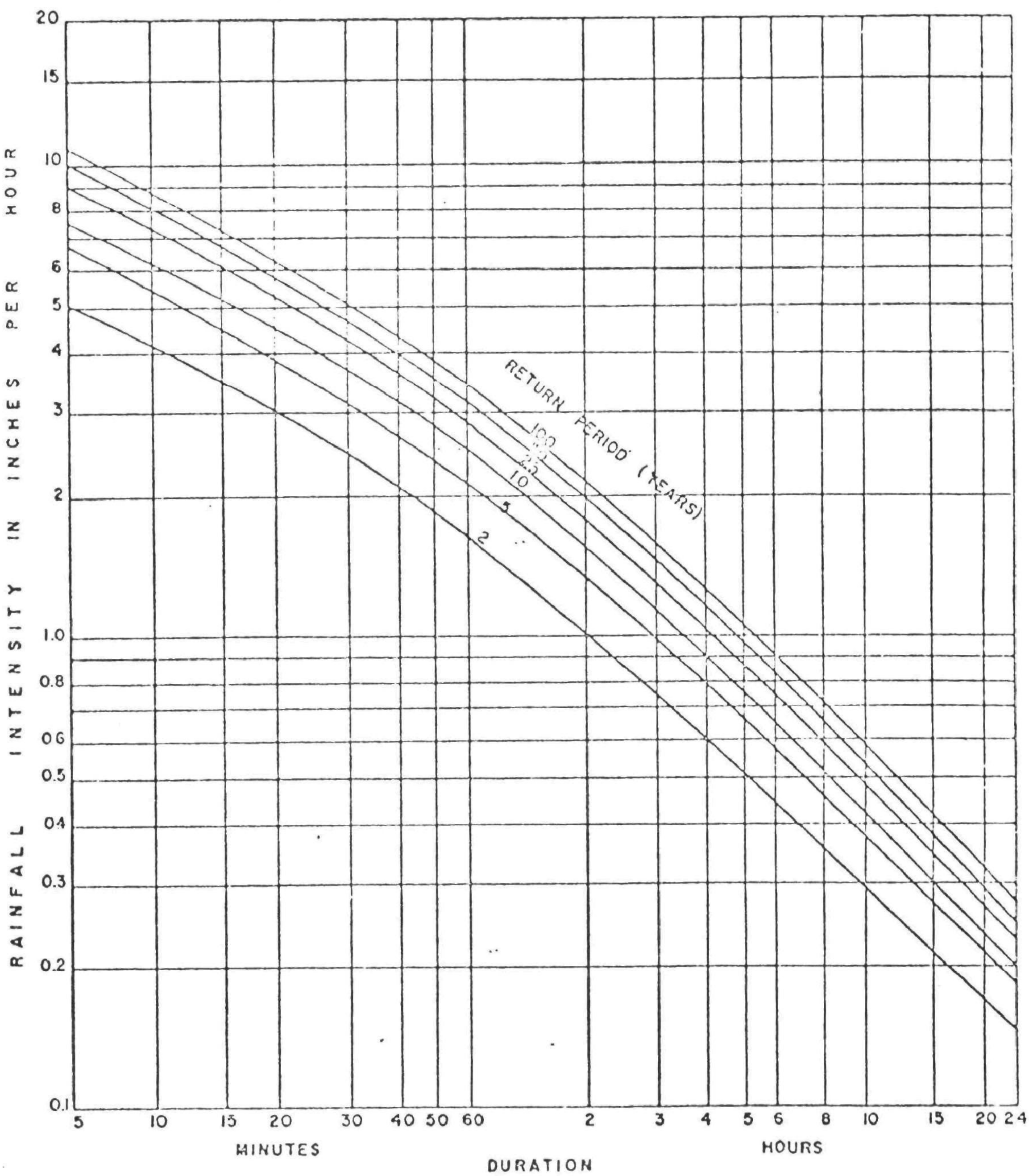
(1) Atlanta Airport Station Records Official for Atlanta Area beginning December 1, 1934.

