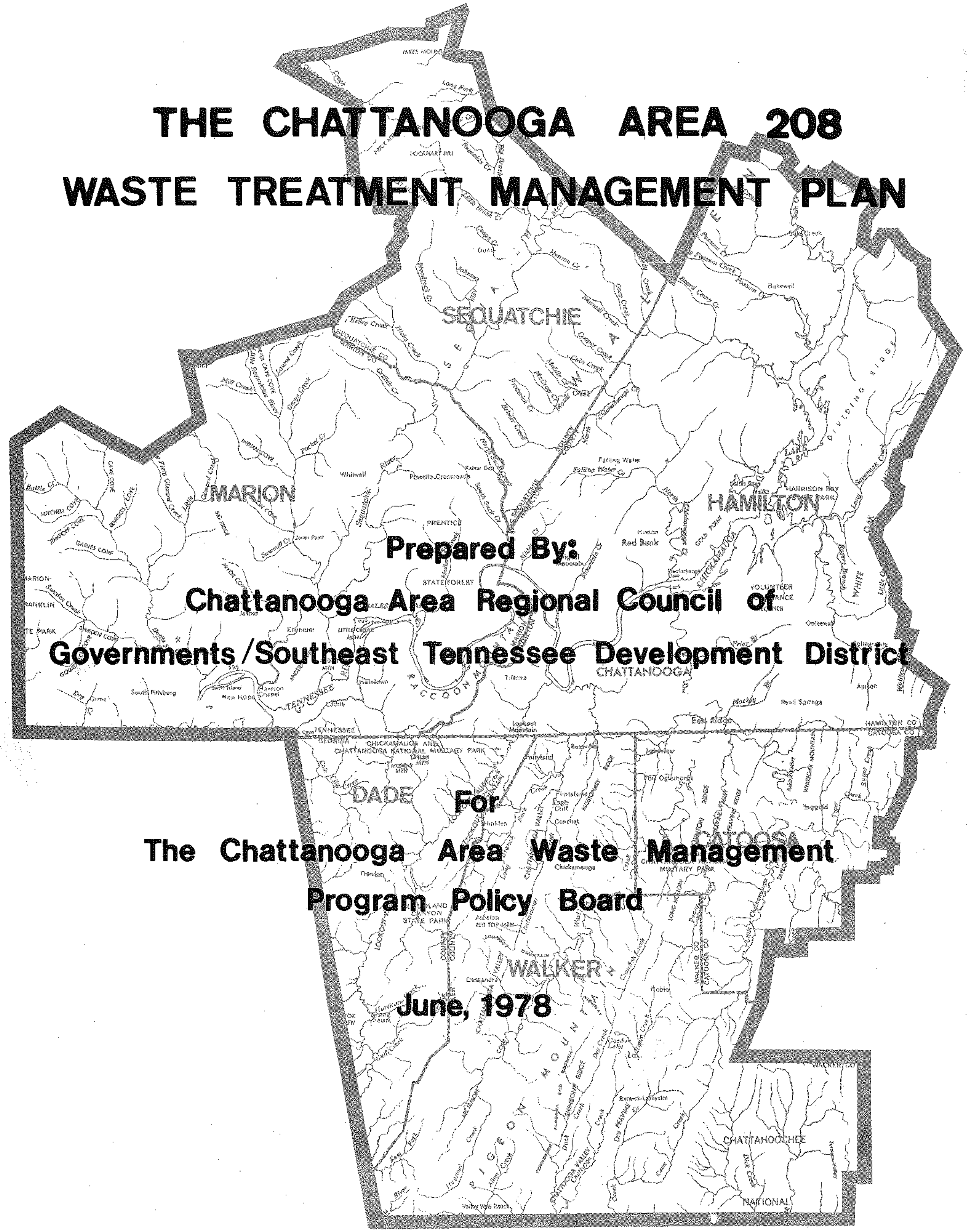
THE CHATTANOOGA AREA 208 WASTE TREATMENT MANAGEMENT PLAN



Prepared By:

Chattanooga Area Regional Council of Governments/Southeast Tennessee Development District

For

The Chattanooga Area Waste Management Program Policy Board

June, 1978

MELLENCAMP

THE CHATTANOOGA 208 AREAWIDE

WASTE TREATMENT MANAGEMENT PLAN

Final Document Preparation By

TenEch Environmental Consultants, Inc.

June, 1978

This report was prepared under a grant from the U.S. Environmental Protection Agency.

PREFACE

The Chattanooga 208 Areawide Waste Treatment Management Plan marks the culmination of more than two years of effort coordinated by the Chattanooga Area Regional Council of Governments/Southeast Tennessee Development District for the Chattanooga Area Waste Management Program Policy Board. This Policy Board consists of the thirty-three chief elected local officials with Commissioner Roy Parrish of Walker County, Georgia serving as Chairman and Mayor Charles A. Rose of Chattanooga serving as Vice Chairman.

Contributory to the development of the plan and/or aspects of program documentation include, but are not limited to: Chattanooga-Hamilton County Regional Planning Commission; Coosa Valley Area Planning and Development Commission; Tennessee State Planning Office; Water Quality Division of Tennessee Department of Public Health; Environmental Protection Division of Georgia Department of Natural Resources; Tennessee Valley Authority; TenEch Environmental Consultants, Inc; Hensley-Schmidt, Inc.; The Research Group, Inc.; The University of Tennessee at Chattanooga; the Chattanooga-Hamilton County Air Pollution Control Bureau; the USDA Soil Conservation Service; Local Soil Conservation Districts; and Environmental Services, Inc.

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CHAPTER I - INTRODUCTION

I
INTRODUCTION

A. PURPOSE, REQUIREMENTS, AND PLAN GOALS

The 208 Areawide Waste Treatment Management Plan for the six county Chattanooga area, which is part of the Chattanooga Area Regional Council of Governments/Southeast Tennessee Development District (CARCOG/SETDD), was prepared pursuant to the requirements of Section 208 of the 1972 Federal Water Pollution Control Act (Public Law 92-500). Through Section 208, Congress intended that water quality management planning be carried out on an areawide basis and that it investigate, evaluate, and prepare a comprehensive plan to control all sources of water pollution for a mandated 20 year planning period.

Two major goals of the Act, upon which the investigation, analysis, and control requirements and recommendations of this Plan are premised, are that:

- The discharge of pollutants into navigable waters of the Nation be eliminated by 1985.

- Wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water be achieved by July 1, 1983 (Section 101 (a) PL 92-500).

Two additional and significant requirements of the Act are that:

- By July 1, 1977, all publicly owned wastewater treatment works must provide at least secondary treatment and that industrial wastewater discharges must provide "best practicable" wastewater treatment.

- By July 1, 1983, all publicly owned wastewater treatment facilities and all industrial discharges provide "best available" wastewater treatment technology economically available (Section 301 (b) PL 92-500).

It should be noted that both "best practicable" and "best available" are terms that are not well defined. For the purpose of this Plan, it is assumed that the 1977 requirements of secondary treatment for publicly owned systems and "best practicable technology" as defined in the Federal Regulations for private dischargers are the minimum treatment levels required. Since it is impossible to predict accurately the future definition of "best practicable technology" that may be applied to publicly owned systems and "best available technology" that may be applied to private dischargers to meet the 1983 requirements, it is left to the required continuing planning process and the annual Plan revision to incorporate such definitions into, and make necessary changes in the Plan.

It should also be noted that the 1977 amendments to the Clean Water Act require the implementation of best conventional pollutant control technology by all nonpublicly owned wastewater treatment works by July 1, 1984.

With the above major goals and requirements in mind, this Plan has addressed sixteen (16) planning elements required by the Section 208 regulations, 40 CFR 131, November 28, 1975, Section 131.11 (a)(p). They include:

- Establishing planning boundaries
- Water quality assessment and proposing water quality segment classification for area streams
- Wastewater, demographic, and land use inventories and projections
- Nonpoint source assessment
- Reviewing water quality standards
- Developing total maximum daily loads of pollutants
- Point source load allocations or reviews
- Municipal waste treatment system needs
- Industrial waste treatment system needs
- Nonpoint source control needs
- Residual waste and land disposal control needs
- Urban and industrial stormwater system needs
- Target abatement dates
- Regulatory programs
- Management agencies identification
- Environmental, social, and economic impact assessment of the Plan

Each of these items is developed in greater detail in subsequent sections of the Plan. The following section of this chapter contains a table indicating the location of each required planning element in the Plan. Planning elements associated with developing total maximum daily loads of pollutants and point source waste load allocations or reviews were not delegated to CARCOG/SETDD and remain the responsibility of the states of Georgia and Tennessee.

The CARCOG/SETDD 208 Areawide Waste Treatment Management Plan has adopted the Federal Goals of PL 92-500. As an immediate objective, CARCOG/SETDD has undertaken the development of the most practical and cost-effective plan that addresses the aforementioned goals by incorporating the following three basic principles:

Protection

To use essentially nonstructural controls as an environmentally sound, relatively unexpensive means of preventing water pollution.

Maintenance

To maximize the efficiency and effectiveness of existing wastewater control systems.

Construction

Where water quality problems are too severe to solve by either prevention or maintenance methods, to employ structural controls for wastewater treatment. Typically, structural solutions are the most expensive means of dealing with wastewater problems.

These principles recognize both environmental protection and cost, and provide what is deemed to be reasonable criteria by which to select various levels of water quality control.

B. PLANNING PROCESS

CARCOG/SETDD was designated an areawide water quality management planning agency on October 10, 1974. A grant of $949,000 was received from the U.S. Environmental Protection Agency, effective June 5, 1975, to develop the CARCOG/SETDD 208 Areawide Waste Treatment Management Plan. The original grant period ended October 10, 1977. Two time extentions totalling nearly nine (9) months were granted CARCOG/SETDD for completion of the plan. These extensions were accomplished within the scope of the original grant amount.

The planning area is situated in a portion of the Lower Tennessee River Basin and includes the three southeastern Tennessee counties of Hamilton, Marion, and Sequatchie and the northeastern Georgia counties of Catoosa, Dade, and Walker. Figure I-1 provides the general location of the CARCOG/SETDD Areawide Waste Treatment Management Plan Study Area. Figure I-2 displays the actual 208 planning boundaries. It should be noted that the southern portion of Walker County, as indicated in Figure I-2, is not included in the CARCOG/SETDD 208 Study Area because it lies within the Coosa River Basin; however, Figures contained in subsequent Chapters of this plan may illustrate Walker County in its entirety since the data base utilized in the development of this plan was primarily assembled on a county-by-county basis.

The planning process involved a start-up period and ten broad work element areas which facilitated the development of the final CARCOG/SETDD 208 Areawide Waste Treatment Management Plan. The following summarizes the plan of study:

Start-up

Select consultants, establish citizens advisory and technical advisory committees, review existing river basin plans, and define area water quality problems.

Work Element 100

Data and Information Requirements - assembly of baseline data including population, employment, water demand, waste flows, existing water quality, environmental conditions, point and nonpoint sources, and local regulations and ordinances.

Work Element 200

Land Use and Policies - review existing land use, economic development, related plans, and policies, and develop land use options.

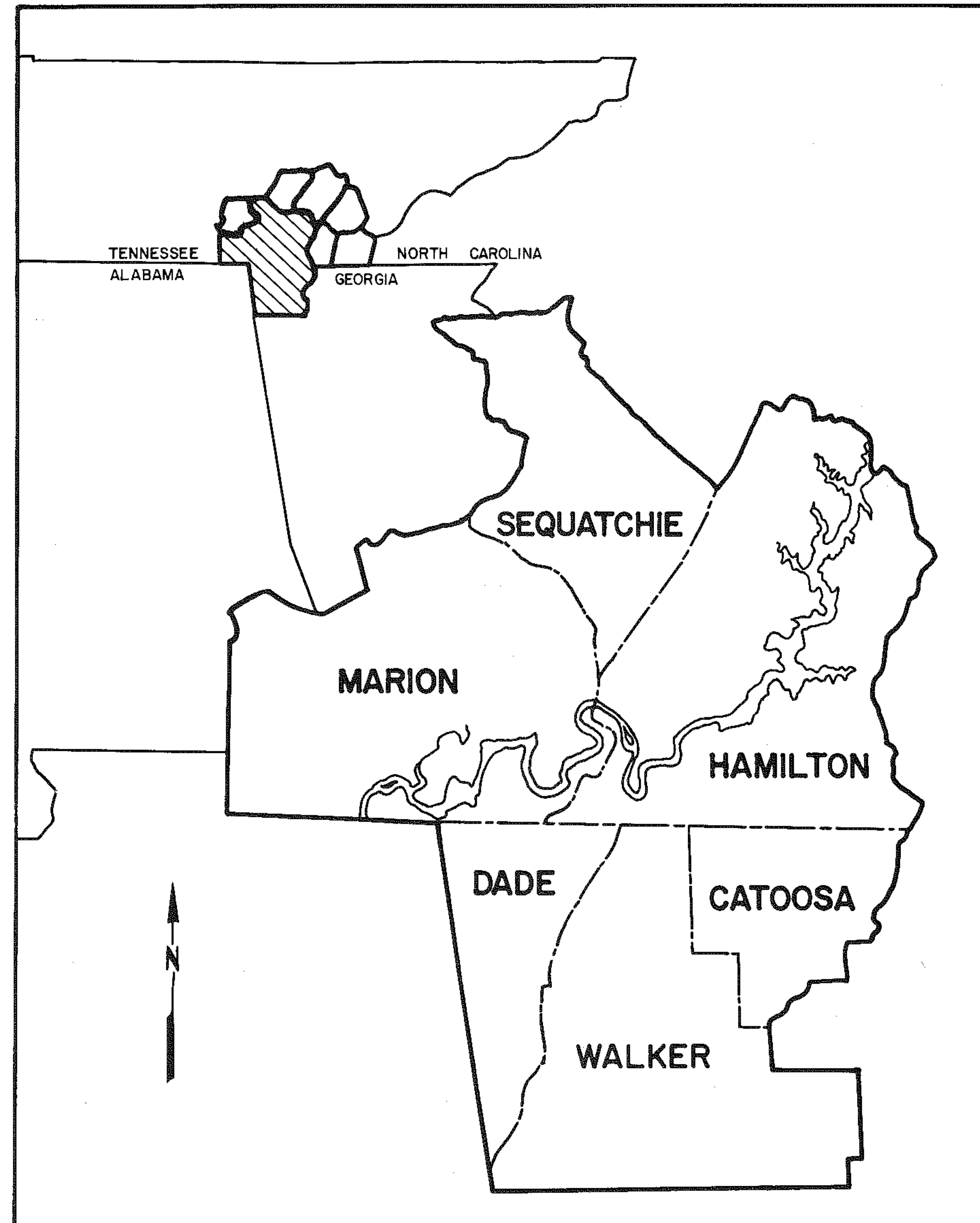


FIGURE I-1

LOCATION MAP

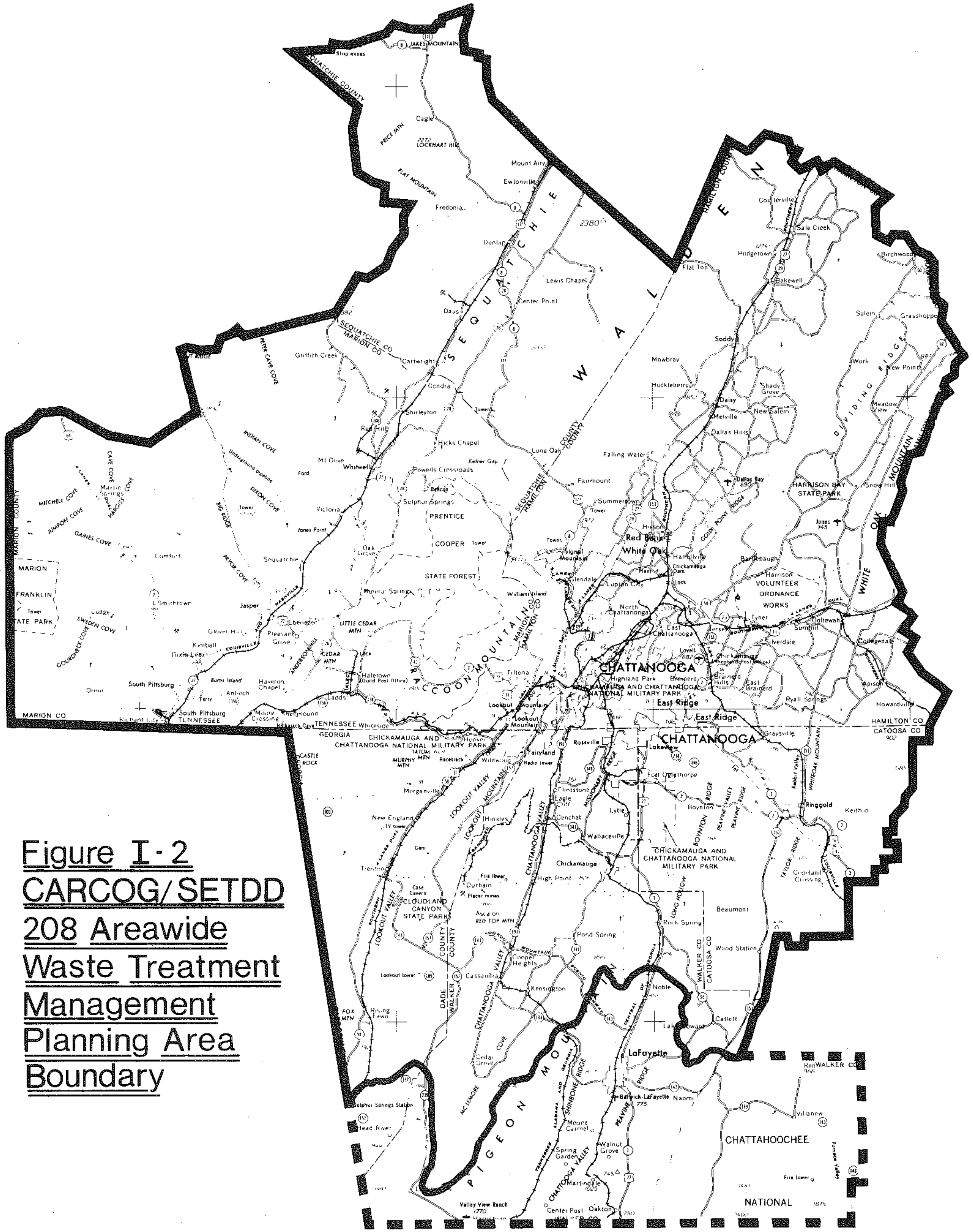


Figure I-2
CARCOG/SETDD
208 Areawide
Waste Treatment
Management
Planning Area
Boundary

Work Element 300

Urban Runoff Analysis - analyze and evaluate existing and future impacts of urban stormwater runoff on water quality, and develop control options.

Work Element 400

Point Source Analysis - summarize facilities planning alternatives, projected costs, impacts, land requirements, and wastewater flows.

Work Element 500

Rural Runoff Analysis - establish hydrological geologic boundaries; identify control options and best management practices; evaluate control options for water quality impacts; and develop priority and scheduling for implementation of best management practices.

Work Element 600

Solid Waste and Residuals Management Analysis - inventory and site analysis of landfills and dumps; define alternative techniques to control leachate problems; inventory industrial chemicals and sludges; and define management techniques for problem wastes.

Work Element 700

Regional Water Quality Management Analysis - evaluate potentials and constraints to coordinated water quality management approaches; identify existing legally authorized coordinated management options; recommend revision to and/or new enabling legislation; and analyze existing financial capabilities of local governments to undertake new management arrangements.

Work Element 800

Management Plan Analysis - define management priorities and constraints; prepare alternative areawide management approaches; and select areawide management alternatives based on such management criteria as required by Sections 204 and 208 of PL 92-500.

Work Element 900

Plan Refinement and Implementation - develop proposed final CARCOG/SETDD Areawide Waste Treatment Management Plan from the various selected technical and management subplans; prepare environmental assessment of the plan and alternatives; and identify costs, financial arrangements, and plan implementation schedule.

Work Element 1000

Public Participation - define responsibilities and requirements for public participation; design information flow systems; develop citizen feedback system; conduct briefings for the policy board; design information brochure, A-V presentation, and speakers bureau; hold public hearings; and produce quarterly newsletter.

Table I-1 indicates where the outputs of these work elements are included in this document. Table I-2 provides a reference for the sixteen (16) required planning elements per 40 CFR 131, November 28, 1975, Section 131.11 (a)(p) with regard to this plan. It should also be noted that a description of chapter contents is contained in Section C of this chapter.

C. THE PLAN

The remaining ten chapters contain descriptions and documentation of major elements of the 208 planning process, as well as the required and recommended components of the Plan. The contents of the following chapters are summarized below.

Chapter II - Background Information: contains the land use, population and employment inventories and projections developed in the CARCOG/SETDD Regional Development Plan - 2000. Projections are provided for the years 1980, 1985, 1990, 1995, and 2000.

Chapter III - Receiving Waters: discusses major streams, stream segments, stream segment classifications, total maximum daily loads for water quality limited segments, and stream standards. Additionally, a discussion of all surface drinking water intakes in the 208 area is presented with special attention focused on the problems associated with the Tennessee-American Water Company's intake.

Inventories and projections for municipal and domestic point sources are provided, as well as an inventory of existing industrial point sources. NPDES permit information is provided for all point source discharges along with a discussion of additional water quality considerations including the water quality impact of low dissolved oxygen discharges from the Chickamauga Dam, the Sequoyah Nuclear Plant, and the Raccoon Mountain Pumped Storage Plant.

Chapter IV - Municipal Point Source Areawide Plan: provides municipal control options and the selected areawide municipal point source plan. Regional priorities and costs associated with implementing this portion of the CARCOG/SETDD Areawide Waste Treatment Management Plan are presented.

Chapter V - Industrial Point Source Areawide Plan: implementation of "Best Practicable Treatment" (BPT) by 1977, "Best Available Treatment" (BAT) by 1983, and "Best Conventional Pollutant Control Technology" (BCT) by July 1, 1984 is established as the preferred industrial point source areawide plan. BPT, BAT, and BCT options available to the area's industries are presented, as well as projected future industrial waste flows.

TABLE I-1

INDEX FOR PLAN OF STUDY WORK ELEMENT GROUPINGS IN THE CARCOG/SETDD 208 PLAN

Work Element Group	Plan Chapter(s)	Content
100 - Data and Information Requirements	II - Background Information	Land use, population and employment inventories and projections - tables.
	III - Receiving Waters	Municipal, industrial, and domestic dischargers section.
	VII - Rural Runoff Areawide Plan	Rural nonpoint source inventory section.
	VIII - Residuals Wastes Areawide Plan	Residual wastes inventory (i.e., disposal sites map and discussion).
	IX - Areawide Management Plan	Existing management systems section.
200 - Land Use Plans	VI - Urban Runoff Areawide Plan VII - Rural Runoff Areawide Plan	Outputs from W.E. 200 were considered in the development of urban and rural runoff control options.
300 - Urban Runoff Analysis	III - Receiving Waters	Additional water quality considerations and stream standards sections.
	VI - Urban Runoff Areawide Plan	Information generated under W.E. 300 was used in the development of all sections of Chapter VI.
400 - Point Source Analysis	IV - Municipal Point Source Areawide Plan	Municipal control options, municipal point source null alternative, and preferred alternative sections.
500 - Rural Runoff Analysis	VII - Rural Runoff Areawide Plan	Information generated under W.E. 500 was used in the development of all sections of Chapter VII.

TABLE I-1

INDEX FOR PLAN OF STUDY WORK ELEMENT GROUPINGS IN THE CARCOG/SETDD 208 PLAN (Continued)

Work Element Group	Plan Chapter(s)	Content
600 - Solid Waste Residuals Analysis	VIII - Residual Wastes Areawide Plan	Information generated under W.E. 600 was used in the development of all sections of Chapter VIII.
700 - Regional Water Quality Management Analysis	IX - Areawide Management Plan	Null and preferred areawide management plan sections.
800 - Management Plan Analysis	IX - Areawide Management Plan	Management system options, null and preferred management plan sections.
900 - Plan Refinement and Implementation	III - Receiving Waters	Major stream, stream segment classification, and ground and surface water quality sections.
	VIII - Residual Wastes Areawide Plan	Residual wastes, null and preferred alternatives sections.
	IX - Areawide Management Plan	Continuing planning process section.
1000 - Public Participation	X - Public Participation	Public participation efforts are documented in the first two sections and continuing activities are addressed in the third section of Chapter X.

TABLE I-2

INDEX FOR REQUIRED PLANNING ELEMENTS PER 40 CFR 131, SECTION 131.11(a)(p)

Required Element	Location
Establish Planning Boundaries	I - Introduction, Section A
Water Quality Assessment and Segment Classification	III - Receiving Waters, Section B XI - Summary, Section E and Environmental Assessment
Wastewater Inventories and Projections and Demographic and Land Use Projections	III - Receiving Waters, Section F II - Background Information, Sections B, C, and D
Nonpoint Source Assessment	VI - Urban Runoff Areawide Plan, Section B VII - Rural Runoff Areawide Plan, Section B
Water Quality Standards	III - Receiving Waters, Section G
Total Maximum Daily Loads	This element was reserved by Georgia DNR and Tennessee DPH and was not delegated to CARCOG/SETDD.
Point Source Load Allocations	Same as above.
Municipal Waste Treatment System Needs	IV - Municipal Point Source Areawide Plan, Section C
Industrial Waste Treatment System Needs	V - Industrial Point Source Areawide Plan, Section C
Nonpoint Source Control Needs	VI - Urban Runoff Areawide Plan, Sections E and F VII - Rural Runoff Areawide Plan, Sections E and F
Residual Waste Control Needs; Land Needs	VIII - Residual Wastes Areawide Plan, Sections E and F
Urban and Industrial Stormwater System Needs	VI - Urban Runoff Areawide Plan, Sections E and F
Target Abatement Dates	Contained in last section of Chapters IV, V, VI, VII, VIII, and IX.
Regulatory Programs	IX - Areawide Management Plan, Section C
Management Agencies	IX - Areawide Management Plan, Section C
Environmental, Social, Economic Impact	Environmental Assessment

Chapter VI - Urban Runoff Areawide Plan: discusses the urban runoff modeling effort including model selection, and the urban subareas and loading factors utilized. Chapter VI further presents the areawide urban runoff null alternative with the resultant wet weather water quality conditions and the preferred areawide urban runoff alternative plan which includes both structural and nonstructural control measures. Finally, Chapter VI provides priorities and project costs for implementing the preferred areawide urban runoff plan.

Chapter VII - Rural Runoff Areawide Plan: contains an inventory of rural nonpoint sources of water pollution with graphics illustrating location and size of various sources. Best Management Practices (BMPs), for the control of rural nonpoint sources, are defined and unit costs provided. The null rural runoff alternative containing no additional nonpoint source regulatory programs, and the preferred areawide rural runoff plan incorporating both structural and nonstructural controls are presented. The recommended structural controls are presented in terms of concept, capacity, and type of construction proposed. Nonstructural controls are presented in tabular form and identified as those which can be initiated by governmental agencies and by the private sector. Chapter VII also contains maps depicting priority rural runoff areas, as well as project costs for implementing the rural runoff control plan.

Chapter VIII - Residual Wastes Areawide Plan: provides inventories of solid waste disposal sites and industrial residuals together with residual waste control options and associated costs. Major elements of this chapter are the residual wastes areawide null alternative and the preferred areawide residual wastes plan. The residual wastes null alternative projects residual waste control activities in the 208 area without implementation of new regulatory programs. The preferred residual wastes plan contains various recommendations for the control of water pollution from residual wastes together with priorities and costs for implementation.

Chapter IX - Areawide Management Plan: provides the method by which this plan's recommendations and requirements will be implemented. The first portion of Chapter IX contains the management system requirements as contained in Section 208 of PL 92-500. It further documents existing management systems and provides several management system options. A discussion of the null areawide management plan addresses projected management activities during the 20 year planning period under the existing management system. The major elements provided in this chapter include a detailed description of the preferred areawide management plan including necessary financial arrangements and a detailed description of the continuing planning process.

Chapter X - Public Participation: documents the scope of the 208 public participation program; provides information relating to the Policy Board meetings and the public hearings; and outlines those activities which will insure continued public input during the continuing planning process.

Chapter XI - Summary: provides summaries of the Point Source Areawide Plan, Nonpoint Source Areawide Plan, Areawide Management Plan, and the Environmental Assessment. Chapter XI also includes a composite map identifying all point, nonpoint, and residual waste sources in the study area. The composite map futher identifies priority rural runoff control areas, as well as treatment plants and residual disposal sites scheduled to be phased out during the planning period.

This proposed Final Plan has been distributed to all members of the Citizen Advisory and Technical Advisory Committees, the Policy Board, the United States Environmental Protection Agency (Region IV), the Georgia Department of Natural Resources, the Tennessee Department of Public Health, and participating Soil Conservation District Commissioners for review. Public hearings will be held on the Plan to receive public comment.

Federal regulations require that formal public notice of the public hearings be published in at least one area newspaper of general circulation not less than 30 days prior to the public hearing date. The regulations also require that the Plan be made available for public review for a reasonable length of time prior to the public hearings.

The impacts on the Chattanooga area expected as a result of Plan implementation can be summarized in two words: maintenance and prevention.

For the most part, existing environmental conditions will be maintained. The elimination of several municipal point source discharges will have a positive impact on water quality in receiving streams in the immediate area of those discharges, in other areas water quality will be maintained or somewhat improved over the 208 planning period.

Soil erosion and resultant sedimentation will be prevented through the implementation of the rural runoff control portion of the plan. It should be noted, however, that the rural runoff control plan utilizes a voluntary approach to control, and the impact (i.e., success of this portion of the Plan) will be dependent upon the participation of the rural citizenry. Further, rural runoff control activities in the Georgia portion of the 208 area must be coordinated through and receive the approval of the Georgia Environmental Protection Division prior to implementation.

Impacts on land use and economic development will be minimal but are considered to be positive in that public services may become more readily available, and the overall environmental conditions in the CARCOG/SETDD 208 planning area will be improved.

CHAPTER II - BACKGROUND INFORMATION

II
BACKGROUND INFORMATION

A. INTRODUCTION

The purpose of this chapter is to provide a description of both the present and projected land use, population, and employment trends in the CARCOG/SETDD 208 Areawide Waste Treatment Management Planning Area. The information presented will provide the baseline data against which the various alternative management plans will be compared and evaluated.

B. LAND USE

The method of land utilization within an area, as determined by local land management practices, may significantly affect the quality of water in receiving streams serving the area. The development of industrial, residential, or resource recovery areas often determines the quantity and quality of discharges to the receiving streams in these areas from both point and nonpoint sources. Correspondingly, land use policies and controls regulating land development may often directly control the waste loads that must be ultimately assimilated by receiving streams. Community growth may be directed toward a balanced system of urban and environmental compatibility through effective land use controls and policies; however, random and uncoordinated growth more commonly precedes the establishment of metropolitan areas, often to the detriment of both the urban community and the natural environment. The following discussion identifies the existing and future land use patterns as they pertain to the CARCOG/SETDD 208 Study Area.

Figure II-1 (enclosure) displays the existing land use patterns within the 208 study area, while Table II-1 summarizes the acreages devoted to the six land use categories listed below.

- Forest lands
- Farm lands
- Water
- Roads
- Urban areas
- Barren land

These acreages were computed with data from the National Forest Service, U. S. Bureau of the Census, Tennessee Valley Authority, Tennessee and Georgia Departments of Transportation, Tennessee State Planning Office, and high altitude aerial photography.

According to Table II-1, the study area is comprised primarily of nonurban land uses i.e., forests, agriculture, open space, and barren land. Forests cover approximately 68.5 percent of the total six county area with particularly large acreages of forest land located in Marion, Hamilton, Walker, and Sequatchie Counties. The major agricultural region of the area traverses Marion and Sequatchie Counties in a southwestern-to-northeastern fashion. This farming area is the largest contiguous area

TABLE II-1

EXISTING LAND USE OF THE CARCOG/SETDD 208 STUDY AREA BY ACREAGE, 1975

County	Total Acreage	Open Space: Forest Acreage	Open Space: Farm Acreage	Open Space: Water Acreage	Developed: Road R-O-W	Developed: Urban Area	Developed: Barren Land
Hamilton	375,680	199,385	46,785	23,424	19,289	85,558	1,239
Marion	329,664	252,323	52,207	11,200	6,268	4,239	3,427
Sequatchie	174,720	143,362	23,617	--	2,989	2,048	2,704
Catoosa	106,900	67,556	28,994	--	3,766	6,584	--
Dade	107,500	82,809	19,045	--	3,487	2,159	--
Walker	284,800	199,073	65,444	--	7,231	13,052	--
CARCOG/SETDD 208 STUDY AREA	1,379,264	944,508	236,092	34,624	43,030	113,640	7,370

SOURCE: CARCOG/SETDD PLANNING STAFF

within the study area. Walker and Hamilton Counties also have large areas in the agricultural land use category with 65,444 acres and 46,785 acres, respectively. Barren areas are evident in the northern parts of Sequatchie and Marion Counties, and also are uniformly scattered throughout Hamilton County. Mining activities are identified in this barren land use category and are found primarily in Marion and Sequatchie Counties.

Land use development patterns are greatly influenced by the Chattanooga Metropolitan Area and the ridge and valley topography of the study area. In fact, the industrial, commercial, and residential activities within the planning area are centered in Chattanooga and extend outward from the core of the city to the surrounding valley hinterland. Major satellite nodes within the planning area include: Jasper, South Pittsburg, Whitwell, Dunlap, Trenton, and Ringgold.

A map depicting the generalized land use patterns within the 208 study area for the year 2000 are presented in Figure II-2 (enclosure), while Table II-2 presents the projected acreage requirements in five year increments (through the year 2000) for the five land use categories listed below.

- Forest and open space
- Agriculture
- Water
- Road right of way
- Urban settlement

These land use categories differ from those analyzed for the year 1975, since the year 2000 figures take into account the implementation of the land use development strategies recommended in the CARCOG/SETDD Regional Development Plan - 2000. This land use plan recommends a development strategy which would achieve a balanced growth between Chattanooga and the satellite cities, increase the quality of life, as well as promote conservation and development, while simultaneously providing a flexible and feasible means for coordination. To achieve these objectives, a satellite/corridor strategy was selected as the regional development framework. The plan also recommends a series of regional development policies that serve as general guides for local public officials in making decisions regarding development strategies. Such regional development policies were formulated for the following functional categories: housing, transportation, economic development, human resource development, public safety, recreation and cultural development, natural resource management, and services to property. A description of the regional land use policies related to the 208 water resources is outlined below.

- Public access should be provided at various points along the region's creeks and streams where feasible.
- Coordination of the review and revision of flood control studies in the region should be continued.
- Urban development, under all circumstances should not be allowed to occur within a floodway. In addition, development within floodplanes adjacent to floodways should be limited to low intensity uses such as parkways, public parks, playgrounds, agriculture, or open space. If direct acquisition of open space is not

TABLE II-2
PROJECTED LAND USE FOR THE CARCOG/SETDD 208 STUDY AREA

Jurisdiction	Forest and Open Space	%	AGRI.	%	Water	%	Road R.O.W.	%	Urban Settlement	%	Total	%
1980												
Hamilton	196,769	52.38	42,930	11.43	23,424	6.24	19,414	5.17	92,143	24.79	375,680	100
Marion	255,750	77.58	51,558	15.64	11,200	3.40	6,353	1.93	4,803	1.46	329,664	100
Sequatchie	146,066	83.60	23,382	13.38	--	0.00	3,020	1.73	2,252	1.29	174,720	100
Catoosa	67,309	62.96	28,501	26.66	--	0.00	3.861	3.61	7,229	6.76	106,900	100
Dade	82,809	77.03	18,166	16.90	--	0.00	3,601	3.35	2,924	2.72	107,500	100
Walker	198,085	69.55	64,950	22.81	--	0.00	7,424	2.61	14,341	5.04	284,800	100
1985												
Hamilton	193,090	51.39	40,633	10.82	23,424	6.24	21,447	5.71	97,086	25.84	375,680	100
Marion	255,750	77.57	50,699	15.38	11,200	3.40	6,782	2.06	5,233	1.59	329,664	100
Sequatchie	145,939	83.53	23,064	13.20	--	0.00	3,236	1.85	2,481	1.42	174,720	100
Catoosa	67,084	62.75	28,052	26.24	--	0.00	3,948	3.69	7,816	7.31	106,900	100
Dade	82,809	77.03	17,639	16.41	--	0.00	3,670	3.41	3,382	3.15	107,500	100
Walker	197,175	69.23	64,495	22.65	--	0.00	7,590	2.67	15,540	5.46	284,800	100
1990												
Hamilton	191,875	51.07	39,417	10.49	23,424	6.24	21,791	5.80	99,173	26.40	375,680	100
Marion	255,750	77.58	50,149	15.21	11,200	3.40	6,862	2.08	5,703	1.73	329,664	100
Sequatchie	145,939	83.53	22,721	13.00	--	--	3,281	1.88	2,779	1.59	174,720	100
Catoosa	66,849	62.53	27,582	25.80	--	--	4,039	3.78	8,430	7.89	106,900	100
Dade	82,809	77.03	17,098	15.91	--	--	3,741	3.48	3,852	3.58	107,500	100
Walker	196,223	68.90	63,979	22.46	--	--	7,919	2.78	16,679	5.86	284,800	100

TABLE II-2
PROJECTED LAND USE FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Jurisdiction	Forest and Open Space	%	AGRI.	%	Water	%	Road R.O.W.	%	Urban Settlement	%	Total	%
1995												
Hamilton	190,962	50.83	38,505	10.25	23,424	6.24	22,029	5.86	100,760	26.82	375,680	100
Marion	255,750	77.58	49,574	15.04	11,200	3.40	6,937	2.10	6,203	1.88	329,664	100
Sequatchie	145,939	83.53	22,680	12.98	--	0.00	3,286	1.88	2,815	1.61	174,720	100
Catoosa	66,688	62.38	27,261	25.50	--	0.00	4,101	3.84	8,850	8.28	106,900	100
Dade	82,809	77.03	16,812	15.64	--	0.00	3,778	3.51	4,101	3.81	107,500	100
Walker	195,633	68.69	63,685	22.36	--	0.00	8,034	2.82	17,448	6.13	284,800	100
2000												
Hamilton	190,100	50.61	37,513	9.99	23,424	6.24	23,077	6.14	101,566	27.03	375,680	100
Marion	255,750	77.58	49,001	14.86	11,200	3.40	7,012	2.13	6,701	2.03	329,664	100
Sequatchie	145,939	83.53	22,062	12.63	--	0.00	3,367	1.93	3,352	1.92	174,720	100
Catoosa	66,520	62.23	26,926	25.19	--	0.00	4,166	3.90	9,288	8.69	106,900	100
Dade	82,809	77.03	16,541	15.39	--	0.00	3,813	3.55	4,337	4.03	107,500	100
Walker	195,093	68.50	63,415	22.27	--	0.00	8,140	2.86	18,152	6.37	284,800	100

SOURCE: CARCOG/SETDD PLANNING STAFF

feasible or desirable, intensive development in the floodplains should be restricted through the effective use of floodplain management by local governments. Such management should restrict uses in floodways to an open nature, and minimum floor elevation standards should be adhered to for all structures allowed in the floodplain.

- Land development which decreases the permeability of the ground should be discouraged in those areas which serve to recharge the groundwater supplies, and land uses that pollute shallow aquifers should also be restricted in the recharge areas. Open space should be encouraged in these areas since this type of land use allows for the recharge of aquifers and protects the groundwater supply from pollution.

The implementation of these recommended controls and the other proposed land use policies will aid in the protection of the region's environmentally sensitive areas, as well as promote growth. For more information regarding the specifics of the land use plan, refer to the CARCOG/SETDD Regional Development Plan-2000. It should be emphasized that the following description of the projected land use, as presented in Table II-2 and Figure II-2, was based upon the recommended strategies developed within the land use plan.

According to Table II-2, it is anticipated that 29,759 acres of land presently devoted to agricultural and forestry uses will be converted to urban settlement uses by the year 2000. While all counties within the planning area are expected to experience an increase in urban needs, the largest growth is anticipated around the Chattanooga area and other principal growth centers including: the Jasper-Kimball-South Pittsburg-Whitwell area, Trenton, and Ringgold. Currently, Chattanooga's growth generally follows the transportation corridors and is somewhat influenced by both natural and political boundaries. Because of these boundaries, significant areas of development are projected for the northern and southern tips of the existing Chattanooga region.

An increase of 6,545 acres is projected for the amount of land necessary for road right-of-ways. In most cases, this increase will be directly proportional to the increase in urban settlement areas of the various counties.

Agricultural lands are projected to decrease by approximately 20,634 acres by the year 2000 due to urban expansion. As would be expected Hamilton County will experience the greatest loss of agricultural lands to urban development while Marion and Walker Counties will continue to be the major agricultural areas (in terms of acreage) within the planning area.

Due to urban development, the acreage devoted to forest and open space within the CARCOG/SETDD 208 Study Area is also anticipated to decline by approximately 15,667 acres, about 5000 acres less than that expected for agricultural lands. These projections of land usage, presented in Table II-2 and Figure II-2, are based on existing barren areas being reclaimed in forest and open space. In the future, such barren areas created by strip mining could possibly be reclaimed as agricultural lands.

C. POPULATION

Analysis of the past and present population trends, in conjunction with projections of future population concentrations, are essential components in determining needed control measures for solving an area's water quality problems. An understanding of these trends will assist in developing and evaluating viable alternatives for the upgrading and expansion of existing public facilities and services.

The 1975 estimate of the number of people living within the 208 urban areas are provided in Table II-3. The data presented indicate that the population within the study area is primarily distributed within the region's urban areas. In 1975, the municipalities in Hamilton County contained approximately 59 percent of the region's total populace, while the urban centers within the remaining 208 counties contained an additional 17 percent. Therefore, approximately 76 percent of the total population within the planning area resides in the urban areas of the six counties.

The population statistics in the 208 study area reflect the general trends of the nation, in that, for the past two decades the 208 study area has shown an increase in population (25.6%). However, the rate of this increase has subsided from 15.2 percent in 1950-1960, to 9.1 percent in 1960-1970 (see Table II-4). All of the counties within the region have exemplified this increase in population with the exception of Marion County. Between 1960 and 1970, Marion County showed a slight decrease (-2.2%) in population. Catoosa County experienced the greatest rate of population growth of all the counties in the past two decades with an increase of approximately 87 percent (between 1950-1970). This increase was due primarily to migration from the Chattanooga urban area.

Better understanding of the growth patterns within the 208 study area can be gained by examining the migration that has taken place since 1950. Table II-5 indicates the net migration for the 1950-1960, 1960-1970, and 1970-1975 time periods. The net migration was calculated by adding the natural increase (births minus deaths) to the beginning year's population and then subtracting the ending year's population. A negative net migration indicated that more people are moving out of an area than moving in. According to the Table II-5, every county within the CARCOG/SETDD 208 Study Area, except Catoosa, had a negative net migration during the period from 1950 to 1960. Between 1960 and 1970, the rates remained negative for all of the 208 counties except Catoosa and Dade. The net migration for the 1970-1975 period was, however, a complete reversal from that of the previous periods, with all counties having a net in-migration.