(2) Climatological Standard Normals (1931 – 1960).

(3) Maximum 24-hour precipitation on record: 7.36 inches, March 1886.

T = Traces

Source: U.S. Department of Commerce, Environmental Science Services Administration



SOURCE: U.S. WEATHER BUREAU
TECHNICAL PAPER NO. 25

PERIOD OF RECORD: 1903 - 1951
FREQUENCY ANALYSIS BY METHOD OF EXTREME VALUES, AFTER GUMBEL.

CITY OF ATLANTA, GEORGIA
RAINFALL INTENSITY-DURATION-FREQUENCY CURVES

DATA CARDS LAYOUTS

PARAMETER FACTOR CARDS

NO. FMT I2. CC 1-2	DESCRIPTION 5A4 CC 3-22	CNT OR LBS/CURB MILE F10.1 CC 23-30
01	BOD5	2.0
02	COD	13.2
03	TOTAL SOLIDS	430.0
04	VOLATILE SOLIDS	18.0
05	TOTAL COLIFORMS	3200C.0E+6
06	FECAL COLIFORMS	2900.0E+6
07		
08		
09		
10		
11	PHOSPHATES	.26
12	KJELDAHL NITROGEN	.5
13	NITRATES	.024
14		
15		
16		
17		
18		
19		
20	ZINC	.11
21	COPPER	.066
22	LEAD	.077
23	NICKEL	.021
24	MERCURY	.023
25	CHROMIUM	.011
26	CADMIUM	.0031
27		
28		
29		
30	DIELDRIN	24.0E-6
31	PCB	65.0E-6
32	P-DDT	34.0E-6
33	METH-OXYCHLOR	.0
34	P,P-DDT	13.0E-6
35	ENDRIN	.0
36	METHYL PARATHION	.0
37	LINDANE	.0
38		
39		
40		

CARD ORDER FOR RUNS.

RUN #1 – CURRENT	RUN #2 – PREDICTED
1. 40 FACTOR CARDS	40 FACTOR CARDS
2. 2-21 AREA CARDS SET 1	2-21 AREA CARDS SET 2
3. 1 BLANK CARD	1 BLANK CARD
4. 1 OR MORE STORM CARDS	1 OR MORE STORM CARDS

*NOTE – THE LAST AREA CARD IS FOR A WATERSHED TOTAL AND MUST HAVE A 1 IN COL 80 AND BLANKS FOR POPULATION AND ACRES.

AREA CARDS

AREA ID 10A4 (CC 1–40)	POP. F10.1 (CC 41–50)	ACRES F10.1 (CC 51–60)	A4 (CC 61–70)	I1 IND (CC 71–80)
SET 1				
DEMONSTRATION AREA #1	2500.0	5000.0	1970	
DEMONSTRATION AREA #2	6000.0	1500.0	1970	
DEMONSTRATION AREA #3	2000.0	2000.0	1970	
TOTAL AREA (1 + 2 + 3) – 1970 POP.	BLANK	BLANK	1970	1
BLANK CARD HERE				
SET 2				
DEMONSTRATION AREA #1	25000.0	5000.0	1990	
DEMONSTRATION AREA #2	30000.0	1500.0	1990	
DEMONSTRATION AREA #3	6000.0	2000.0	1990	
TOTAL AREA (1 + 2 + 3) – 1990 POP.	BLANK	BLANK	1990	1
BLANK CARD HERE				

STORM CARDS

RETURN YEARS (I3, CC 1–3)	INT. IN/HR. (F7.1, CC 4–10)	DURATION MINUTES (F10.1, CC 11–20)	R.O. FACTOR IMPERVIOUS AREAS (F10.1, CC 21–30)	R.O. FACTOR PERVIOUS AREAS (F10.1, CC 31–40)	ANNUAL RAINFALL INCHES (F10.1, CC 41–50)	ANNUAL SNOWFALL INCHES (F10.1, CC 51–60)	NO. DAYS WITH PRECIPITATION PER YEAR (F10.1, CC 61–70)	NO. OF FREEZING DAYS/YR. <33°F (F10.1, CC 71–80)
	.25	120.0	.90	.20	48.46	.1	107.0	73.0
2	1.0	120.0	.90	.20	48.46	.1	107.0	73.0
5	1.4	120.0	.90	.20	48.46	.1	107.0	73.0
10	1.6	120.0	.90	.20	48.46	.1	107.0	73.0
25	1.8	120.0	.90	.20	48.46	.1	107.0	73.0
50	2.0	120.0	.90	.20	48.46	.1	107.0	73.0
100	2.2	120.0	.90	.20	48.46	.1	107.0	73.0
1°								

ANNUAL RAINFALL, ANNUAL SNOWFALL, NO. DAYS WITH PRECIPITATION, NO. OF FREEZING DAYS: NOT REQUIRED

TABLE II-1. Surface Water Criteria for Public Water Supplies

Constituent or characteristic	Permissible criteria	Desirable criteria	Paragraph
Physical:			
Color (color units)	75	<10	1
Odor	Narrative	Virtually absent	2
Temperature [a]	do	Narrative	3
Turbidity	do	Virtually absent	4
Microbiological:			
Coliform organisms	10,000/100 ml [1]	<100/100 ml [1]	5
Fecal coliforms	2,000/100 ml [1]	<20/100 ml [1]	5
Inorganic chemicals:	(mg/l)	(mg/l)	
Alkalinity	Narrative	Narrative	6
Ammonia	0 5 (as N)	<0 01	7
Arsenic [a]	0 05	Absent	8
Barium [a]	1 0	do	8
Boron [a]	1 0	do	9
Cadmium [a]	0 01	do	8
Chloride [a]	250	<25	8
Chromium,[a] hexavalent	0 05	Absent	8
Copper [a]	1 0	Virtually absent	8
Dissolved oxygen	$\geq$4 (monthly mean) $\geq$3 (individual sample)	Near saturation	10
Fluoride [a]	Narrative	Narrative	11
Hardness [a]	do	do	12
Iron (filterable)	0 3	Virtually absent	8
Lead [a]	0 05	Absent	8
Manganese [a] (filterable)	0 05	do	8
Nitrates plus nitrites [a]	10 (as N)	Virtually absent	13
pH (range)	6 0-8 5	Narrative	14
Phosphorus [a]	Narrative	do	15
Selenium [a]	0 01	Absent	8
Silver [a]	0.05	do	8
Sulfate [a]	250	<50	8
Total dissolved solids [a] (filterable residue).	500	<200	16
Uranyl ion [a]	5	Absent	17
Zinc [a]	5	Virtually absent	8
Organic chemicals:			
Carbon chloroform extract [a] (CCE)	0 15	<0 04	18
Cyanide [a]	0 20	Absent	8
Methylene blue active substances [a]	0 5	Virtually absent	19
Oil and grease [a]	Virtually absent	Absent	20
Pesticides:			
Aldrin [a]	0 017	do	21
Chlordane [a]	0 003	do	21
DDT [a]	0 042	do	21
Dieldrin [a]	0 017	do	21
Endrin [a]	0 001	do	21
Heptachlor [a]	0 018	do	21
Heptachlor epoxide [a]	0 018	do	21
Lindane [a]	0 056	do	21
Methoxychlor [a]	0 035	do	21
Organic phosphates plus carbamates.[a]	0 1 [2]	do	21
Toxaphene [a]	0 005	do	8
Herbicides			
2,4-D plus 2,4,5-T, plus 2,4,5 TP [a]	0 1	do	21
Phenols [a]	0 001	do	8
Radioactivity:	(pc/l)	(pc/l)	
Gross beta [a]	1,000	<100	8
Radium 226 [a]	3	<1	8
Strontium 90 [a]	10	<2	8

[a] The defined treatment process has little effect on this constituent

[1] Microbiological limits are monthly arithmetic averages based upon an adequate number of samples Total coliform limit may be relaxed if fecal coliform concentration does not exceed the specified limit