Much of the out-migration during the period of 1950 to 1970 was the result of the youth of the region moving into other areas for schooling and employment. It should be noted that many of those that leave for schooling do eventually return to the region. While no age data is available regarding the migration movements for the 1970-1975 period, the CARCOG/SETDD believes that some of the movement into the 208 study area was due

TABLE II-3

1975 URBAN POPULATION WITHIN THE CARCOG/SETDD 208 STUDY AREA

Jurisdiction	Urban Population	% of Total Population
Catoosa	20,746	5.28
Dade	1,808	.46
Hamilton	231,674	58.95
Marion	11,806	3.00
Sequatchie	1,920	.49
Walker	32,362	8.23
CARCOG/SETDD 208 Study Area	300,316	76.41

SOURCE: CARCOG/SETDD PLANNING STAFF

TABLE II-4

POPULATION GROWTH WITHIN THE CARCOG/SETDD 208 STUDY AREA

County	Census Population				Percent Change		
	1950	1960	1970	1975 (Estimated)	1950-1960	1960-1970	1970-1975
Hamilton	208,255	237,905	255,077	265,700	14.2	7.2	4.2
Marion	20,520	21,036	20,577	21,700	2.5	-2.2	5.5
Sequatchie	5,685	5,915	6,331	7,200	4.0	7.0	13.7
Catoosa	15,146	21,101	28,271	32,200	39.3	34.0	13.9
Dade	7,364	8,666	9,910	11,700	17.7	14.4	18.1
Walker	38,198	45,264	50,691	54,500	18.5	12.0	7.5
CARCOG/ SETDD	295,168	339,887	370,857	393,000	15.2	9.1	6.0
Tennessee	3,292*	3,567*	3,924*	4,188*	8.4	9.9	6.8
Georgia	3,445*	3,943*	4,590*	4,926*	14.5	16.5	7.3
United States	150,845*	179,326*	203,210*	212,905*	18.9	13.3	4.8

*Rounded to nearest thousand.

SOURCE: Census of Population, 1950, 1960, 1970, Federal-State Cooperative Population Estimates, 1975.

TABLE II-5

NET MIGRATION WITHIN THE CARCOG/SETDD 208 STUDY AREA

County	1950-1960 Number	1960-1970 Number	1970-1975 Number
Hamilton	-8,307	-8,437	500
Marion	-2,932	-2,523	300
Sequatchie	-609	-351	500
Catoosa	2,573	4,007	2,200
Dade	-450	129	1,200
Walker	-138	-463	1,400
CARCOG/SETDD 208 Study Area	-9,863	-7,638	6,100
Tennessee	-272,605	-45,018	115,000
Georgia	-213,569	67,604	98,000

SOURCE: Net Migration of Population, 1950-1960 and 1960-1970; Federal-State Cooperative Population Estimates to the relocation of retired people to the area. In addition, the region's increased economic activity has attracted people.

Population projections for the 208 study area through the year 2000 are presented in Table II-6. According to this table, it is anticipated that there will be an increase in population from 370,857 in 1970 to 481,600 by 2000. Walker and Hamilton Counties are projected to have the smallest percent change in population by the year 2000, while the greatest rates of growth are expected to occur in Dade and Sequatchie Counties.

D. EMPLOYMENT

The following discussion describes the significant features of the economy within the CARCOG/SETDD 208 Study Area, as well as presents the employment projections in five year increments through the year 2000. Presently, the economy of the 208 study area is in a phase of growth characterized by the expansion of market areas, growth of income, and the advancement of the service sector of the economy to support continued manufacturing growth. Agriculture is relatively stable within the region.

As seen in Table II-7 both the labor force and the work force in the 208 study area have increased since 1970. In fact, since 1970, the work force has grown from 154,162 to 177,093 persons, a 14.9 percent increase. Similarly, the labor force has increased from 145,892 in 1970 to 171,250 in 1974, a 17.4 percent increase. It is interesting to note that within the CARCOG/SETDD 208 Study Area the work force is larger than the labor force. This phenomenon is primarily attributable to the commuting patterns of the region. As depicted in Table II-8, many people commute into the 208 study area in order to capitalize on the employment opportunities offered in the Chattanooga Standard Metropolitan Statistical Area (SMSA). The Chattanooga SMSA, which includes all of Hamilton, Dade, and Catoosa Counties, as well as a portion of Walker County, is the center of economic activity for the 208 study area. Commuting also occurs among the 208 counties. As might be expected, the city of Chattanooga (located in Hamilton County) has the greatest movement of daily incoming workers with 17,919 persons, while Walker County is next with 4,113.

According to the employment figures for 1974, the single largest sector of the economy within the CARCOG/SETDD 208 Study Area is manufacturing activities accounting for over one third of the total employment. The second largest sector of the economy, the service sector, makes up 25 percent of the region's employment. Other major areas of employment include trade activities and the government.

The sources of personal income, depicted in Table II-9, reflect the economic activities that exist within the study area. These data indicate that manufacturing activities are the predominant sector of the economy, thus, concurring with the employment distribution figures presented above. The personal income sources displayed in the Table II-9 are based on the income earned according to the county of work rather than by the place of residence. Thus, the data reveal the importance of the employment activities of Hamilton County to that of the entire 208

TABLE II-6

OBERS, SERIES E, POPULATION PROJECTIONS FOR THE CARCOG/SETDD 208 STUDY AREA

County	1970	1980	1990	2000	Percent Increase 1970-1980	Percent Increase 1980-1990	Percent Increase 1990-2000
Hamilton	255,077	280,400	299,300	313,500	9.9	6.9	4.6
Marion	20,577	24,300	28,000	31,600	18.1	15.2	12.9
Sequatchie	6,331	7,900	9,700	11,600	24.8	22.8	19.6
Catoosa	28,271	34,100	38,100	39,300	20.6	11.7	3.1
Dade	9,910	15,800	20,900	23,900	59.4	32.3	14.4
Walker	50,691	56,700	60,300	61,700	11.9	6.3	2.3
CARCOG/SETDD 208 Study Area	370,857	419,200	456,800	481,600	13.0	9.0	5.4
Tennessee	3,924,164	4,514,400	5,118,400	5,547,000	15,0	13.4	8.4
Georgia	4,589,515	5,147,300	5,907,400	6,458,100	12.2	14.8	9.3
United States	203,210*	223,532*	246,039*	263,830*	10.0	10.1	7.2

*In Thousands

SOURCE: Bureau of Economic Analysis projections based on 1970-1972 Benchmark

TABLE II-7

EMPLOYMENT FOR THE CARCOG/SETDD 208 STUDY AREA

Jurisdiction	Population	Labor* Force	Work** Force	Manufac- turing	Construc- tion	Govern- ment	Trade	Mining	Service
1970									
Hamilton	255,077	100,780	128,465	45,898	6,336	17,108	25,479	198	33,446
Marion	20,577	8,231	4,106	1,275	211	648	822	316	834
Sequatchie	6,331	2,153	1,062	277	44	297	182	43	219
Catoosa	28,271	11,844	4,880	1,829	168	979	828	0	1,076
Dade	9,910	3,568	1,505	560	116	270	266	39	254
Walker	50,691	19,316	14,144	7,606	593	2,019	1,882	13	2,031
CARCOG/SETDD 208 Study Area	370,857	145,892	154,162	57,536	7,468	21,321	29,459	609	37,860
1974									
Hamilton	265,500	118,210	145,764	48,844	7,866	20,336	28,130	178	40,410
Marion	22,000	8,470	4,977	1,465	178	726	1,021	566	1,021
Sequatchie	7,000	2,520	1,954	644	73	367	243	106	521
Catoosa	31,700	13,720	5,520	2,355	244	1,335	963	0	623
Dade	11,400	4,220	1,924	802	132	302	329	30	329
Walker	53,400	24,110	15,854	8,504	596	2,096	2,302	10	2,346
CARCOG/SETDD 208 Study Area	391,000	171,250	177,093	62,614	9,029	25,162	32,988	890	45,250

*People available for work according to county of residence
**Total employment according to county of employment

SOURCE: Prepared by CARCOG/SETDD Economist 12/76

TABLE II-8

1970 COMMUTING PATTERNS WITHIN THE CARCOG/SETDD 208 STUDY AREA

County of Residence	Place of Employment						
	Chattanooga	Remainder of Hamilton County	Marion County	Sequatchie County	Catoosa County	Dade County	Walker County
Hamilton	N.A.	N.A.	38	21	514	27	2,052
Marion	1,688	410	N.A.	44	--	13	41
Sequatchie	448	200	47	N.A.	--	--	22
Catoosa	2,933	528	--	--	N.A.	--	870
Dade	1,510	147	--	--	20	N.A.	126
Walker	6,795	121	--	--	528	28	N.A.
Other Counties in the Commuting Field	4,545	1,249	768	154	80	298	1,002
Total for the CARCOG/SETDD 208 Study Area	17,919	2,534	583	219	1,142	366	4,113

N.A. - Not Applicable

SOURCE: Place-of-work commuting data, 1970 CENTAB - Fourth Count Population Data.

TABLE II-9

MAJOR PERSONAL INCOME SOURCES, 1974

(Dollars in Thousands)

County	Total	Farm	Manufac-turing	Construc-tion	Trade	Trans. Comm. Utilities	Services	Govt.	All Other
Hamilton	1,391,570	0.2	37.2	6.7	16.3	4.8	13.0	14.9	7.0
Marion	41,243	1.6	31.1	3.6	13.9	5.5	10.0	13.5	20.8
Sequatchie	13,138	5.6	22.8	4.7	11.2	2.0	23.9	18.6	11.3
Catoosa	44,718	5.1	39.2	6.8	13.4	5.1	6.2	21.3	2.8
Dade	12,819	1.6	42.0	10.7	14.8	2.5	7.2	16.6	4.7
Walker	122,394	0.8	53.7	4.3	11.7	2.5	9.0	14.1	3.9

SOURCE: Bureau of Economic Analysis, Department of Commerce.

study area. Approximately 85.5 percent of the region's total income is earned there.

The importance of agriculture to the economy of the study area has been continually declining over the past years, and at present it contributes only a small percentage of the region's personal income. Furthermore, farming within the study area tends to be more of a secondary occupation for the farm operators than for operators in Georgia, Tennessee, and the United States because of the low income earned and the high expenses involved in the farming operation.

Table II-10 provides a comparison of the 1970 median family income within the 208 study area. As indicated, the highest income ocurred in Catoosa County at $8,653, followed closely by Hamilton and Walker Counties. These counties were the only counties to even approach the National figure of $9,590. Sequatchie had the lowest median family income with $6,111. Table II-10 also presents statistics for the percent of families below the poverty level. According to the data provided, Catoosa County had the lowest percent of families below the poverty level, while Marion and Sequatchie Counties had the largest percent of families with incomes below the poverty level. Table II-11 presents the distribution (by percent) of the annual family income.

Employment projections have been prepared for the study area to gage the location and quantity of new commercial and industrial acres required to handle future economic growth (see Table II-12). These projections indicate that Hamilton County will remain the focal point of economic activity for the study area and that the manufacturing sector of the economy will still be predominant. The service sector of the economy is anticipated to have the largest percent increase in employment between the years 1974 to 2000, a 60.6 percent gain. Generally, both the labor force and the work force are expected to increase during the planning period.

E. SUMMARY

This chapter of the report dealt with the land use, population, and employment characteristics of the CARCOG/SETDD 208 Study Area utilizing past, present, and projected trends in relating land use and demographic patterns to the water quality of the study area. Specific goals achieved include:

- The division of existing land use into six categories and identification of present land use patterns.
- Identification of the anticipated future land use patterns.
- Identification of present population, employment, and economic trends in the study area.
- Prediction of future demographic and economic development relating to regional water quality.

TABLE II-10

MEDIAN FAMILY INCOMES AND FAMILIES BELOW THE POVERTY LEVEL
WITHIN THE CARCOG/SETDD 208 STUDY AREA

County	Median Family Income ($)	% Families Below Poverty
Hamilton	8,609	13.3
Marion	6,118	25.1
Sequatchie	6,111	24.6
Catoosa	8,653	11.2
Dade	6,593	21.1
Walker	8,111	13.4
Tennessee	7,447	18.2
Georgia	8,167	16.7
United States	9,590	10.7

SOURCE: CARCOG/SETDD Regional Development Plan - 2000
Volume I: Summary

TABLE II-11

ANNUAL FAMILY INCOME OF THE CARCOG/SETDD 208 COUNTIES, 1970

County	# Of Families	$0 - $1,999	$2,000- $3,999	$4,000- $5,999	$6,000- $7,999	$8,000- $9,999	$10,000- $11,999	$12,000- $14,999	$15,000- and over
Hamilton	67,725	7.5	10.6	12.5	14.6	14.6	12.7	11.8	15.7
Marion	5,373	12.6	16.6	19.7	18.2	12.3	10.0	4.9	5.6
Sequatchie	1,689	11.8	16.7	20.5	17.1	13.1	12.8	6.2	1.7
Catoosa	7,624	6.0	7.9	13.1	17.7	16.7	15.0	13.4	10.3
Dade	2,523	11.9	11.9	20.5	19.1	17.0	9.7	7.1	2.8
Walker	13,838	7.0	10.3	14.0	17.6	16.9	13.7	11.6	8.9
Tennessee	1,024*	10.4	13.4	15.1	15.2	13.8	10.8	9.7	11.6
Georgia	1,150*	9.0	11.8	13.7	14.3	13.3	11.3	11.4	15.2
United States	51,169*	5.9	9.3	10.8	12.9	13.9	12.9	13.7	20.6
Southern United States	15,906*	8.8	12.5	13.7	14.5	13.4	11.2	11.0	14.9

*Rounded to nearest thousand

SOURCE: General Social and Economic Characteristics, 1970, Bureau of the Census.

TABLE II-12

EMPLOYMENT PROJECTIONS FOR THE CARCOG/SETDD 208 STUDY AREA

Jurisdiction	Population	Labor* Force	Work** Force	Manufacturing	Construction	Government	Trade	Mining	Service
1980									
Hamilton	280,400	126,200	159,300	52,910	8,710	22,500	29,930	180	45,070
Marion	24,300	10,200	6,040	1,880	310	880	1,190	560	1,220
Sequatchie	7,900	2,800	2,560	880	90	450	310	120	710
Catoosa	34,100	15,000	7,100	2,900	180	1,520	1,010	0	1,490
Dade	15,800	5,500	2,230	990	120	350	330	40	400
Walker	56,700	25,500	18,590	10,260	600	2,340	2,290	20	3,080
CARCOG/SETDD 208 Study Area	419,200	185,200	195,820	69,820	10,010	28,040	35,060	920	51,970
1985									
Hamilton	290,100	130,500	166,260	53,660	8,960	24,430	30,240	180	48,790
Marion	26,100	11,100	6,680	2,040	340	980	1,270	590	1,460
Sequatchie	8,800	3,100	2,880	930	100	500	350	150	850
Catoosa	36,100	15,900	7,580	3,000	200	1,660	1,060	0	1,660
Dade	18,300	6,500	2,360	1,020	130	380	340	50	440
Walker	58,500	26,300	19,410	10,460	650	2,530	2,360	20	3,390
CARCOG/SETDD 208 Study Area	437,900	193,400	205,170	71,110	10,380	30,480	35,620	990	56,590

TABLE II-12

EMPLOYMENT PROJECTIONS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Jurisdiction	Population	Labor* Force	Work** Force	Manufac- turing	Construc- tion	Govern- ment	Trade	Mining	Service
1990									
Hamilton	299,800	134,900	173,260	54,420	9,220	26,360	30,560	190	52,510
Marion	28,000	12,000	7,370	2,200	380	2,090	2,360	630	1,710
Sequatchie	9,700	3,400	3,210	980	110	560	390	180	990
Catoosa	38,100	16,800	8,070	3,100	220	1,810	1,110	0	1,830
Dade	20,900	7,500	2,520	1,050	150	420	360	60	480
Walker	60,300	27,100	20,260	10,670	700	2,720	2,440	30	3,700
CARCOG/SETDD 208 Study Area	456,800	201,700	214,780	72,420	10,780	32,960	36,220	1,090	60,770
1995									
Hamilton	306,600	141,100	181,140	55,260	9,670	27,980	30,990	190	57,050
Marion	29,800	12,900	8,100	2,370	390	1,210	1,460	640	2,030
Sequatchie	10,600	3,700	3,620	1,060	120	630	440	190	1,180
Catoosa	38,700	17,800	8,600	3,190	240	1,960	1,160	0	2,050
Dade	22,400	8,300	2,660	1,070	160	450	370	70	540
Walker	61,000	28,000	21,110	10,830	740	2,910	2,520	30	4,080
CARCOG/SETDD 208 Study Area	469,100	211,800	225,230	73,780	11,320	35,140	36,940	1,120	66,930

TABLE II-12

EMPLOYMENT PROJECTIONS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Jurisdiction	Population	Labor* Force	Work** Force	Manufac-turing	Construc-tion	Govern-ment	Trade	Mining	Service
2000									
Hamilton	313,500	147,300	189,060	56,100	10,130	29,610	31,420	200	61,600
Marion	31,600	13,900	8,890	2,550	410	1,330	1,570	680	2,350
Sequatchie	11,600	4,100	4,060	1,150	130	700	500	210	1,370
Catoosa	39,300	18,900	9.170	3,290	260	2,120	1,220	0	2,280
Dade	23,900	9,100	2,810	1,090	170	490	380	80	600
Walker	61,700	29,000	21,990	10,990	790	3,110	2,600	40	4,460
CARCOG/SETDD 208 Study Area	481,600	222,300	235,980	75,170	11,890	37,360	37,690	1,210	72,660

*People available for work according to county of residence.
**Total employment according to county of employment.

SOURCE: Prepared by CARCOG/SETDD Economist 12/76

In achieving each of these goals several conclusions concerning land use and demography were reached. These include:

- The majority of the study area is forest and agricultural land, with residential use being a distant second.
- Chattanooga is the predominant urban area within the 208 region.
- Development will occur contiguous to existing urban areas and transportation routes over the 20 year planning period.
- An increase in population and employment has taken place within the study area over the last few years and is anticipated to continue through the year 2000.
- High expected growth rates will place an increased importance on wise use of natural aquatic resources.

These goals and conclusions are presented in this context for use within the alternatives selection and evaluation process of the CARCOG/SETDD 208 Areawide Waste Treatment Management Plan.

CHAPTER III - RECEIVING WATERS

III
RECEIVING WATERS

A. INTRODUCTION

The goal of this chapter is to provide a comprehensive discussion of the water quality related aspects of the receiving waters in the CARCOG/SETDD 208 Study Area. A physical description of the major streams, reservoirs, and drainage basins is provided, and stream segments and segment classifications are outlined. Stream standards and surface and groundwater quality data are reviewed, as are the current municipal, domestic, and industrial dischargers and their permit limitations. Special attention is given to the eutrophication potential of the stream reservoirs and problems associated with the location of drinking water intakes within the study area. A final section discusses water quality considerations particular to this locale.

B. DRAINAGE BASINS AND RECEIVING STREAMS

The CARCOG/SETDD 208 Study Area may be divided into drainage basins located around the receiving streams which, in turn, may be broken down into stream segments. This section of the chapter contains a description of these basins, streams, and segments.

1. Hydrologic Description of the Planning Area

The six counties comprising the study area lie within the Lower Tennessee River Basin in southeastern Tennessee and the northwest corner of Georgia. This River Basin may be divided into thirty-one subbasins as follows:

- Soddy Creek Basin
- Jones Bay Basin
- North Chickamauga Creek Basin
- Middle Creek Basin
- Shoal Creek Basin
- Mountain Creek Basin
- Stringers Branch Basin
- Dallas Bay Basin
- Hurricane Creek Basin
- Tiger Creek Basin
- Browns Ferry Basin
- Lookout Creek Basin
- Chattanooga Creek Basin
- West Chickamauga Creek Basin
- Spring Creek Basin
- Bennett Lake Basin
- Moccasin Bend Basin
- Gold Point Basin
- Citico Creek Basin
- South Chickamauga Creek Basin
- Friar Branch Basin
- Lake Chickamauga Basin
- Wolftever Creek Basin
- Mackey Branch Basin
- Peavine Creek Basin
- Little Chickamauga Creek Basin
- East Chickamauga Creek Basin
- Sequatchie River Basin
- Little Sequatchie River Basin
- Battle Creek Basin
- Big Fiery Gizzard Creek Basin

These subbasins represent the primary drainage characteristics of the 208 area and are centered around the streams shown in Figure III-1. These streams are discussed below.

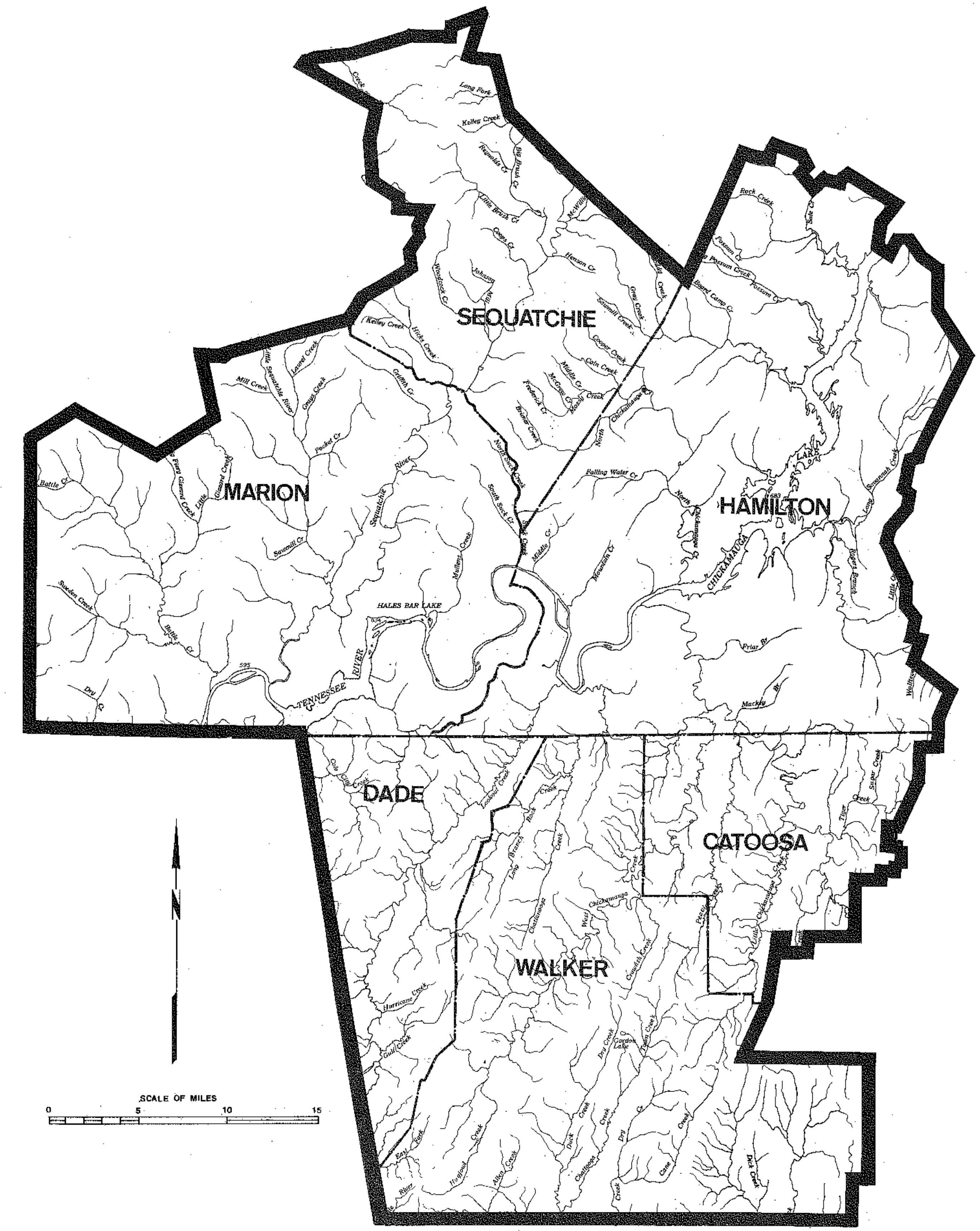


FIGURE III-1
STREAMS IN THE CARCOG / SETDD 208 AREA

The surficial water system of the 208 study area is comprised of the Tennessee River and its tributaries. The Tennessee River traverses the study area from northern Hamilton County to the central region, flowing southwest through the Chattanooga metropolitan area, across southern Marion County, and into Alabama. This portion of the Tennessee River can be divided into two reservoirs: (1) the Chickamauga Reservoir, extending from a dam at TRM 499, and (2) the Nickajack Reservoir, running from Nickajack Dam at TRM 424.7 to Chickamauga Dam at TRM 471. The remaining eight miles of the Tennessee River in the study area consist of the backwaters of the Guntersville Reservoir. While this stretch of the River flows through only two of the six counties in the study area, its tributaries drain the entire region. Those lying to the south of the river are as follows:

- Black Creek
- Chattanooga Creek
- Citico Creek
- Dry Creek
- Friar Branch
- Lookout Creek
- Wolftever Creek
- Ryall Spring Branch
- South Chickamauga Creek and its branches (East and Little Chickamauga Creeks, Peavine Creek)
- Spring Creek
- Waconda Bay
- West Chickamauga Creek

These streams drain the three Georgia Counties and the southern portion of Hamilton County in Tennessee. Sequatchie and Marion Counties are drained by the Sequatchie River and its tributaries: Battle Creek, Big Fiery Gizzard Creek, Coops Creek, Little Fiery Gizzard Creek, Little Sequatchie River, Ownes Spring Branch, and Popular Spring Branch. The northern portion of Hamilton County in Tennessee is drained by North Chickamauga Creek, Shoal Creek, Sale Creek, Stringers Branch, Roaring Creek, and Bush Creek. The use classifications, segments, and segment designations for these streams are discussed in the following section.

2. Stream Use Classifications, Segments, and Segment Designation

Stream use classifications and segment designations have been developed for all streams in the study area by both the states of Tennessee and Georgia. The criteria used to assign these classifications and designations, as well as the classifications and designations themselves, vary between the states. Consequently, the evaluations performed by both states are reviewed below.

The state of Georgia classifies streams according to the water use requiring the highest level of water quality. These classifications are:

- Drinking water supplies
- Recreation
- Fishing, propagation of fish, shellfish, game, and other aquatic life
- Agricultural
- Industrial

- Navigation
- Wild River
- Scenic River
- Urban Stream

The applicable water quality criteria are outlined for each use classification in the Rules and Regulations for Water Quality Control of the Georgia Department of Natural Resources, Environmental Protection Division (Chapter 391-3-6). General criteria for all waters are given, and recommended levels of bacteria, dissolved oxygen, pH, temperature, and toxic substances are defined for each stream use classification.

Streams are classified according to all intended uses by the state of Tennessee; therefore, any stream may have more than one use classification. The Tennessee use classifications are as follows:

- Domestic raw water supply
- Industrial water supply
- Fish and aquatic life
- Recreation
- Irrigation
- Livestock watering and wildlife
- Navigation

The Tennessee Water Quality Control Board defines water quality standards for each stream use classification in their publication, General Water Quality Criteria for Definition and Control of Pollution in the Waters of Tennessee. As in the Georgia system, general criteria are given for some pollutants, and specific regulations are set according to use for dissolved oxygen, pH, temperature, total dissolved solids, and fecal coliforms. Table III-1, reprinted from Work Element 902.1, lists both the state of Tennessee and state of Georgia use classifications for the 208 study area streams.

Federal legislation requires states to categorize polluted stream segments into one of two designations: water quality or effluent limited segments. Water quality limited segments are those which presently do not meet water quality standards and are not expected to meet such standards, even after application of best practicable control technology for private dischargers and secondary treatment for public facilities. Effluent limited segments, however, either are presently in compliance with state standards or will achieve compliance upon implementation of the above levels of treatment. Such segments, located along stream reaches receiving point source discharges, have been designated by both the states of Tennessee and Georgia for streams in the 208 study area. Table III-2, reprinted from Work Element 902.1, lists these segments and the maximum allowable waste loads for each, based upon wastewater flows from dischargers and the assimilative capacity of the receiving stream. Those segments having the most serious water quality problems are shown in Figure III-2.

TABLE III-1

STREAM USE CLASSIFICATION FOR THE CARCOG/SETDD 208 STUDY AREA

Stream	Description	Tennessee Stream Use 1	2	3	4	5	6	7	Georgia Stream Use 1	2	3	4	5	6	7	8	9
TENNESSEE RIVER	Tennessee-Alabama State Line (mile 416.5) to the Pot Light (mile 448)	X	X	X	X	X	X	X									
Unnamed Tributary	Unnamed tributary to the Tennessee River at mile 417.5; mouth to origin			X		X	X										
Battle Creek	Mouth to origin	X	X	X	X	X	X										
Big Fiery Gizzard	Mouth to origin			X	X	X	X										
Little Fiery Gizzard	Mouth to origin			X	X	X	X										
Unnamed Tributary	Unnamed tributary to Little Fiery Gizzard at mile 0.6; mouth to origin			X		X	X										
Sequatchie River	Mouth to mile 3.5	X	X	X	X	X	X	X									
Sequatchie River	Mile 3.5 to 41.0	X	X	X	X	X	X										
Sequatchie River	Mile 41.0 to 43.9			X		X	X										
Sequatchie River	Mile 43.9 to 74.0	X	X	X	X	X	X										
Coops Creek	Mouth to Mile 0.3			X		X	X										
Coops Creek	Mile 0.3 to Origin			X		X	X										
TENNESSEE RIVER	Pot Light (Mile 448.0) to mouth of Chattanooga Creek (Mile 460.6)		X	X			X	X									
Shoal Creek	Mouth to origin			X	X	X	X										
Mountain Creek	Mouth to Mile 0.3			X		X	X										

TABLE III-1 (Continued)

Stream	Description	Tennessee Stream Use 1	2	3	4	5	6	7	Georgia Stream Use 1	2	3	4	5	6	7	8	9
Mountain Creek	Mile 0.3 to origin			X	X	X	X										
Unnamed Tributary	Unnamed tributary of the Tennessee River at Mile 458.7; mouth to origin			X	X	X	X										
Lookout Creek	Mouth to Georgia-Tennessee state line		X	X		X	X										
Lookout Creek	Georgia-Tennessee state line to origin										X						
Black Creek	Mouth to Mile 1.6			X		X	X										
Black Creek	Mile 1.6 to origin			X	X	X	X										
Chattanooga Creek	Mouth to Georgia-Tennessee state line		X	X		X	X										
Chattanooga Creek	Georgia-Tennessee state line to origin										X						
Dry Creek	Mouth to origin										X						
TENNESSEE RIVER	Mouth of Chattanooga Creek (Mile 460.6) to mouth of the Hiwassee River (Mile 499.4)	X	X	X	X	X	X	X									
[illegible] Creek	Mouth to origin			X													
South Chickamauga Creek	Mouth to Georgia-Tennessee state line		X	X		X	X										
South Chickamauga Creek	Georgia-Tennessee state line to origin										X						
Friar Branch	Mouth to origin			X		X	X										
West Chickamauga Creek	Mouth to Georgia-Tennessee state line		X	X		X	X										
West Chickamauga Creek	Georgia-Tennessee state line to origin										X						
Spring Creek	Mouth to Georgia-Tennessee state line		X	X		X	X										

TABLE III-1 (Continued)

Stream	Description	Tennessee Stream Use 1	2	3	4	5	6	7	Georgia Stream Use 1	2	3	4	5	6	7	8	9
Spring Creek	Georgia-Tennessee state line to origin										X						
Mackey Branch	Mouth to origin			X	X	X	X										
Ryall Springs Branch	Mouth to origin			X		X	X										
Unnamed Tributary	Unnamed tributary to the Tennessee River at Mile 469.2; Mouth to Mile 1.5			X		X	X										
Unnamed Tributary	Mile 1.5 to origin			X	X	X	X										
North Chickamauga Creek	Mouth to origin			X	X	X	X										
Unnamed Tributary	Unnamed tributary to North Chickamauga Creek at Mile 0.7; mouth to Mile 0.3			X		X	X										
Unnamed Tributary	Mile 0.3 to origin			X	X	X	X										
Unnamed Tributary	Unnamed tributary to North Chickamauga Creek at Mile 4.4; mouth to Mile 1.0			X		X	X										
Unnamed Tributary	Mile 1.0 to origin			X	X	X	X										
Wolftever Creek	Mouth to Mile 13.6			X	X	X	X										
Wolftever Creek	Mile 13.6 to Mile 16.6			X		X	X										
Wolftever Creek	Mile 16.6 to origin			X	X	X	X										
Sale Creek	Mouth to origin			X	X	X	X										
All other tributaries not classified shall be classified				X	X	X	X										

TABLE III-2

STREAM SEGMENT CLASSIFICATIONS AND WASTE LOAD ALLOCATIONS FOR THE CARCOG/SETDD STUDY AREA

Stream Segment	Main Discharge into Stream Segment	Classification[1]	Maximum Allowable Waste Loads[2] BOD_5 (mg/l)	BOD_5 (lb/day)	NH_3-N (mg/l)	DO (mg/l)	Temp (°C)
Battle Creek 0.0-2.2	Scottish Inn	B	10		1.6		
Sequatchie River 4.3/Unnamed tributary 0.0-0.5	Hales Laundromat, Economy Cleaners	B	10		1.6		
Tennessee River 416.5-424.7	S. Pittsburg, Nickajack Reservation, Tenn. Metallurgical Corp., W. R. Grace & Co.	C	30	No deoxygenating wastes	5.0		
Sequatchie River 40.0-43.9	Dunlap	C		UOD - 1270 lbs/day			
Tennessee River 424.7-448.0	Raccoon Mountain Project, General Portland, Tennessee Consolidated Coal Company, Vulcan Materials	C C	30	No deoxygenating wastes	5.0		
Owen Spring Branch 0.0-1.0	Sequatchie Handle Works	C		No deoxygenating wastes			
Poplar Spring Branch 0.0-1.9	Penn-Dixie Cement Company	C		No deoxygenating wastes			
Sequatchie River 0.0-5.0	Jasper	D		UOD = 1860 lbs/day			
Tennessee River 448.0-471.0	Moccasin Bend, Red Bank, Signal Mountain, N. River YMCA, Chattanooga Voc.-Tech. Sch., Valley View Elem. Sch., Chattanooga Tech. College, K-Mart, Chickamauga Dam, American Oil Co., Central Soya Co., Combustion Eng., Consolidated Latex Co., Dixie Sand & Gravel, Dixie Yarns, DuPont Corp., General Portland Inc., Gilman Paint & Varnish, Gulf Oil Co., Olin Corp., Polysar Latex, Roper Corp., Selox Inc., Tenn. Paper Mills, Texaco Oil Co., U.S. Pipe & Foundry, sewer bypass and pavement runoff	A	10[3]		1.6		30.5

TABLE III-2 (Continued)

Stream Segment	Main Discharge into Stream Segment	Classification[1]	Maximum Allowable Waste Loads[2]				
			BOD_5 (mg/l)	BOD_5 (lb/day)	NH_3-N (mg/l)	DO (mg/l)	Temp (°C)
Stringers Branch 2.0-5.6	Jiffy Car Wash	A	10		1.6		
Lookout Creek 2.4/ Black Creek	Holiday Inn, LaDel Mobile Home Valley, Tiftonia Restaurant, Gulf Oil Co., L & N Railroad	A	10		1.6		
Lookout Creek 4.3/ Unnamed tributary	I-24 Welcome Station	B	10		1.6		
Lookout Creek 6.6/ Unnamed tributary	Covenant College	E	30	12.7	20	2.0	
Lookout Creek 7.4/ Unnamed tributary	Lookout Mountain Junior High School	E	30	10	20	2.0	
Lookout Creek 7.2/ Wauhatchie Branch	Wildwood Sanitarium	E	30	2.5	20	2.0	
Lookout Creek 18.9/ Unnamed tributary	Trenton	F	30	80	20	5.0	
Chattanooga Creek 0.0-9.3 (including all tributaries)	ALC Inc., Chattanooga Products Co., Chattem Drug and Chemical Co., Chemetron Corp., Crane Co., Jackson Co., Reilly Tar & Chemical Corp., Southern Wood Piedmont Co., Steward Mfg. Co., Swift Edible Oil Co., Velsicol Chem. Corp., Wheland Foundry, Woodward Co., pavement runoff and sewer bypass, interstate pollution	A	10		1.6		30.5
Chattanooga Creek 12.8, Rock Creek 1.1	Yates Bleachery Company	F	44	257	0.0	5.0	
Citico Creek 0.0-origin	Chattanooga Gas Co., Desoto Inc., Grand Sheet Metal, Rainbow Processing Co., Ray-Ser Dyeing Co., Southern Railway Co., Sewer bypass and pavement runoff	A	10		1.6		30.5

TABLE III-2 (Continued)

Stream Segment	Main Discharge into Stream Segment	Classification[1]	Maximum Allowable Waste Loads[2] BOD$_5$ (mg/l)	BOD$_5$ (lb/day)	NH_3-N (mg/l)	DO (mg/l)	Temp (°C)
South Chickamauga Creek 0.0-17.3 (including all tributaries)	Bork Hospital, Brainerd, East Ridge, N. Twinbrook Subdivision, Shepard Elem. Sch., Valley Psychiatric Hospital, Cedar Creek Mobile Home Park, Hwy. 58 Shopping Ctr., Red Food Store, E. Brainerd Wishy-Washy, Henry's Car Wash, Quick-Thrift Car Wash, Alco Chemical Co., American Oil Co., CF Inds., Desoto Inc., Fibron Inc., GAF Corp., Moccasin Bushing Co., Mueller Co., Vulcan Materials, W.R. Grace Inc., sewer bypass and pavement runoff, interstate pollution	A	10 (Nitrates 10 mg/l)		1.6		30.5
South Chickamauga Creek 17.5	Morris Estates	E	30	20.3	20	2.0	
South Chickamauga Creek 17.9/Peavine Creek 2.2	Days Inn	E	30	4.3	20	5.0	
South Chickamauga Creek 17.9/Peavine Creek 3.6	I-75 Welcome Station	E	30	3.3	20	5.0	
South Chickamauga Creek 29.4	Ringgold #1	E	30	37.5	20	2.0	
South Chickamauga Creek 31.6	Ringgold #2	E	30	17.5	20	2.0	
Little Chickamauga Creek 0.6	Salem Carpet Mills	E	20	2.5	0.0	5.0	
Little Chickamauga Creek 1.8	Dixie Yarns, Inc.	E	74	8	0.0	5.0	
East Chickamauga Creek 1.5	Union 76 Truck Stop	E	30	7.5	20	2.0	

TABLE III-2 (Continued)

Stream Segment	Main Discharge into Stream Segment	Classification[1]	Maximum Allowable Waste Loads[2]				
			BOD_5 (mg/l)	BOD_5 (lb/day)	NH_3-N (mg/l)	DO (mg/l)	Temp (°C)
West Chickamauga Creek 4.4	Fort Oglethorpe	E	30[4]	501	20	2.0	
West Chickamauga Creek 6.9	Mitchell Acres Subdivision	E	30	10	20	2.0	
West Chickamauga Creek 22.8/Coke Oven Branch 0.7	Chickamauga	G	20	876	2.0	5.0	
West Chickamauga Creek 24.5/Crawfish Creek 3.8	Walker County State Prison	E	30	6.3	20	5.0	
West Chickamauga Creek 40.3	Barwick Carpet Mills, Inc.	E	20	251	1.9	5.0	
West Chickamauga Creek 40.7	Standard Brands, Inc.	E	21	19	25	5.0	
North Chickamauga Creek 0.0-6.0	Chickamauga Power Service Center, Northgate Shopping Center	B	10[5]		1.6		
North Chickamauga Creek 7.0-8.7	Hixson Junior High and High Schools	C	(UOD = 230 lb/day)				
Tennessee River 471.0-499.4	Harrison Bay State Park, Lakeshore Country Club Apts., Loret Resort Villa, Dallas Car Wash, Sequoyah Nuclear Plant	C	30[5]		5.0		30.5
Tennessee River 478.2/Unnamed tributary 0.0-0.9	Brown Jr. High School, Central High School	B	10		1.6		

TABLE III-2 (Continued)

Stream Segment	Main Discharge into Stream Segment	Classification[1]	Maximum Allowable Waste Loads[2] BOD_5 (mg/l)	BOD_5 (lb/day)	NH_3-N (mg/l)	DO (mg/l)	Temp (°C)
Waconda Bay 0.5-3.0	Volunteer Army Ammunition Plant	A	10		0.5 (Nitrates 10 mg/l)		
Wolftever Creek 0.0-16.8	Collegedale, Ooltewah, Ooltewah Elem. School, Southern Missionary College, MeKee Baking Co.	A	10		1.6		
Sale Creek 5.0-8.7	Graysville, Dutch Maid Laundry	B	10		1.6		

[1]Tennessee Stream Segment Classification:

A - Water-quality-limited in violation of stream standards
B - Water-quality-limited not presently violating stream standards
C - Effluent-limited in violation of stream standards
D - Effluent-limited not presently violating stream standards

Georgia Stream Segment Classification:

E - Effluent-limited
F - Effluent-limited - dissolved oxygen exception
G - Water-quality-limited

[2]BOD = 5-day 20°C biochemical oxygen demand in effluent
AN = Ammonia nitrogen in effluent
UOD = Ultimate oxygen demand

[3]UOD not calculated due to unpredictable low flow values and heavy pollution from tributaries.

[4]If significant nitrification takes place in West Chickamauga Creek, effluent limits may be changed to 10 mg/l BOD_5, 2.0 mg/l AN, and 5.0 mg/l DO.

[5]UOD not calculated due to discharge into reservoir backwater.

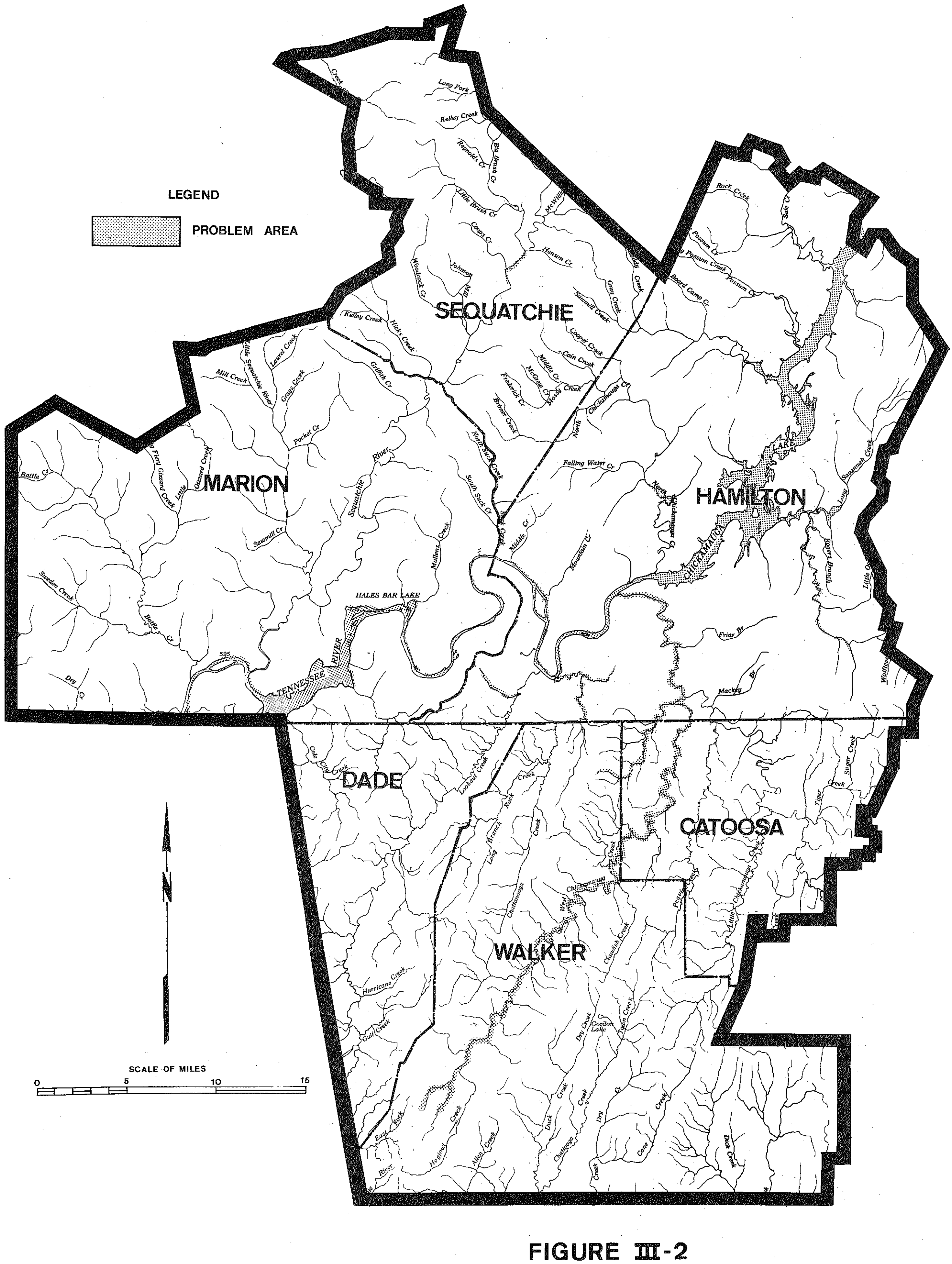


FIGURE III-2

WATER QUALITY PROBLEM AREAS IN THE CARCOG / SETDD 208 AREA

C. EXISTING WATER QUALITY

The discussion of existing water quality in the CARCOG/SETDD 208 Study Area is based upon available data and deals with both surface and groundwater. Since the Tennessee River is the major surface water feature, its water quality is described first and is then related to that of its tributary streams. Groundwater quality is outlined with respect to the geologic formation in which it is found.