[2] As parathion in cholinesterase inhibition It may be necessary to resort to even lower concentrations for some compounds or mixtures See par 21

```
C     M.A. TRUE - EPA 5/25/73.
C     PROGRAM RUNOFF-EIS.
      DIMENSION NAME(10),INI(40),INV(40,5),PCMI(40),XLB(40),XMGL(40)
      DIMENSION NAMM(21,10),POPM(21),ACREM(21),IND(21),NPOPY(21)
      DO 9 I=1,40
      READ(5,8) INI(I),(INV(I,J),J=1,5),PCMI(I)
    8 FORMAT(I2,5A4,F10.1)
    9 CONTINUE
      POPT = 0.0
      ACRET = 0.0
      DO 911 I=1,21
   10 READ(5,11) (NAMM(I,J),J=1,10),POPM(I),ACREM(I),NPOPY(I),IND(I)
   11 FORMAT(10A4,2F10.1,5X,A4,9X,I1)
      POPT = POPT + POPM(I)
      ACRET = ACRET + ACREM(I)
      IF(POPM(I)) 611,611,911
  611 IF(IND(I).EQ.0) GO TO 912
  911 CONTINUE
  912 READ(5,12,END=99)IY,XINT,XDURM,CIMPA,CPVA,XRFAN,XSFANN,XPRDA,XFRDA
   12 FORMAT(I3,F7.1,7F10.1)
      AIA = 0.0
      CBL = 0.0
      DO 60 N=1,21
      IF(IND(N).EQ.1) GO TO 712
      GO TO 713
  712 POPM(N) = POPT
      ACREM(N) = ACRET
      CURBL = CBL
      AIMPA = AIA
      AIMPP = (AIA * 100.0) / ACRET
  713 CONTINUE
      IF(POPM(N)) 912,912,913
  913 POP = POPM(N)
      ACRES = ACREM(N)
      DO 914 I=1,10
      NAME(I) = NAMM(N,I)
  914 CONTINUE
      WRITE(6,13) (NAME(I),I=1,10)
   13 FORMAT(1H1,'INFORMATION COVERING   ',10A4)
      WRITE(6,513) IY
  513 FORMAT(1H ,'RETURN YEARS = ',I3//)
      DO 14 I=1,40
      XLB(I) = 0.0
      XMGL(I)= 0.0
   14 CONTINUE
      POPDA = POP / ACRES
      P = POP
      PD = POPDA
      IF(IND(N).EQ.1) GO TO 714
C     CALCULATE CURB LENGTH IN MILES.
      CURBL =(423.7 - (420.8* (0.6797 ** POPDA))) * ACRES / 5280.
      CBL = CBL + CURBL
C     CALCULATE IMPERVIOUSNESS IN %.
      AIMPP =( 91.32 - (69.34 * (0.9309 ** POPDA)))
      AIMPA = AIMPP * ACRES * .01
      AIA = AIA + AIMPA
C     CALCULATE QUANTITY Q FOR THIS AREA.
  714 CONTINUE
      APA  = ACRES - AIMPA
      T= XDURM * 60.
      CEO=((CIMPA * AIMPA)+(CPVA * APA))/ACRES
      QCFS = CEO * XINT * ACRES
      QUAN = QCFS * T
      RO15 = QUAN * 15.0 / XDURM
      XEQC = RO15 / .9
      QMG = QUAN * 7.48 / 1000000.0
      QACFT = QUAN / 43560.0
      QL =  XEQC * 7.48 * 231.* 16.39 * .001
      MGILB = 453.6 * 1000.0
      WRITE(6,15) NPOPY(N),P,PD, ACRES,CURBL,AIMPP,AIMPA,XINT,XDURM,
     1XRFAN,XSFANN,XPRDA,XFRDA,QCFS,QACFT,QUAN,RO15
   15 FORMAT(1H ,'POPULATION-',A4,3X,F10.1/
     *       1H ,'POP. DENSITY/ACRE',F10.1/1H ,'AREA ACRES       ',F10.1
     1,/     1H ,'MILES OF CURB    ',F10.1/1H ,'% IMPERVIOUSNESS ',F10.1
     2,/     1H ,'IMPERVIOUS ACRES ',F10.1/1H ,'RAIN INTENSITY   ',F11.2
     3,/     1H ,'DURATION MIN.    ',F10.1/1H ,'ANN. RAINFALL IN.',F10.1
     4,/     1H ,'ANN. SNOWFALL IN.',F10.1/1H ,'PRECIP. DAYS/YR. ',F10.1
     5,/     1H ,'FRZ. DAYS/YR.    ',F10.1/1H ,'RUNOFF CFS      ',F13.1
     6,/     1H ,'RUNOFF ACRE-FT.  ',F10.1/1H ,'RUNOFF CU. FT.',F13.1
     7,/     1H ,'R.O. C.F. 15 MIN.',F10.1///)
C     CALCULATE POUNDS,COUNTS,MG/L AND COUNTS/100 ML.
      DO 29 I=1,40
      IF(PCMI(I))29,29,21
   21 XLB(I) = PCMI(I) * CURBL
      XMGL(I)=(XLB(I) * MGILB) / QL
   29 CONTINUE
      XMGL(5) = XLB(5) / (QL * 10.0)
      XMGL(6) = XLB(6) / (QL * 10.0)
C     WRITE BODY LINES.
      WRITE(6,30)
   30 FORMAT('                   COEFFICIENTS  TOTAL LOAD  <<CONC.INIT. 1
     *5 MIN.>>')
      WRITE(6,31)
   31 FORMAT(' PARAMETER        CNT OR LBS/CM CNT OR LBS    MG/L*  CNT/1
     100 ML'/)
      DO 59 I=1,40
      IF(PCMI(I)) 59,59,33
   33 IF(I-6) 34,34,40
   34 IF(I-5) 40,36,36
   36 WRITE(6,37) (INV(I,J),J=1,5),PCMI(I),XLB(I),XMGL(I)
   37 FORMAT(1H ,5A4,2F10.3,10X,F10.1)
      GO TO 59
   40 IF(I-11) 51,41,44
   41 WRITE(6,42)
   42 FORMAT('0**NUTRIENTS**'/)
   44 IF(I-20) 51,45,48
   45 WRITE(6,46)
   46 FORMAT('0**METALS**'/)
   48 IF(I-30) 51,49,51
   49 WRITE(6,50)
   50 FORMAT('0**PESTICIDES**'/)
   51 WRITE(6,52) (INV(I,J),J=1,5),PCMI(I),XLB(I),XMGL(I)
   52 FORMAT(1H ,5A4,3E10.3)
   59 CONTINUE
      WRITE(6,61)
   61 FORMAT('0 *NOTE CONC. ASSUMED 90% WASHOFF OF CONTAMINANTS IN 15 MI
     *N.')
   60 CONTINUE
      GO TO 912
   99 CALL EXIT
      END
```

EXHIBIT 9

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2. "Storm and Combined Sewer Pollution Sources and Abatement - Atlanta, Georgia" EPA 11024 ELB January 1971, by Black, Crow and Eidsness, Inc. Consulting Engineers, Atlanta, Georgia.

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5. "Interim Report on Three Rivers Study Water Quality Management Plan for City of Atlanta, Atlanta, Georgia" by Black, Crow and Eidsness, Inc. Engineers, Atlanta, Georgia, May 1973.

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7. "Concrete Pipe Handbook", 1967, by Howard F. Peckworth, American Concrete Pipe Association, 1815 North Fort Myer Drive, Arlington, Virginia 22209.

8. "Weather Data Analyses of the University of Georgia College of Agriculture Experiment Stations", February 1970 Report 66 by F. L. Crosby, H. S. Carter, B. H. Quattlebaum, Jr. and Sam Burgess.

9. Municipal Water Works, Weather Bureau Stations at Airports, Consulting Engineers and Governmental Public Works Departments can supply various types of historical information.