1. Surface Water Quality

The water quality of streams in the 208 study area varies from very good to poor. In general, the streams which receive few discharges have a higher quality water, with typical ranges of water quality parameter values being as follows:

- pH - 6.0 to 8.5
- fecal coliforms - 2 to 9000 colonies/100 ml
- dissolved oxygen - 5.0 to 14.0 mg/l

Those streams with a number of dischargers and lower assimilative capacity exhibit a much lower water quality, with low dissolved oxygen levels, high fecal coliform counts, and a wide variation in pH. A more detailed discussion of the existing water quality and specific water quality problems in the 208 study area streams is given below.

Tennessee River

As previously stated, the reach of the Tennessee River lying within the study area consists of two reservoirs: the Chickamauga and Nickajack. There is a considerable difference in the water quality of these two reservoirs due to the locations of dischargers and tributary streams. Chickamauga Reservoir has relatively good water quality, while Nickajack Reservoir is subjected to numerous sources of pollution. A summary of water quality conditions in both of these reservoirs is presented below.

Table III-3 presents 1975 water quality data for three locations on the Chickamauga Reservoir. In general, pollutant levels are low and dissolved oxygen concentrations are high. On occasion, however, hypolimnetic releases from the upstream reservoir have produced zero dissolved oxygen levels at some sites. The water quality does not vary significantly from site to site, indicating that the numerous municipal and industrial dischargers along the reach have not taxed the stream's assimilative capacity.

Nickajack Reservoir receives flows from the most severely polluted streams in the 208 study area, numerous dischargers (including three major municipal treatment plants), and hypolimnetic releases from the Chickamauga Reservoir. All of these factors contribute to the dissolved

TABLE III-3

WATER QUALITY IN CHICKAMAUGA RESERVOIR

	TRM 527.4				TRM 484.10				Chickamauga Dam Tailrace TRM 471.02			
	Min.	Avg.	Max.	No.[1]	Min.	Avg.	Max.	No.[1]	Min.	Avg.	Max.	No.[1]
Total Suspended Solids (mg/l)	3	9	12	15	3	12	43	8	3	8	19	12
Total Dissolved Solids (mg/l)	80	87	100	15	70	98	120	8	70	93	120	12
BOD_5 (mg/l)	<1.0	1.1	1.4	16	<1.0	1.2	2.7	8	<1.0	<1.0	<1.0	4
DO (mg/l)	4.2	8.0	12.9	20	4.8	8.0	12.2	32	6.1	8.3	10.5	12
COD (mg/l)	3.0	5.5	8.0	16	3.0	5.5	9.0	8	3.0	6.8	15.0	12
Org. N (mg/l)	0.07	0.12	0.22	16	0.11	0.15	0.19	8	0.03	0.13	0.30	12
NH_3-N (mg/l)	0.03	0.07	0.11	16	0.01	0.05	0.08	8	0.02	0.06	0.13	12
NO_2 and NO_3-N (mg/l)	0.18	0.40	1.30	16	0.17	0.47	1.80	8	0.25	0.42	1.00	12
Total Phosphorus (mg/l)	0.01	0.02	0.05	16	0.02	0.03	0.06	8	0.02	0.03	0.05	12
Hardness (mg/l)	53	63	71	14	56	62	69	8	36	61	87	12
Turbidity (JTU)	6	10	20	15	4	13	40	8	3	10	28	11

[1]Number of Samples

oxygen and fecal coliform standards violations occasionally observed in this stream reach. The results of a Tennessee Valley Authority water quality study, performed in 1973, indicate that those pollutants generally associated with industrial sources were found in high concentrations, while other pollutants were present in much lower levels. This phenomenon is typified by phenol concentrations averaging over 4 μg/l with a maximum of 75 μg/l, and standards violating levels of cadmium, chromium, lead, and mercury. BOD values were low (approximately 1 mg/l at all sampling sites), however, and suspended solids averaged 20 mg/l with a maximum of 200 mg/l. The mineral quality of the reservoir was classified as soft to moderately hard (total hardness ranging from 55 to 87 mg/l as $CaCO_3$), while ammonia-nitrogen levels averaged 0.07 mg/l. Many of the contributing factors affecting the water quality of Nickajack Reservoir are a result of tributary inflows to the stream. These are outlined in the following section on the water quality of tributary streams.

Tributary Streams

Water quality data are available for the following major tributaries in the CARCOG/SETDD 208 Study Area: South Chickamauga Creek, Citico Creek, Chattanooga Creek, North Chickamauga Creek, Wolftever Creek, Lookout Creek, Friar Branch, Town Creek, and the Sequatchie River. The following discussion relates the water quality of each stream to the discharger effluents it receives.

South Chickamauga Creek: The water quality of South Chickamauga Creek has been adversely affected by the numerous industrial discharges and municipal wastewater flows which it receives. A study by the Tennessee Department of Public Health, completed in 1964, showed substantial evidence that the Brainerd and East Ridge wastewater facilities contributed to elevated coliform counts and lowered dissolved oxygen levels downstream from their discharges. This survey also indicated that industrial effluents further degrade the stream. Excessive concentrations of ammonia-nitrogen, nitrate-nitrogen, and toxic metals have been found in the lower reaches of the stream. Dissolved oxygen levels were frequently observed to fall below 5.0 mg/l, while fecal coliform counts of over 9,000 colonies per 100 ml were noted.

Citico Creek: Citico Creek is one of the most severely polluted streams in the CARCOG/SETDD 208 Study Area. The creek acts as a receiving stream for numerous industrial effluents, urban stormwater runoff, and bypassed domestic wastewater from Chattanooga's combined sewer system. The effect of these waste flows is readily noted in reviewing water quality parameter values for the stream. A 1973 study by the Tennessee Valley Authority reports a mean BOD concentration of 38.3 mg/l, with high levels of odor, oil and grease, nitrogen, phosphorus, sulfates, and toxic substances being present. Very high bacterial counts and zero dissolved oxygen concentrations have been observed, reflecting gross levels of pollution and a limited assimilative capacity.

Chattanooga Creek: Numerous industrial discharges into Chattanooga Creek cause it to be the most highly polluted stream in the CARCOG/SETDD 208 Study Area. Deoxygenating wastes are discharged to Chattanooga Creek by the Reilly Tar and Chemical Corporation and the Velsical Chemical Corporation. These dischargers have produced an extremely low average concentration of dissolved oxygen, with zero values being found on many occasions. Extremely high coliform counts have been noted, and BOD levels have reached 64.0 mg/l. Industrial pollution is also evidenced by wide variations in pH and high concentrations of toxic substances, notably heavy metals, phenols, and cyanide. In general, water quality in Chattanooga Creek may be characterized as very poor.

North Chickamauga Creek: In contrast to Chattanooga Creek, the water quality of North Chickamauga Creek is generally good. The stream does receive discharges from Hixson High and Junior High Schools; however, violations of state standards for dissolved oxygen, fecal coliforms, and ammonia-nitrogen have been observed in downstream reaches.

Wolftever Creek: Wolftever Creek is the receiving stream for discharges from the Collegedale municipal treatment facility and Ooltewah Elementary and High Schools. These effluents have degraded the water quality of the stream, resulting in occasional zero dissolved oxygen levels and fecal coliform standard violations. The McKee Baking Company, another discharger to the stream, has, in the past, been responsible for elevated concentrations of BOD, solids, and oil and grease. Recent improvements in production and treatment techniques have resulted in decreased discharges of these pollutants to the stream, however.

Lookout Creek: Water quality parameters values for Lookout Creek indicate little evidence of pollution even though the stream receives several small effluent discharges. Dissolved oxygen levels are high and BOD concentrations are low. High fecal coliform counts have been noted on occasion, however.

Friar Branch: Friar Branch receives waste flows from the Cedar Creek Trailer Court and the Bess T. Shepard School, as well as a number of industrial sources. The domestic dischargers contribute bacterial pollution to the stream, resulting in counts of nearly 10,000 colonies/100 ml for fecal coliforms. Two industries, GAF Corporation and C.F. Industries, have distinctive effluents which degrade this stream. GAF Corporation is a latex producing plant discharging a waste high in color, turbidity, solids, COD, and styrene. C.F. Industries, a large fertilizer plant, profoundly influences the water quality of Friar Branch with its high nitrogen discharges. Samples taken downstream from this point source show ammonia-nitrogen to average between 50 and 70 mg/l. Additionally, a 1964 plankton study by the Tennessee Department of Public Health indicates that this discharge is increasing eutrophication in the stream. In general, the water quality of Friar Branch is not good, and this stream contributes to water quality problems in South Chickamauga Creek downstream from their confluence.

Town Creek: The upper reaches of Town Creek generally have very good water quality; however, this is not true of its downstream portions. Several raw sewage discharges are reported to flow into the stream, and urban stormwater runoff from the city of Jasper reaches the stream through a number of drainage channels. These flows lower the water quality, and during low flow situations result in septic conditions in some pools of the stream. Several wet weather springs also contribute pollutants from underground drainage fields.

Sequatchie River: The Sequatchie River exhibits good water quality and possesses excellent scenic value due to the lack of urban development along its shores. The river acts as a receiving stream for flows from the municipal treatment facility at Dunlap, urban runoff, and agricultural nonpoint pollution. Because of the large assimilative capacity, however, the river has not been degraded by these pollutants.

2. Groundwater Quality

The quality of groundwater in the CARCOG/SETDD 208 Study Area may be generally characterized as good, and is present in quantities suitable for residential, farm, municipal, or industrial use. The quantity as well as quality of this water varies, however, with the composition of the geologic formation in which the water exists. As groundwater flows through different formations, minerals can be dissolved, thus affecting the quality of the water. Available quantities are influenced by the premeability of the formations and the rate of recharge within the formation. For these reasons, groundwater is discussed according to the geologic formation in which it is found.

Rome Formation

The Rome Formation is not generally considered to be a good groundwater source; however, it has been used to supply water for farm and domestic needs. Yields from wells drilled in this formation range from less than 10 gpm up to 20 gpm, while springs may produce as much as 450 gpm. Hardness of this water ranges from 7 to 203 mg/l (as $CaCO_3$), and iron concentrations up to 10 mg/l have been noted.

Conasauga Formation

Wells drilled in the Conasauga Formation are generally good sources of water; however, areas with shale and siltstone deposits tend to yield less than those with calcareous rocks. Water obtained from this formation is ususally of high quality with little iron or sulfur. Hardness ranges from 84 to 200 mg/l (as $CaCO_3$). Adequate supplies of water for domestic or farm use may result from dug wells of 20 to 40 feet in depth.

Knox Group

Water lying within the rocks of the Knox Group is usually plentiful and of good quality. Springs of high yield are common, and from

62.5 to nearly 16,000 gpm may be obtained from them. Wells generally produce 100 gpm or less, but some have been known to supply up to 450 gpm. The quality of this water is typical of that found in carbonate aquifers with hardness values of 50 to 250 mg/l (as $CaCO_3$).

Chickamauga Limestone

Chickamauga Limestone is a good source of water with wells commonly producing over 200 gpm. Many springs of high yield also issue from this formation, but the water quality is variable. A sulfurous taste is often noticeable in water from Chickamauga Limestone, and hardness may be extremely high (over 750 mg/l as $CaCO_3$). Chloride concentrations from 5 to 90 mg/l are also found, further restricting the use of this water.

Red Mountain Formation

The Red Mountain Formation produces a moderate supply of water capable of meeting domestic and farm needs. Water is generally available in wells of 100 feet deep. Very little of the water present in this formation is actually used, however, due to the high iron concentration generally present.

Fort Payne Chert

The water contained in deposits of Fort Payne Chert is of excellent quality and is usually soft. Wells drilled in this formation are reliable sources of water producing as much as 1000 gpm in some areas. Springs can be expected to yield over 100 gpm of good quality water. The supplies of water in the formation are very reliable and will meet most needs even during drought conditions.

Mississippian System

Regions of this geologic grouping with large quantities of chert and limestone are excellent sources of water. They may be counted upon to supply several hundred gpm from wells of less than 200 feet deep. In those areas where shale is present, it acts to reduce the availability of water due to its impermeability. Here, shallow wells produce less than 10 gpm of good quality water.

Pennsylvanian System

Groundwater in the Pennsylvanian System of rocks is restricted to the fractures in sandstone and shale. Wells may yield up to 300 gpm in highly fractured sandstone near streams; whereas, in other overlying locations, they generally supply less than 40 gpm. Water quality in the aquifers of this system is variable even in wells drilled in the same general area. Sulfate and iron are usually present, and local deposits of carbonaceous material may result in poor water quality.

Quaternary Alluvium

Groundwater in deposits of Quaternary Alluvium generally occurs in sufficient quantities of good quality for use in domestic supplies. In most cases, wells need not be deep to reach the water table; however, where artesian conditions exist they must be dug deeper. Large springs are often found issuing from these deposits.

Other unconsolidated deposits in the CARCOG/SETDD 208 area consist of colluvium and residuum. Colluvium is generally thicker than alluvium deposits, and is composed of clay, silt, sand, and rock fragments. These deposits, after lying on steep slopes, are not high yielding sources of groundwater. Residuum, however, does in some locations yield sufficient water for domestic use. This is particularly true where it overlies the Knox Group and contains large chert fragments. Deposits on limestone do not produce high yields, however, since they are composed mainly of low permeability clay.

D. POINT SOURCE DISCHARGERS

The following discussion inventories the municipal, domestic, and industrial dischargers to the receiving waters of the CARCOG/SETDD 208 Study Area. Future flows and pollutant loadings to the streams are projected using techniques detailed below. A review of state of Tennessee and NPDES permits is also presented in this section of the chapter.

1. Discharger Inventory

A listing of the existing point sources discharging to the study area receiving streams is presented in Tables III-4, III-5, and III-6. Dischargers are categorized according to type (municipal, domestic, or industrial), and are numbered following their alphabetical sequence. Information regarding existing flows, treatment types, and locations on receiving streams is also presented in these tables. The data contained therein were based upon the 201 facilities plans, 303(e) water quality management plan, and information received from the state of Tennessee Department of Public Health's Division of Water Quality Control. Where available, operating data from existing municipal facilities were summarized and are presented in Table III-7. Figures III-3 through III-6 display the locations of all the inventoried discharges.

There are fourteen (14) municipal, 77 domestic, and 137 industrial dischargers in the CARCOG/SETDD 208 Study Area. The domestic discharger category includes a few private businesses, but it is generally composed of public facilities (schools, nursing homes, state and federal installations). Nearly all privately owned dischargers are classified as being "industrial," regardless of type of commercial enterprise. Discharger flows range from near zero to several million gallons per day. Future flows and loads for municipal and domestic sources are projected in the following section of this chapter.

TABLE III-4
MUNICIPAL DISCHARGER INVENTORY

Discharger Name and Number	Estimated Sewered Population	Estimated Industrial Waste P.E.	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
Brainerd (M-1)	35,000	0	20,101	3.5 mgd 35,000P.E.	Secondary, SC,* CM, AE, PC, NM	95	976	Mile 10.8 of South Chickamauga Creek
Chickamauga (M-2)				5.25 mgd	Secondary,SC, AE, NM, PG, WL	47.5		Mile 0.7 of Crawfish Spring Branch to Mile 22.8 of West Chickamauga Creek
Collegedale (M-3)	3,031	4,641	7,672	.075 mgd 1800 P.E.	Secondary, SC, AE, PC	84	1,224	Mile 16.6 of Wolftever Creek
Dunlap (M-4)	1,400	2,000	3,400	0.2 mgd 2000 P.E.	Secondary, SC, CM, PC	75	850	Mile 0.7 of Coops Creek to Mile 44.0 of Sequatchie River
East Ridge (M-5)	24,000	0		3.0 mgd	Secondary, GH, SH, SC, CM, FD, AM, DT, ZI, ZL, VV, XP			Mile 14.5 of South Chickamauga Creek
Fort Oglethorpe (M-6)	4,500	8,000	12,500	2.0 mgd	Secondary, SC, SM, AM, PC			Mile 0.3 of unnamed tributary to Mile 4.8 of W. Chickamauga Creek
Jasper (M-7)				0.78 mgd	Secondary, SC, LO, PC			Mile 421.8 of the Tennessee River

TABLE III-4
MUNICIPAL DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Estimated Industrial Waste P.E.	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
Moccasin Bend (M-8)	85,000	478,920	563,920	42.0 mgd 500,000P.E.	Secondary, SC, SM, AE, PC, CM	66	189,230	Mile 457.8 of the Tennessee River
Red Bank (M-9)	5,540	3,561	9,101	1.50 mgd 15,000 P.E.	Secondary, SC, CM, FT, PC	83	1,504	Mile 455.6 of the Tennessee River
Ringgold (M-10)			2,100	0.16 mgd	Secondary, SC, AE, PC			Mile 31.4 of South Chickamauga Creek
Signal Mountain (M-11)	1,381	200	1,581	0.40 mgd 4,000 P.E.	Secondary, SC, CM, AE, PC	90	161	Mile 453.8 of the Tennessee River
South Pittsburg (M-12)	3,070	8,689	11,759	0.46 mgd 5,000 P.E.	Primary, SC, CM, PC	50	5,880	Mile 417.5 of the Tennessee River
Trenton (M-13)	2,415	1,500	4,500	0.32 mgd	Secondary, SC, FT, PC			Mile 19.0 of Lookout Creek
Whitwell (M-14)				0.30 mgd	Secondary, LO			Sequatchie River

*Key to abbreviations used in describing Type Treatment is presented following Table III-5.

TABLE III-5
DOMESTIC DISCHARGER INVENTORY

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
Boynton Elem. School (D-1)	570	171		Secondary, CS, FR*			Mile 0.6 of unnamed tributary to Mile 6.1 of Peavine Creek
Brookvale Estates (D-2)	315	94.5		Secondary, SC, NM, PC			Mile 0.5 of unnamed tributary to Mile 3.4 of Spring Creek
Brown Junior and Central Senior High Schools (D-3)	1,950	650	.012 mgd 400 P.E.	Secondary, SC, AE, PC	89	73	Mile 0.9 of tributary to Mile 478.2 of Tennessee River
Cedar Creek Mobile Home Park (D-4)	130	120	.012 mgd 160 P.E.	Secondary, SC, AE, PC	73	33	Mile 0.2 of Cedar Creek to Mile 5.8 of Friar Branch
Chattanooga Area Vocational Technical School (D-5)	250	800	.013 mgd 130 P.E.	Secondary, SC, AE, PC	91	72	Mile 470.1 of the Tennessee River
Chattanooga Power Service Center (D-6)	80	38	.006 mgd 60 P.E.	Secondary, SC, AE, PC	87	5	Mile 0.3 of unnamed tributary to Mile 0.7 of North Chickamauga Creek
Chattanooga State Technical Community College (D-7)	512	93	.040 mgd 400 P.E.	Secondary, SC, AE, PC	98	2	Mile 470.4 of the Tennessee River
Chattanooga Valley High School (D-8)			.018 mgd 183 P.E.	CS, FR			Mile 1.7 of Ellis Branch to Mile 13.2 of Chattanooga Cr.
Covenant College (D-9)	550	165	.050 mgd 500 P.E.	Tertiary, AE			Mile 0.8 of unnamed tributary to Mile 7.1 of Lookout Creek
Days Inn Motel (D-10)			.017 mgd 170 P.E.	Tertiary, SC AE,NM,PC,FR,WL			Mile 1.0 of Peavine Creek
Dunlap Water Treatment Plant (D-11)				None			Mile 0.1 of unnamed tributary to Mile 9.0 of Coops Creek

TABLE III-5
DOMESTIC DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
Georgia Welcome Station (D-12)			.015 mgd 150 P.E.	Tertiary, SC,AE, NM,PC,FR			Mile 0.1 of unnamed tributary to Mile 4.1 of Peavine Creek
Granny's Restaurant (More Petroleum) (D-13)		12	.004 mgd 40 P.E.	CS, FR			Mile 1.8 of Wauhatchie Branch to Mile 7.2 of Lookout Creek
Grindstone Mountain Mobile Home Estates (D-14)			0.05 mgd				Mile 0.8 of unnamed tributary to Mile 17.6 of Wolftever Creek
Gulf Oil Service Station (Cummings Highway) (D-15)				Secondary, AE			Mile 1.0 of unnamed tributary to Mile 0.6 of Black Creek to Mile 2.5 of Lookout Creek
Gulf Oil Service Station (Hixson Pike) (D-16)				Secondary, AE			Mile 1.2 of unnamed tributary to Mile 469.2 of Tennessee R.
Hamilton Co. Nursing Home (D-17)	800	878	.080 mgd 840 P.E.	Secondary, SC, AE, PG	89	94	Mile 0.8 of Cedar Creek to Mile 5.8 of Friar Branch
Highway 58 Shopping Center (D-18)		63	.006 mgd 110 P.E.	Tertiary, SC, AE, FR, PC	97	2	Mile 2.1 of unnamed tributary to Mile 2.3 of Friar Branch
Hixson High School (D-19)	945	284	.001 mgd 200 P.E.	Secondary, SC, AE, PC	75	71	Mile 0.4 of unnamed tributary to Mile 8.7 of North Chickamauga Creek
Hixson Junior High School (D-20)	1,275	383	.003 mgd 100 P.E.	Tertiary, SH, AE, FR, PC	69	120	Mile 0.2 of unnamed tributary to Mile 7.9 of North Chickamauga Creek
Holiday Inn (D-21)	160	48	.016 mgd 160 P.E.	Tertiary, SC, AE, DO, FR, PC			Mile 0.4 of Isbill Creek to Mile 1.5 of Black Creek to Mile 2.3 of Lookout Creek

TABLE III-5
DOMESTIC DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
I-75 Tourist Welcome Center (D-22)			.045 mgd	Tertiary, PC			Mile 1.5 of West Chickamauga Creek
Jasper Water Treatment Plant (D-23)				None			Mile 3.2 of Town Creek
K-Mart (Hixson Pike) (D-24)		170	.01 mgd 100 P.E.	Secondary, SC, AE, PC			Mile 1.5 of unnamed tributary to Mile 469.2 of Tennessee R.
Krystal Restaurant (Highway 58) (D-25)			.004 mgd 72 P.E.	Secondary, SC, AE, PC, IS			Subsurface field lines
LaDel Mobile Home Valley (D-26)	246	208	.01 mgd 130 P.E.	Secondary, SC, AE, PC	82	38	Mile 0.9 of unnamed tributary to Mile 0.6 of Black Creek to Mile 2.5 of Lookout Creek
Lakeshore Country Club Apartments (Statewide Enterprises, Inc.) (D-27)	340	302	.145 mgd 1,450 P.E.	Secondary, SC, AE, PC	80	60	Mile 471.7 of the Tennessee River
Lookout Mtn. Junior High School (D-28)			.04 mgd 400 P.E.	Secondary, AC, N, P, D			Mile 0.8 of unnamed tributary to Mile 8.0 of Lookout Creek
Loret Resort Villa (Harrison) (D-29)	240	200	.04 mgd 400 P.E.	Secondary, SC, AE, PC	87	26	Mile 477.6 of the Tennessee River
Loret Resort Village (Chattanooga) (D-30)							Tennessee River
McDonald's Hamburgers (Highway 58) (D-31)			50 P.E.	Tertiary, SC, AE, NM, FR, PC			Subsurface field lines
McDowell Wastewater Treatment Plant (D-32)			0.25 mgd 2,500 P.E.	Secondary, AM			Mile 0.2 of Black Creek to Mile 2.5 of Lookout Creek

TABLE III-5
DOMESTIC DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
Mitchell Acres Subd. (D-33)	150	150	0.04 mgd	Primary, LO			Mile 6.9 of W. Chickamauga Creek
Morris Estates Subd. (D-34)	455	136	.022 mgd	Primary, LO			Mile 17.4 of S. Chickamauga Creek
Mowbray Utility District (D-35)				None			
Northgate Mall (Hixson Sewage, Inc.) (D-36)		1,216	0.25 mgd 2,500 P.E.	Tertiary, SC, AA, DO, FR, PG	99	18	Mile 1.0 of unnamed tributary to Mile 4.4 of W. Chickamauga Creek
North Twinbrook Subd. (D-37)	25	23	.014 mgd 141 P.E.	Secondary, SC, AE, PE	87	3	Mile 0.6 of Cedar Creek to Mile 5.8 of Friar Branch
Northwest Hamilton Co. Human Resources Center (D-38)			0.01 mgd 100 P.E.	Primary, CS			Subsurface field lines
Ooltewah Elem. Sch. (D-39)	590	177	.004 mgd 125 P.E.	Secondary, SC, AE, PC			Mile 0.4 of Little Wolftever Creek to Mile 14.4 of Wolftever Creek
Ooltewah High Sch. (D-40)							Mile 4.3 of Rogers Branch to Mile 6.0 of Wolftever Creek
Plaza 76 Service Sta. (Union Oil) (D-41)			7 P.E.	Secondary, AE			Mile 1.1 of unnamed tributary to Mile 469.2 of Tennessee R.
Powell Mobile Home Park (D-42)			0.03 mgd flow < 75% of capacity	Secondary, AA, FR			Mile 1.0 of Peavine Creek

TABLE III-5
DOMESTIC DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
Red Bank Water Treatment Plant (D-43)				None			Tennessee River
Red Food Stores (D-44)		53	.005 mgd 76 P.E.	Tertiary, SC, AE, PC	96	2	Mile 1.7 of Mackey Branch
Rock City Gardens (D-45)			200 P.E.	Tertiary	98.4		Mile 1.9 of unnamed tributary to Mile 11.5 of Chattanooga Creek
Sandmont Nursing Home (D-46)			.007 mgd	Secondary, LO			Mile 5.5 of Crawfish Creek to Mile 26.1 of Lookout Creek
Savannah Valley Utility District (D-47)				None			Mile 11.0 of Long Savannah Creek
Scottish Inn (Junction Enterprises) (D-48)			0.01 mgd 200 P.E.	Tertiary			Mile 2.2 of Battle Creek
Shephard Elem Sch. (D-49)			.005 mgd 50 P.E.	Secondary AE, NM, PC			Mile 1.0 of unnamed tributary to Mile 5.0 of Friar Branch
Sherwood Forest Mobile Home Park (D-50)			300 P.E.	Tertiary			Mile 29.6 of South Chickamauga Creek
Signal Plaza Shopping Ctr. (D-51)		28	.006 mgd 90 P.E.	Secondary, SC, AE, PC	82	5	Mile 4.3 of Shoal Creek
Soddy-Daisy Water Treatment Plant (D-52)				None			Mile 3.6 of Soddy Creek Bay

TABLE III-5
DOMESTIC DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
S. Pittsburg Water Treatment Plant (D-53)				Complete Recycle			Mile 418.0 of the Tennessee River
Standard Brands, Inc. (D-54)							Mile 0.1 of Mill Creek to Mile 38.2 of West Chickamauga Creek
Stuckey's Pecan Shoppe (D-55)			.004 mgd	Secondary, CS, FR, PC			Mile 35.6 of South Chickamauga Creek
Tennessee Dept. of Transportation I-24 Welcome Station (D-56)	600	167	0.02 mgd 200 P.E.	Tertiary, SC, AE, PC	90	17	Mile 1.3 of unnamed tributary to Mile 4.3 of Lookout Creek
Tennessee Dept. of Transportation I-24 Rest Area (Marion Co.) (D-57)	400	400	0.04 mgd 400 P.E.	Tertiary			Mile 429.1 of the Tennessee River
TVA Chickamauga Dam Hydro Plant (D-58)	45	13.5	.006 mgd 45 P.E.				Mile 471.0 of the Tennessee River
TVA Nickajack Hydro Plant (D-59)	50	45	0.01 mgd 100 P.E.	Secondary, SC, AE, PC	90	5	Mile 424.5 of the Tennessee River
TVA Raccoon Mtn. Project (STP No. 1) (D-60)		10	0.01 mgd 100 P.E.	Secondary, SC, AE, PC	87	1.3	Mile 444.7 of the Tennessee River
TVA Raccoon Mtn. Project (STP No. 2) (D-61)		13	.005 mgd 50 P.E.	As above	87	1.6	As above
TVA Raccoon Mtn. Project (STP No. 3) (D-62)		12	.002 mgd 20 P.E.	As above	87	1.5	As above
TVA Sequoyah Nuclear Plant (STP) (D-63)			.0149 mgd				Mile 484.0 of the Tennessee River

TABLE III-5
DOMESTIC DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
TVA Sequoyah Nuclear Plant (Unit 1) (D-64)		18	.005 mgd 50 P.E.	Secondary, SC, AE, PC	87	2.3	Mile 484.8 of the Tennessee River
TVA Sequoyah Nuclear Plant (Unit 1A) (D-65)		18	0.01 mgd 100 P.E.	As above	87	2.3	As above
TVA Sequoyah Nuclear Plant (Unit 2) (D-66)		193	.018 mgd 175 P.E.	As above	87	2.5	As above
TVA Sequoyah Nuclear Plant (Unit 3) (D-67)				None			As above
TVA Sequoyah Nuclear Plant (Cooling Water) (D-68)				None			Mile 484.5 of the Tennessee River
Union Oil Service Station (Hixson Pike) (D-69)		8	.001 mgd 7 P.E.	Secondary, AE	63	3	Mile 1.2 of unnamed tributary to Tennessee River
Union '76 Truck Stop (D-70)			0.03 mgd 300 P.E.	Tertiary, AE, NM, PG, WL			Mile 0.8 of unnamed tributary to Mile 35.6 of South Chickamauga Creek
Valley Psychiatric Hospital (D-71)			.008 mgd 76 P.E.	Tertiary, SC, AE, LP, PC			Spray irrigation
Valley View Elem Sch. (D-72)	360	108	.002 mgd 63 P.E.	Secondary, SC, AE, PC	81	20	Mile 0.8 of unnamed tributary of Mile 458.7 of Tennessee R.
Walden Ridge Utility District (D-73)				None			Mile 0.1 of unnamed tributary to Falling Water Creek
Walker Co. Correctional Institute (D-74)	360	250	.025 mgd 250 P.E.	Tertiary	90		Mile 0.1 of Mill Creek to Mile 38.2 of W. Chickamauga Creek

TABLE III-5
DOMESTIC DISCHARGER INVENTORY (Continued)

Discharger Name and Number	Estimated Sewered Population	Influent Waste P.E.	Design Capacity	Type Treatment	% Reduction	Treated Waste P.E.	Location on Receiving Stream
Westside School (D-75)	429	128		Primary, FR			Mile 1.0 of unnamed tributary to Mile 5.9 of West Chickamauga Creek
Whitwell Water Treatment Plant (D-76)				None			Mile 3.5 of the Sequatchie River
Wildwood Sanitarium (D-77)			.0095 mgd 95 P.E.	Primary, LO			Mile 0.6 of unnamed tributary to Mile 0.7 of Wauhatchie Creek to Mile 7.2 of Lookout Creek

*Key to abbreviations used in describing type treatment is presented following this table.

KEY TO TABLES III-4 AND III-5

The treatment methods and processes shown in this table are, in general, arranged in the order in which they normally occur during a sewage disposal cycle.

S Screens

- SC comminutor (screenings ground in sewage stream)
- SF fine screen (less than 1/8" openings)
- SG screenings ground in separate grinder and returned to sewage flow
- SH bar rack (1/2" to 2" openings) hand cleaned
- SI intermediate screens (1/8" to 1/2" openings)
- SM bar rack (1/2" to 2" openings) mechanically cleaned
- SR coarse rack (openings over 2")
- ST garbage ground at plant and added to sewage flow

G Grit chambers

- GA aerated grit chambers
- GH without continuous removal mechanism
- GM with continuous removal mechanism
- GP grit packet or screen chamber
- GW separate grit washing device

O Grease removal or skimming tanks--not incidental to settling tanks

- OA aerated tank (diffused air)
- OM mechanically equipped tank

E Pre-Chlorination

- EC with contact tank
- EG by chlorine gas
- EH by hypochlorite

C Primary settling tanks

- CI two story (Imhoff)
- CM mechanically equipped
- CP plain, hopper bottom or intermittently drained for cleaning
- CS septic tank
- CT multiple tray mechanically equipped

R Intermediate settling tanks

- RI two story (Imhoff)
- RM mechanically equipped
- RP plain, hopper bottom or intermittently drained for cleaning
- RT multiple tray, mechanically equipped

KEY TO TABLES III-4 AND III-5 (Continued)

A		Aeration
	AA	activated sludge, diffused air aeration
	AC	contact aerators
	AE	extended aeration (in conjunction with AA or AM)
	AM	activated sludge, mechanical aeration
	AP	aeration, plain, without sludge return
F		Filters
	FC	contact beds
	FM	magnetite (straining)
	FO	roughing filters
	FR	rapid sand or other sand straining
	FS	intermittent sand
	FT	trickling (no further details)
	FTH	high capacity
	FTN	fixed nozzle standard capacity
	FTR	rotary distributor, standard capacity
	FTT	traveling distributor, standard capacity
K		Intermediate treatment-flocculation-with or without chemicals. Chemical treatment-type units or equipment not necessarily complete, or not operated.
	KA	flocculation tank, air agitation
	KC	chemicals used
	KM	flocculation tank, mechanical agitation
	KX	no chemicals used
	KY	chemical treatment facilities provided, but not used
N		Final settling tanks
	NI	two story (Imhoff)
	NM	mechanically equipped
	NP	plain, hopper bottom or intermittently drained for cleaning
	NT	multiple tray, mechanically equipped
P		Post-chlorination
	PC	with contact tank
	PG	by chlorine gas
	PH	by hypochlorite
I		Sewage application to land
	IC	with cropping
	IP	percolation beds
	IS	subsurface application
	IU	land underdrained

KEY TO TABLES III-4 AND III-5 (Continued)

L		Lagoons
	LE	evaporation lagoons
	LO	oxidation lagoons or ponds
	LP	lagoon for settling of sewage
D		Digester, separate sludge
	DC	with cover (fixed if not otherwise specified)
	DE	gas used in engines (heat usually recovered)
	DF	with floating cover
	DG	with gasometer cover
	DH	gas used in heating
	DM	stirring mechanism
	DO	open top
	DP	unheated
	DR	heated
	DS	gas storage in separate holder
	DT	stage digestion
B		Sludge beds
	BC	glass covered
	BL	sludge lagoons--not for treatment of sewage
	BO	open
H		Sludge storage tanks (not second stage digestion units)
	HC	covered
	HM	with stirring or concentrating mechanism
	HO	open
T		Sludge thickener
	TC	covered
	TM	stirring mechanism
	TO	open top
V		Mechanical sludge dewatering
	VC	sludge centrifuge
	VV	rotary vacuum filter
	VO	other
Z		Sludge conditioning
	ZA	chemicals used, alum
	ZC	chemicals used (unidentified)
	ZI	chemicals used, iron salt
	ZL	chemicals used, lime
	ZX	no chemicals used
	ZY	elutriation

KEY TO TABLES III-4 AND III-5 (Continued)

W		Advanced treatment (beyond conventional secondary)
	WA	adsorption
	WB	freezing
	WC	chemical coagulation and sedimentation, final distillation
	WD	distillation
	WE	evaporation
	WF	electro-chemical treatment
	WG	electrodialysis
	WHD	filtration, diatomite
	WHS	filtration, sand
	WI	ion exchange
	WK	foaming
	WL	lagoon
	WO	oxidation, wet
	WR	reverse osmosis
	WS	solvent extraction
X		Sludge disposal
	XB	barged to sea
	XD	used for fertilizer
	XF	burned for fuel
	XN	incinerated
	XP	used for fill

KEY TO ABBREVIATIONS USED IN TABLES
III-6, III-10, III-11, and III-12.

BOD_5 - Biochemical Oxygen Demand (five-day)
COD - Chemical Oxygen Demand
TSS - Total Suspended Solids
Sett. - Settleable Solids
DO - Dissolved Oxygen
O & G - Oil and Grease
NH_3 - Ammonia nitrogen
Fe - Iron
Cr - Chromium
Cl - Chlorine residual
Phe. - Phenols
Sur. - Surfactants
Zn - Zinc
Al - Aluminum
Fl - Fluoride
Pb - Lead
SO_4 - Sulfates
PO_4 - Phosphates
Ni - Nickel
Cu - Copper
TKN - Kjeldahl nitrogen
P - Phosphorus
Cn - Cyanide
Mn - Manganese
Hg - Mercury
Na - Sodium

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-1	Accu-Cast Inc.	Wax pattern casting	Cooling	.0021	None	Temperature	Trib. to Chattanooga Cr. 3,4,5,6
I-2			Wax pattern wash water	.0001	None	Temp., SS	Trib. to Chattanooga Creek 3,4,5,6
I-3	Acheson Foundry & Machine Works	Iron foundry	Process	0.02	None	SS, metal	Chattanooga Creek 2,3,5,6
I-4	ALC, Inc.	Latex emulsions 33	Surface runoff & Washwater	0.040	Holding tank & hauls	SS, turbidity	Near Chattanooga Cr. (4.9) 2,3,5,6
I-5	Alco Chemical Co., Inc.	Organic chemicals 20	Cooling water TN0002798	0.150	None	Temperature	S. Chickamauga Creek (0.8) 2,3,5,6
I-6	Alloy Fabricators	Stainless steel process equipment - 42	Pressure vessel testing and wash water	0.011	None	Suspended Solids, Oils, Fe, Surfactants	Chattanooga Creek (2.6) 2,3,5,6
I-7	American Cyanamid	Aluminum sulfate	Process	None	Complete Recycle	None	Near Tenn R. (457.0)
I-8			Surface Runoff TN0026760	Varies	None	pH, solids	Tenn R. (457.0) 1,2,3,4,5,6,7
I-9	American Electrical Industries	Aluminum Conductors - 275	Cooling water TN0002542	0.25	None	BOD_5 = 1 mg/l Cu, Zn Oil & Grease = 7 mg/l Al = 0.08 mg/l	Unnamed trib. (0.5) to Tn. River (462.8) 3,4,5,6
I-10	American Oil Co. Chattanooga Barge Terminal	Asphalt unloading terminal - 7	Surface runoff, boiler blowdown TN0002577	0.05	Sedimentation	SS, oils, phenols	Tennessee River (463.4) 1,2,3,4,5,6,7
I-11	American Oil Co. Chattanooga Pipeline Term.	Gasoline, kerosene, fuel oil terminal 6	Surface runoff, fuel separation water TN0002577	0.001	Skimming, sedimentation	Oils, phenols	Unnamed trib. (0.8) to Friar Branch (2.3)
I-12	Atlas Paper Box Company	Packaging	Cooling water	.0058	None	Temperature	Chattanooga Cr. 2,3,5,6
I-13	BHY Concrete Finishing, Inc.	Ready Mix Concrete - 75	Washwater and and storm runoff	0.002	Recycle	N/A[4]	Near Dobbs Branch (0.2) to Chattanooga Cr. (2.1) 3,4,5,6

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-14	Central Soya Co., Inc.	Vegetable oil extraction, livestock feedmilling 290	Process, cooling, boiler blowdown, runoff TN0003557	0.11	Grease skimming equalization, extended aeration	BOD_5 = 25 mg/l SS = 25 mg/l Oils = 6 mg/l pH = 7.5	Tennessee R. (467.9) 1,2,3,4,5,6,7
I-15	C.F. Industries, Incorporated	Nitrogen fertilizers, Ammonia - 188	Process wastes, cooling tower blowdown, boiler blowdown TN002267	0.968	Sedimentation, ion exchange	BOD_5 = 3mg/l NO_3 = 3 mg/l NH_3-N = 1.6 mg/l Silica = 80 mg/l	Unnamed trib. (1.1) to Friar Branch (2.0) 3,5,6
I-16	Chattanooga Boiler and Tank Co.	Metal plate fabrication - 150	Pressure vessel testing	0.0391	None	Suspended solids, Oils, Fe	Dobbs Branch (0.2) to Chatt. Creek (2.1) 3,4,5,6
I-17	Chattanooga Gas Co., LPG Storage	Liquified petroleum gas - 5	Cooling water	0.020	None	SS, Sett. S, temp., pH, oil, phenols	Unnamed trib. to Citico Cr. (1.5) 3
I-18	Chattanooga Gas Co., LNG Storage	Liquified natural gas - 6	Cooling water	0.030	None	SS, Sett. S, temp., pH, oil, phenols	Unnamed tributary to Citico Cr. (1.5) 3
I-19	Chattanooga Coke & Chemicals Co.	Coke and specialty chemicals 10	Process and Surface runoff TN0001635	Varies	Not in operation	BOD_5, turbidity, oils and NH_3-N	Unnamed trib. (0.5) to Chattanooga Cr. (4.6) 3,4,5,6
I-20	Chattem Drug and Chemical Co.	Medicinal chemicals proprietory medicines - 212	Cooling water TN0002780	0.6	None	BOD_5 = 10 mg/l TSS = 15 mg/l	Storm sewer to Gillespie Spring Branch (0.2)
I-21	TVA Chickamauga Dam Hydro Plant	Electricity	Bearing cooling water TN0027413	Varies	None	O & G, SS	Tenn. R. (471.0) 1,2,3,4,5,6,7
I-22	Cities Service Oil Co.	Oil & gasoline storage - 2	Surface runoff and spills TN0022438	0.001	Oil & water separator	SS, Oils, Phenols	Unnamed trib. (0.8) to Friar Br. (2.3) 3,4,5,6
I-23	Clowes Ceramic Division	Steatite Cermics 95 (to close)	Cooling water	.02	None	Temperature	Trib. (0.5) to Chattanooga Creek (5.7) 3,4,5,6
I-24	Cobble Muse Hosiery	Hosiery	Steam Condensate	Varies	None	Temperature	Dobbs Branch (0.4) 3,4,5,6
I-25	Colonial Pipeline	Oil & Gas transmissoin	Surface runoff and spills	Varies	Oil and water separator	SS, Oils, phenols	Unnamed trib. (0.8) to Friar Br. (2.3) 3,4,5,6
I-26	Combustion Engr., Inc.	Steam generating equipment and stainless tubing - 5400	Cooling water TN0003514	0.120	None	Temperature = 17°C BOD 4 mg/l	Tennessee R. (462.1) 1,2,3,4,5,6,7

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-27	Consolidated Latex Company	Rubber latex suspensions - 60	Cooling and surface runoff	0.001	None	Color, turbidity	Drainage ditch (0.1) to Tennessee R. (466.0) 3,4,5,6
I-28	Crane Co., Chatt. Div.	Enameled cast iron plumbing fixtures and steel valves - 191	Cooling water	0.260	Spray coolers	Temperature	Chattanooga Cr. (1.8) 2,3,5,6
I-29	Cutter Labs., Inc.	Intravenous feedings - 550	Condensate and runoff TN0001481	0.01	None	SS, BOD = 2.1 mg/l	Tannery Branch (0.5) 3,4,5,6
I-30	Dallas Car Wash	Washing autos 1	Wash water	0.0028	Sand filter	BOD_5 = 20 mg/l SS = 30 mg/l Surfactants	Unnamed trib. to Dallas Bay (0.3) to Tn. R. (480.0) 1,2,3,4,5,6,7
I-31	Dept. of Defense Volunteer Army Ammunition Plant	TNT - 1,100 (Full production)	Process wastes, cooling water runoff and water plant waste TN0002313	3.0 (Full production	Neutralization, equalization, sedimentation, ion exchange	Variable; Plant is scheduled to discontinue operation by Sept. 1978	Waconda Bay of Tenn. R. (3.0) 1,2,3,4,5,6,7
I-32	Dixie Sand and Gravel Company	Sand and gravel 35	Wash water, & runoff TN0004707	0.760	None	SS = 8,200 mg/l turbidity = 1400 FTU	Tennessee R. (463.0) 1,2,3,4,5,6,7
I-33	Dixie Yarns, Inc. Lupton City Plant	Textile yarns - 606	Cooling tower blowdown, and air cleaner wastewater TN0082453	0.30	None	PO_4, Cu	Unnamed trib. (0.6) to Tenn. R. (469.0) 3,4,5,6
I-34	E. I. duPont deNemours & Co.,	Nylon, polyester, synthetic fibers 3875	Process TN0002844	2.76	Equalization, nitrification	BOD_5 = 65 #/day TSS = 89 #/day NH_3 = 23 #/day	Tennessee R. (469.9) 1,2,3,4,5,6,7
I-35			Cooling and boiler blowdown	9.0	None	Uncontaminated	Tennessee R. (469.9) 1,2,3,4,5,6,7
I-36			Sanitary	0.14	Secondary, T.F.	BOD_5 = 11 mg/l, Cl	Tennessee R. (469.9) 1,2,3,4,5,6,7
I-37	East Brainerd Wishy-Washy	Unattended coin laundry & car wash 2	Wash water	0.010	Filtration	BOD_5, oil	Unnamed trib. (0.2) to Ryall Springs Br. (0.6) to Mackey Br. (1.2) 3,5,6

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-38	Ernest Holmes Co., Div. of Dover Corp.	Auto wrecker assembly - 441	Paint booth wash water	0.0007	Flotation and skimming	BOD_5 = 400 mg/l TSS ≟ 350 mg/l Cr = 2.1 mg/l Zn = 2 mg/l oil & grease = 50 mg/l	Storm sewer to unnamed trib. (0.8) to Chattanooga Cr. (5.5) 3,4,5,6
I-39	Exxon Company (Pipeline Terminal)	Oil & Gasoline Storage	Surface runoff and spills TN0028533	Varies	Oil & Water separator	SS, Oils, Phenols	Unnamed trib. (1.0) to Friar Branch (2.2)
I-40	Fibron, Inc.	Polyethylene and polypropylene extrusions - 100	Cooling water TN0002822	0.048	None	Temperature	Unnamed trib. (0.5) to S. Chickamauga Creek (5.1) 3,4,5,6
I-41	GAF Corporation	Rubber latex suspension - 244	Latex waste, cooling water and boiler feed TN0003492	0.300	Air flotation, coagulation, aeration, and sedimentation	BOD = 56 mg/l SS = 92 mg/l NH_3-N = 42 mg/l	Friar Branch (0.5) 3,5,6
I-42	General Crushed Stone	Crushed limestone	Washwater and runoff TN0022764	Varies	Partial recycle process water	SS, turbidity	Wauhatchie Branch (2.0) to Lookout Cr. (6.5) 3,4,5,6
I-43	General Oils	Bulk petroleum 45	Runoff, boiler blowdown and water softener	.0004	None	O & G, solids SS, pH	Tenn. river (456.9) 1,2,3,4,5,6,7
I-44	General Portland, Inc., Signal Mountain Div.	Portland cement 135	Process, cooling TN0001821	1.600	Sedimentation	SS, TDS = 2,400 mg/l	Tennessee R. (454.6) 2,3,5,6,7
I-45	General Shale	Manufacture of face brick - 60	Process, pump cooling water	0.0072	Sedimentation	SS, turbidity	Overland flow to unnamed trib. (0.8) to Chattanooga Cr. (4.8) 3,4,5,6
I-46	Godsey's Automotive Shop	Automotive cleanup	Process	Varies	None	O & G, SS, BOD	Unnamed trib. (0.5) to Tenn River (463.5) 3,4,5,6
I-47	Hamilton Co. Nursing Home	Laundry facility for nursing home 19	Wash water	0.004	Sand filtration	BOD = 8 mg/l SS, Surfactants	Unnamed trib. (1.8) to Friar Br. 3,4,5,6
I-48		Nursing home - 559	Sanitary TN0026751	0.064	Secondary	BOD = 5 mg/l	Unnamed trib. (1.8) to Friar Branch 3,4,5,6

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-49	Harrison Bay Park	Swimming pool	Filter backwash	0.0015	None	SS, Cl	Tennessee R. (479.4) 1,2,3,4,5,6,7
I-50	(Stacy Oil Company) formerly Henry's Red Bird Car Wash	Car washing - 1	Wash water	0.0025	Sand filter	BOD_5, SS, surfactants	Unnamed trib. to Ryall Springs Br. (0.1) 3,4,5,6
I-51	Hixson Coin Laundry	Laundry - 1	Wash water	.0025	None	BOD, SS, Surfactants	Sinkhole
I-52	Independent Enterprises, Inc. Hwy. 58 Shopping Center	Commercial shopping center	Cooling water	0.001	None	Temperature	Unnamed trib. (1.9) to Friar Br. (2.1) 3,5,6
I-53	Kay's Ice Cream, Inc.	Ice cream and sherbert - 118	Cooling	0.0050	None	Temperature	Unnamed trib. (1.9) to Spring Cr. (0.9)
I-54	Koehring Southern Co., Lorain Div.	Hydraulic and mechanical cranes 500	Steam cleaning and paint booth water	.0010	None	BOD_5, SS, color, Oil & Grease	Drainage ditch (0.1) to Mountain Cr. (0.4) 3,4,5,6
I-55	L & N Railroad Co. Wauhatchie Yards	Diesel engine service area repair & switch yr. - 350	Spills and contaminated surface runoff TN0004588	Varies	Oil sedimentation	Oils = 10 mg/l BOD_5 = 15 mg/l SS = 46 mg/l	Black Cr. trib. to Lookout Cr. (2.5) 3,5,6
I-56			Sanitary	0.010	Extended aeration	BOD_5 = 140 mg/l SS = 280 mg/l Cl = 6.4 mg/l	Black Cr. (0.6) 3,5,6
I-57	Lutex Chemical Corp.	Textile Chemicals - 50	Runoff	Varies	None	BOD_5, SS, pH, O & G, turbidity	Unnamed trib of S. Chickamauga Cr. (10.5) 2,3,5,6
I-58	McDowell Development Corp. (P.B. & S Chemicals)	Bleach - 12	Process TN0029513	0.01	Neutralization Equalization	TDS = 2000 mg/l Cl, SO_4	Lookout Cr. (2.5) 2,3,5,6
I-59	McKee Baking Co.	Bakery - small cakes and cookies 1300	Wash water, cooling and water TN0003204	0.045	Trickling filter, aeration, filtration	BOD = 3.2 mg/l P = 1.8 mg/l Oil & Grease = 9.7 mg/l	Wolftever Cr. (16.6) 3,5,6

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-60	Missouri Portland Cement Company	Portland Cement distribution	Cooling water	0.04	None	Temperature	Tenn. River (456.5) 1,2,3,4,5,6,7
	Mowbray Utility District	Drinking water - 4	Filter backwash and sedimentation sludge	0.01	None	SS, Cl	
I-61	Mueller Company	Gate valves and fire hydrants - 933	Process TN0001414	0.001	Sedimentation, closed system recycle	Not applicable	Near S. Chickamauga Cr. (0.8) 2,3,5,6
I-62	N. River YMCA	Recreational facility - 7	Swimming pool filter backwash	0.0004	None, spray irrigation under construction	BOD_5, SS, Cl	Unnamed trib. (0.7) to unnamed trib. to Tenn. R. (469.3) 3,4,5,6
I-63	Norton Company	Ceramics	Cooling water	.0007	None	temperature	Poe Branch (4.5) 3,4,5,6
I-64	Polysar Latex, Incorporated	Rubber latex suspensions - 76	Cooling - 002 TN0002861	0.067	None	Temperature	Tennessee R. (469.0) 1,2,3,4,5,6,7
I-65	Provident Life & Accident Ins. Co.	Employee recreation area	Swimming pool filter backwash	0.002	Equalization, spray irriga-tion	BOD_5, SS, Cl	Adjacent to Harrison Bay (0.6) 1,2,3,4,5,6,7
I-66	Thrifty Way Car Car Wash No. 1	Unattended coin operated	Wash water	0.0028	Sand filter, grit chamber	BOD_5, SS, oils	Ditch to sinkhole 3,4,5,6
I-67	Racket Club Swimming Pool	Recreation	Swimming pool drainage	0-0.1	None; discharges once a year	Cl	Tributary (0.2) to N. N. Chickamauga Cr. (4.3) 3,4,5,6
I-68	Rockwell Internl. Rockwell Standard Division	Enameled cast iron plumbing fixtures & steel valves, truck brake castings 550	Cooling water and process and surface runoff TN0001902	Varies	Neutralization sedimentation recycle	BOD_5 = 20 mg/l SS = 152 mg/l pH = 4.8-6.4 temp. = 31°C Fe = 24, Pb = 39 mg/l	Unnamed trib. (0.4) to Chatt. Cr. (1.8) 3,4,5,6
I-69	Rock-Tenn Co. Mill Division	Manufacturers of paper boxboard - 175	Cooling water, boiler blowdown water softener backwash	0.137	None	Temperature, TDS, pH, TSS	Tenn. R. (463.5)

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-70	Roper Corporation Chattanooga Div.	Gas and electric ranges - 300	Cooling water No. 006 TN0003603	0.06	Oil skimmer	Temp., Oil & Grease	Unnamed trib. (0.3) to Tenn. R. (463.9) 3,4,5,6
I-71	Roper Corporation Chattanooga Div. (cont'ed)		Cooling water No. 007	0.02	None	Temp = 28^{o}C	Unnamed trib. (0.3) to Tenn. R. (463.9) 3,4,5,6
I-72	Roy's Car Wash	Coin operated car wash - 0	Wash water	0.0028	Sand filtration	BOD_5, SS, Surfactants and	Unnamed Creek (0.4) to Lookout Cr. (1.4)
I-73	Sequoyah Nuclear Plant (to start 1978)	Electricity	Cooling water blowdown	55.8	None	Temperature	Tenn. River (484.5)
I-74			Metal cleaning waste, liquid radioactive waste	Varies	None	SS, radioactivity Cl, Oil & Grease	Tenn. River (484.5)
I-75			Demineralizer waste, utility waste		None	Cu, Fe, Cl	Tenn. R. (484.5) 1,2,3,4,5,6,7
I-76	Sha-Rue Co.	Car wash	Wash water	0.0028	Sand filter	BOD_5, SS and Surfactants	Drainage ditch to sinkhole
I-77	Selox. Inc.	Air liquefaction 10	Cooling water TN0004031	0.0001	None	TDS, SS, PO_4, Zn,	Tennessee River (470.3) 1,2,3,4,5.6,7
I-78	Shell Oil Company	Petroleum products pipeline terminal 5	Spills and surface runoff TN0001562	0.0003	Oil skimmer	Oils, SS, phenols	Unnamed trib. to Friar Branch (0.6) 3,4,5,6
I-79	Southern Cellulose (Water Plant)	Cellulose fiber chips	Off specification water	Varies	None	SS - 142 mg/l TDS - 352 mg/l	Chattanooga Cr. (4.1) 2,3,5,6
I-80	Southern Oil Service	Bulk petroleum products storage 10	Surface runoff and spills	0.001	Oil - water separator	SS = 15 mg/l Soluable oils = 20 mg/l Phenols	Unnamed trib. (0.8) to Citico Creek (1.9) 3,4,5,6
I-81	Southern Wood Piedmont Co.	Creosoted timber 120	Surface runoff, 001 & 002 TN0028380	Varies	Bio-oidation	BOD_5, color, oil, turbidity, phenol	Chattanooga Creek (3.2) 2,3,5,6

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-82	Stainless Metal Products Co.	Display Racks - 79	Plating waste and rinse water	0.012	Settling	BOD_5 = 15 mg/l Hexavalent Cr = 66 mg/l Ni = 101 mg/l	Sinkhole near South Chickamauga Creek (5.0) 3,4,5,6
I-83			Cooling water overflow	0.0004	None	Temperature, BOD Cr, Ni	Sinkhole near South Chickamauga Creek (5.0) 3,4,5,6
I-84	Texaco, Inc. Barge Terminal	Petroleum products - 13	Spills and surface runoff TN002241	0.0002	Oil separation	Oils, SS, phenols	Unnamed trib. (0.8) to Tennessee River (463.4) 3,4,5,6
I-85	U.S. Army Reserve	Training	Truckwash water	Varies	Oil skimmer	SS, Oil & Grease BOD, surfactants	Dobbs Branch (0.8) 3,4,5,6
I-86	U.S. Pipe and Foundry Corp., Soil Pipe Div.	Soil pipe - 520	Cooling tower blowdown and process leaks TN0003808	0.255	None	SS = 40 mg/l BOD_5 = 10 mg/l Oil & Grease = 23 mg/l	Tennessee River (462.0) 1,2,3,4,5,6,7
I-87	U.S. Pipe and Foundry Corp., Pressure Pipe Division	Cast iron pipe & fittings - 705	Cooling & quench water #001 TN0002429	0.180	None	SS = 40 mg/l, Fe, oils = 11.4 mg/l	Tennessee River (461.3) 1,2,3,4,5,6,7
I-88			Quench cooling water #002	0.080	None	SS, Fe, oils, = 4.0 mg/l	Tennessee River (461.2) 1,2,3,4,5,6,7
I-89	U.S. Stove	Fireplace accesories and wood heaters	Cooling water	.027	None	Temp., Fe, Zn	Unnamed trib. to Citico Cr. (1.3) 3,4,5,6
I-90	Velsicol Chemical Corporation	Industrial chemicals - 320	Surface runoff TN0025895	Varies	Lagoons to sewer	BOD_5 = 650 mg/l organics, oils, phenols	Unnamed trib. (0.5) to Chattanooga Cr. (4.6) 3,4,5,6
I-91	Vulcan Materials Co., Chattanooga	Crushed stone and sand - 63	Wash water, groundwater and asphalt scrubber (001 & 002) TN0003077	12.6	Sedimentation	SS = 45 mg/l TDS = 253 mg/l turbidity	S. Chickamauga Cr #001 (8.5) Friar Br. #002 (0.3) 2,3,5,6

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-92	Wauhatchie Washie	Coin Laundry - 1	Wash water	0.0064	Sand filter	BOD_5, SS, surfactants	Unnamed trib. (0.4) to Lookout Cr. (1.4) 2,3,5,6
I-93	Wheland Foundry, Div. of N. Am. Royalties, Inc.	Iron castings 1,100	Surface runoff No. 001, 002, 003, 004, 006; surface runoff and air compressor 008	Varies	None	SS, Sett. S, Fe, O & G, Zn, Mn	Chattanooga Creek (0.7) 2,3,5,6
I-94	Blue Springs Trout Farm	Trout	Fish food residue		None	BOD	Town Creek (3.0) 3,4,5,6
I-95	Economy Cleaners	Coin-operated laundry	Wash water	0.0058	Chemical precipitation, filtration, chlorination	pH = 6 BOD_5, SS, Surfactants	Drainage ditch (0.2) Town Creek (1.0) 3,4,5.6
I-96	Gamble Construction Company	Hot mix asphalt	Surface runoff & process		Complete recycle	None	Near Battle Creek (5.2) 3,4,5,6
I-97	General Portland, Incorporated, S.E. Division	Limestone quarry crushing & barge terminal - 35	Cooling water TN0001830	0.216	None	Uncontaminated	Bennette Lake Embayment of Tennessee R. (0.7) 1,2,3,4,5,6,7
I-98	Hales Maytag Laundry	Coin Laundry - 1	Wash water	0.011	Sand filter	BOD = 63 mg/l SS = 60 mg/l Surfactants	Unnamed trib. (0 [illegible]) to Sequatchie River [illegible]) 1,2,3,4,5,6,7
I-99	Marion Sand & Gravel Co.	Sand & Gravel	Process and combined runoff	1.15	Settling pond	SS	Clayton Camp Branch (2.0) 3,4,5,6
I-100	National Waste Oil Control Inc.	Oil Storage	Runoff, spills and process	.04	Spray irrigation oil/water separator	Oil & Grease, phenols, SS	Trib. to Hall Br. (1.5) 3,4,5,6
I-101	U.S. TVA Nickajack Hydro Plant (Federal Facility)	Electricity	Bearing cooling water TN0027472		None	Temp., Oil & Grease	Tenn. R. (424.6)

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-102	Penn Dixie Cement Company	Portland cement 120	Wash water & cooling water	0.040	Sedimentation	SS, Sett. S, oil	Poplar Spring Br. (1.9) 3,4,5,6
I-103	Powells Crossroads Laundry	Coin laundry	Washwater	.0008	Spray	SS, BOD Surfactants	Ditch (0.6) to Sequatchie R. (0.9) 3,4,5,6
I-104	Tenn. Consolidated Coal Company (Dogwood Flat Plant)	Coal - 15	Wash water & runoff TN0028509	0.07	Sedimentation & recycle	SS, Sett. S. turbidity, Fe, Mn	Unnamed trib. to Grays Cr. (0.7) 3,4,5,6 (Normally no discharge)
I-105	Tenn. Consolidated (Grundy Mining Co. #21)	Coal	Runoff and pumpout	Varies	None	pH, SS, Fe, Mn	Grays Creek 3,4,5,6
I-106	Tenn. Consolidated (Va. Mining Co. #18)	Coal	Runoff and pumpout	Varies	None	pH, SS, Fe, Mn	Grays Creek 3,4,5,6
I-107	Tenn. Consolidated (Marion Coal Co. #29)	Coal	Runoff and pumpout	Varies	None	pH, SS, Fe, Mn	Grays Creek 3,4,5,6
I-108	Tennessee Alloys Co. (TAC Alloys)	Ferrosilicon-75	Cooling tower blowdown & Runoff-001	0.012	None	SS, TDS	Tributary to Battle Creek (1.5) 1,2,3,4,5,6
I-109			Runoff and bag house slurry pond-002	Varies	None	SS, TDS	Trib. to Battle Cr. (1.5)
I-110	Vulcan Materials Co. (Quarry #20)	Gravel Operation	Wash water & runoff	Varies	Settling Pond	SS	Battle Creek (5.2) 1,2,3,4,5,6
I-111	Earl Patton Coal Company (Area #31)	Coal	Deep mine drainage TN0028487	Varies	None	pH, Mn, Fe, SS	Kelley Creek (8.4) 3,4,5,6
	Tenn. Consolated Coal Co.						
I-112	(Chestnut #23)	Coal	Deep mine drainage [illegible]	Varies	None	pH, Mn, Fe, SS	Unnamed trib. 0.1 to Kelley Creek (8.0) [illegible]

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-113	(Grundy #24)	Coal	Deep mine drainage TN00028410	Varies	None	pH, Mn, Fe, SS	Kelley Creek (8.3) 3,4,5,6
I-114	(Grundy #28)	Coal	Deep mine drainage TN0030961	Varies	None	pH, Mn, Fe, SS	Kelley Creek (8.0) 3,4,5,6
I-115	(Grundy #30)	Coal	Deep mine drainage TN0028428	Varies	None	pH, Mn, Fe, SS	Kelley Creek (7.5) 3,4,5,6
I-116	(Walnut Coal #25)	Coal	Deep mine drainage TN0028452	Varies	None	pH, Mn, Fe, SS	Kelley Creek (8.8) 3,4,5,6
I-117	(Mary Lee Coal #27)	Coal	Deep mine drainage TN0028479	Varies	None	pH, Mn, Fe, SS	Dick Br. to 0.2 Kelley Creek (7.5) 3,4,5,6
I-118	Texaco Dunlap Terminal	Bulk Petroleum - 1	Truck washwater, septic tank discharge	.0002	None	Oil & Grease, SS, BOD	Coops Creek (44.0) 3,4,5,6
I-119	Acuff Meat Processing Plant	Custom slaughtering	Meat processing wastes	0.0005	None	BOD_5, TSS	Unnamed tributary to Mile 29.0 of S. Chickamauga Creek.
I-120	Alton Box Board	Paper cones for yarn spools	Sanitary, process water	0.0125	Aerated	BOD_5 - 150 mg/l COD - 520 mg/l O & G - 47 mg/l Color - 500 PCU TSS - 168 mg/l	Mile 4.7 of Dry Creek tributary to Mile 6.5 of Chattanooga Creek.
I-121	E.T. Barwick Ind., Inc.	Tufted textiles	Process and sanitary	0.900	Secondary	BOD_5 - 13 mg/l COD - 110 mg/l TSS - 11 mg/l Color - 200 PCU	Mile 38.1 of West Chickamauga Creek.
I-122	Cole Steel Drum Co.	Steel drums	Process water	0.0010	Neutralization, sedimentation	pH, TSS, Fe	Mile 4.9 of Spring Creek.
I-123	(Candlewick & Turbo Div.)	Textile yarns	Sanitary	0.0105	Extended	BOD_5, TSS, Fecal Coliform- 93,100/100 ml	Mile 1.5 of Little Chickamauga Creek.

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-124			Cooling, boiler feed, process water	0.0423	None	Temperature Cr - 8 mg/l	Mile 1.5 of Little Chickamauga Creek.
I-125	W.L. Jackson Mfg. Co.	Enameled water heaters	Process water	0.03	Sedimentation, neutralization	BOD_5 - 37 mg/l TSS - 120 mg/l O & G - 10 mg/l	Storm sewer to Mile 0.4 of unnamed tributary to Mile 6.5 of Chattanooga Creek.
I-126	Quik Thrift Car Wash	Car wash	Wash water	0.002	Grit trap	BOD_5, TSS, Surfactants	Unnamed tributary to Mile 1.1 of unnamed tributary to Mile 0.8 of Black Branch tributary to Mile 1.2 of Mackey Branch.
I-127	Reichhold Polymers, Inc.	Textile chemicals		0.058		BOD_5 - 50 mg/l TSS - 83 mg/l NH_3-n - 73 mg/l	Mile 38.0 of West Chickamauga Creek.
I-128	Salem Carpet Mills, Inc.	Tufted carpet	Process and sanitary	0.015	Extended aeration	BOD_5 - 25 mg/l TSS - 50 mg/l TDS - 1050 mg/l	Mile 1.4 of Little Chickamauga Creek.
I-129	Southern Energy Resources (Mines 2 & 6)	Coal	Deep mine drainage and surface runoff			TSS, Fe, pH, Mn	Dry Creek.
I-130	Southern Metal Products Corp.	Shelving and vending machines		0.0001	None	BOD_5, TSS	Mile 38.0 of West Chickamauga Creek.
I-131	Standard Brands Chemical Ind., Inc.	Synthetic carpet backing compounds	Process and sanitary	0.15	Coagulation, vacuum filtration, aeration, sedimentation	BOD_5 - 10 mg/l NH_3-N - 60 mg/l TSS - 20 mg/l	Mile 0.1 of Mill Creek tributary to Mile 38.2 of W. Chickamauga Cr.
I-132			Cooling water	0.85	None	Temperature - 60-80°F	Mile 38.3 of West Chickamauga Creek.
I-133	Sweetwater Carpet Corp.	Rugs and tufted carpets	Cooling water	0.05	None	Temperature	Mile 32.6 of South Chickamauga Creek.

TABLE III-6
INDUSTRIAL DISCHARGER INVENTORY (Continued)

Discharger Number	Industry	Principal Product No. of Employees	Waste Type Permit Status	Volume[1] MGD	Type Treatment	Treated Waste[2] Characteristics	Receiving Stream (R.M.)[3] Stream Classification
I-134			Latex waste	None	Discharge to sanitary sewer		
I-135			Sanitary	None	Discharge to sanitary sewer		
I-136	Union Oil, Ringgold	Oil and gasoline storage	Sanitary, run-off, and spills	0.01	Activated sludge, chlorination	BOD_5, NH_3-N, TSS, Oils, Phenols	Mile 25.0 of South Chickamauga Creek.
I-137	Yates Bleachery Co.	Bleaching, dying and weaving cotton fibers	Process water	0.60.	Activated sludge	Alk. - 688 mg/l BOD_5 - 11 mg/l TSS - 104 mg/l Cl - 100 mg/l O & G - 80 mg/l Color - 200 PCU	Mile 0.8 of Rock Creek tributary to Mile 11.4 of Chattanooga Creek.

[1]Average daily use as given in Table _____ may not in some cases be indicative of waste discharged as given in this table due to recirculation and evaporation losses or recycling of wastewater.

[2]Parameters listed are considered likely to be found in significant quantity in the discharged waste; where concentrations of the specific parameter are not given, no data was available in the Division of Water Quality Control. Abbreviations used under this column are: Sett. S. - settleable solids, SS - suspended solids, Fe - iron, TDS - total dissolved solids, temp. - temperature, Cr - chromium, App. - apparent, Ni - nickel, Zn - zinc, Tot. S - total solids, NH_3-N - ammonia nitrogen, F - fluoride, Pb - lead, TSS - total suspended solids, CN - cyanide, Hg - mercury, Cl - chloride, Ag - silver, Br - bromine, NO_3-N - nitrate nitrogen, MN - manganese, PO_4 - phosphate, Th - thorium, U - uranium, TKN - total Kjeldahl nitrogen (organic nitrogen),[3] P - phosphorus, Al - aluminum, Na - sodium, DO - dissolved oxygen, As - arsenic, Cd - cadmium, Cu - copper, Se - selenium, Ti - titanium, SO_4 - sulfate, O & G = oil and grease.

[3]R.M. denotes outfall at River Mile measured from mouth of river: Stream Use Classifications are found in Appendix _____. 1 - domestic water supply, 2 - industrial water supply, 3-fish and aquatic life, 4-recreation, 5-irrigation, 6-livestock watering and wildlife, and 7-navigation.

[4]Data was accurate as of May, 1978.

TABLE III-7
OPERATING DATA FOR MUNICIPAL TREATMENT FACILITIES

Treatment Facility	Average Flow (mgd)	Average Influent BOD_5 (mg/l)	Average Effluent BOD_5 (mg/l)	Average % Removal BOD_5	Average Influent Suspended Solids (mg/l)	Average Effluent Suspended Solids (mg/l)	Average % Removal Suspended Solids
Brainerd M-1		143	8.3	93.5	154	12	91.3
Fort Oglethorpe M-6	0.8	213	26.2	79.8	112	20	76.7
Moccasin Bend M-8	35.2	349	64.4	80.8	288	45	85.2
Red Bank M-9	1.24	163	29	79	207	67	82
Signal Mountain M-11	0.37	111	16	78.9	248	10	95.4

SOURCE: Chattanooga 201 Facilities Plan

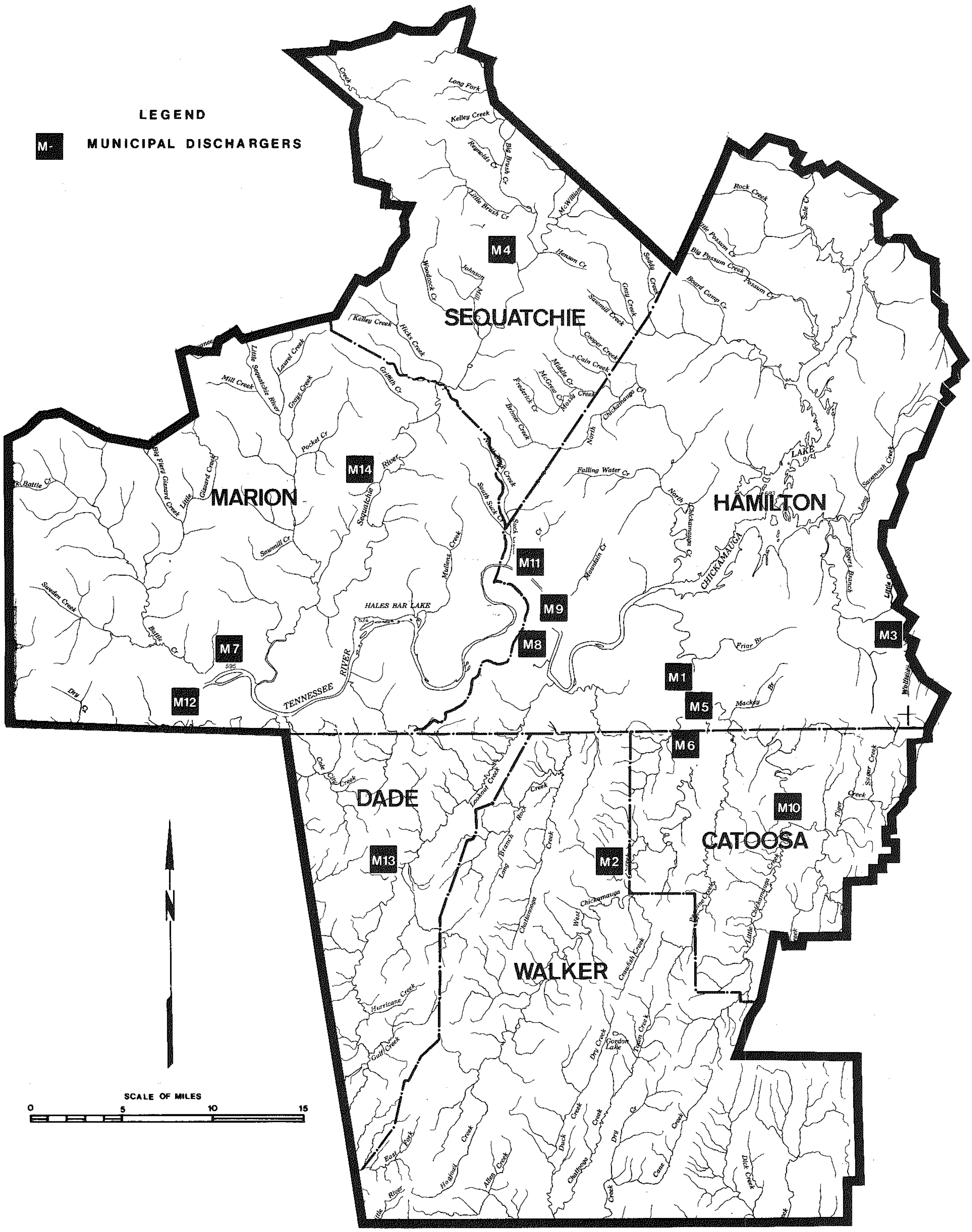


FIGURE III-3
MUNICIPAL DISCHARGERS IN THE CARCOG/SETDD 208 AREA

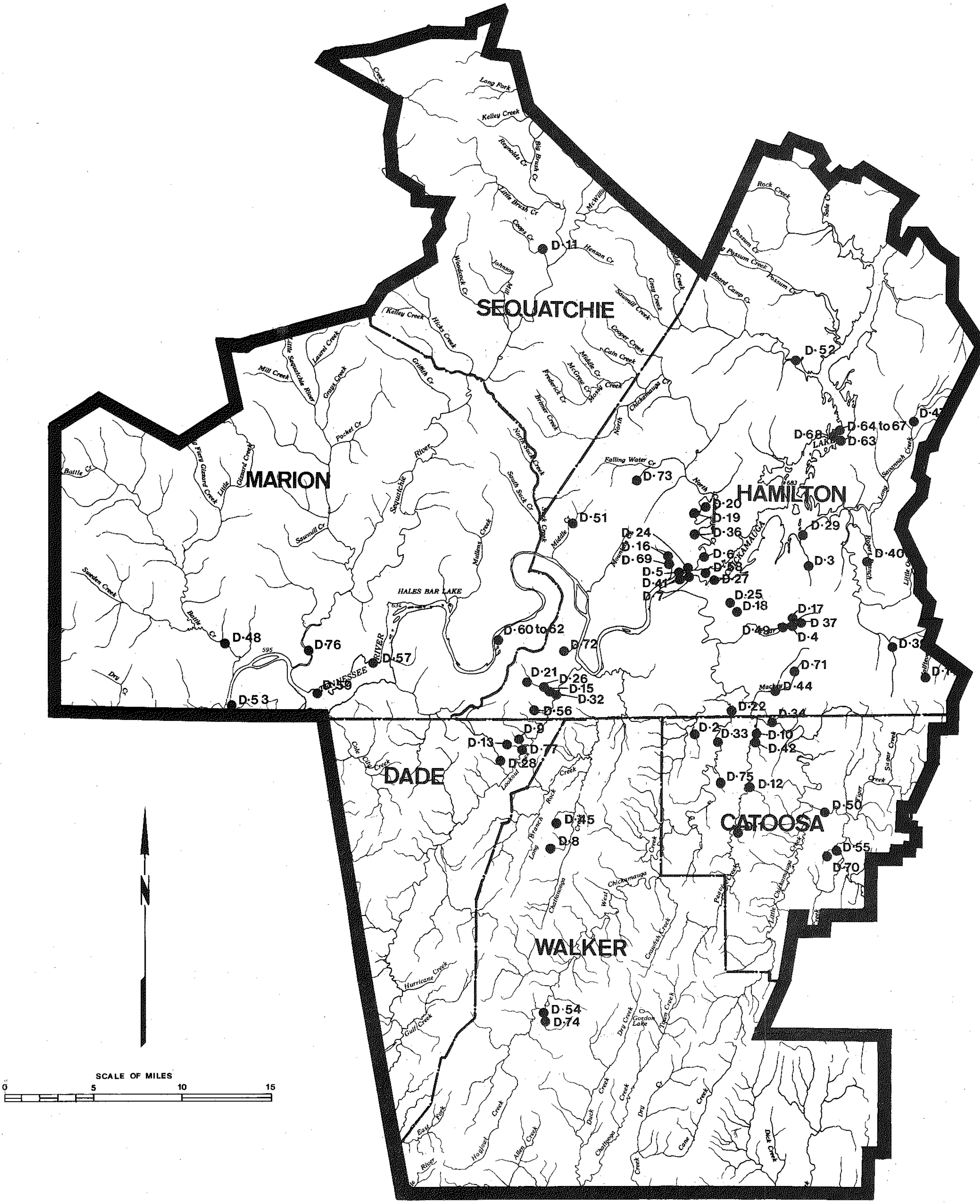


FIGURE III-4
DOMESTIC DISCHARGERS IN THE CARCOG / SETDD 208 AREA

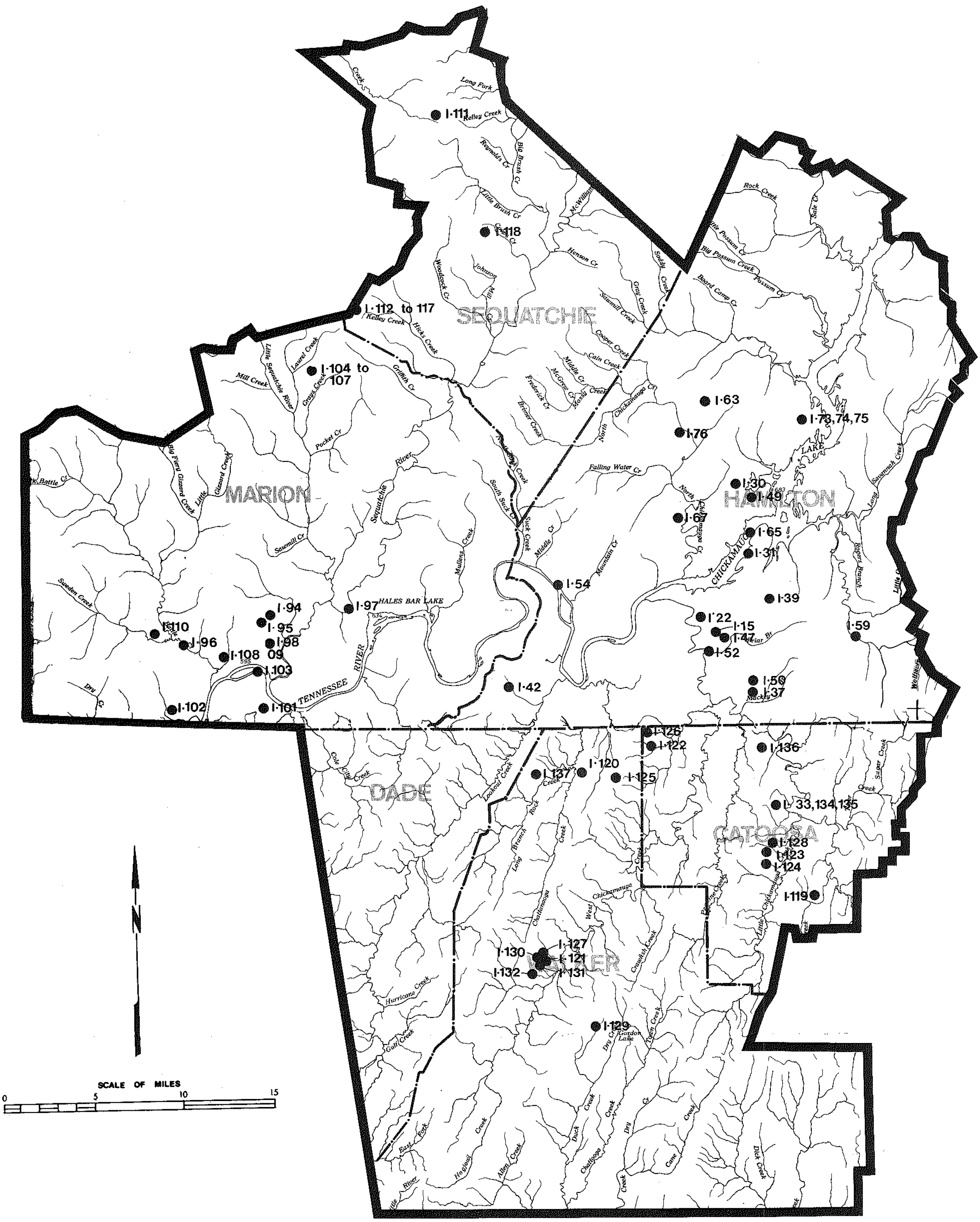


FIGURE III-5
INDUSTRIAL DISCHARGERS IN THE CARCOG/SETDD 208 AREA

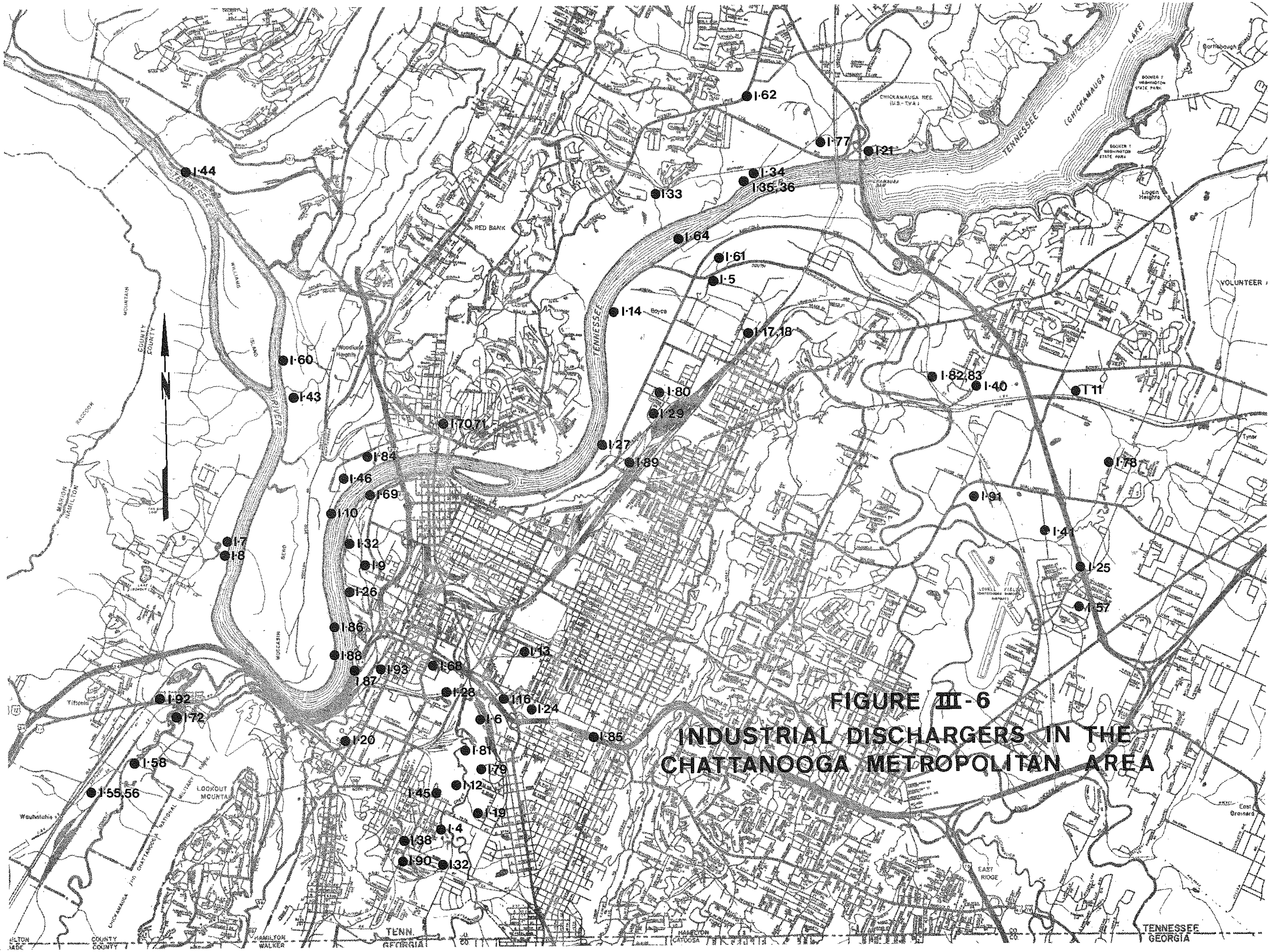


FIGURE III-6
INDUSTRIAL DISCHARGERS IN THE CHATTANOOGA METROPOLITAN AREA

2. Waste Flow Projections

Future waste flows and stream loadings for both municipal and domestic dischargers were developed from population projections, and are presented in Tables III-8 and III-9. Even though population projections formed the basis for each set of flow predictions, the process utilized in estimating municipal flows and loads differed from that used for domestic dischargers. This variance is due to the difference in factors which affect the municipal and domestic flows and a desire to produce as accurate as possible figures. The techniques used in the formulation of flow and load projections are described below.

Municipal flows and loads were developed using existing population projections for the respective service areas presented in the 201 plans. The flows were estimated as follows:

- Flows from residential sources were taken as 100 gallons per capita per day (gpcd) in areas that are presently sewered or where actual figures for water use were unavailable. Where possible, existing data regarding waste flow per capita were used. A peaking factor of 1.5, stemming from the assumption that residential wastewater contribution occurs over a 16 hour period (24/16 = 1.5), was then applied to these flows to yield the treatment design flows.

- Flows to municipal treatment systems from commercial sources were developed in two ways. Where the 201 plans contained projections, these were used. Where no estimates were given, these flows were based on existing commercial flows assuming a 1.5 percent increase per year throughout the planning period.

- Industrial flows to municipal systems were estimated in the same manner as commercial flows.

- Flows from infiltration/inflow were taken from the 201 plans.

Waste loadings to municipal sources were based upon the above flows using the following waste characteristics:

BOD_5 = 240 mg/l
TSS = 300 mg/l
NH_3-N = 20 mg/l

Future waste flows from domestic sources were based upon existing flows and population projections for the drainage basin in which the discharger is located. Flows were assumed to increase by the same percentage as the population. No future flows or loads were predicted for those dischargers whose existing flows are unknown. Waste loadings to domestic point sources were based on the following waste characteristics:

TABLE III-8
PROJECTED FLOWS AND LOADS FOR MUNICIPAL DISCHARGERS

Discharger Name and Number	Flows (mgd)				Loads (lb/day)											
					1975			1980			1990			2000		
	1975	1980	1990	2000	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N
Chickamauga (M-2)	4.12	4.43	5.10	5.82	8,251	10,314	688	8,872	11,090	739	10,213	12,767	851	11,655	14,569	971
Dunlap (M-4)	--	--	--	0.78										1,562	1,953	130
Jasper (M-7)	--	--	1.12	1.46							2,243	2,804	187	2,924	3,655	244
Moccasin Bend (M-8) Regional facility including flows from the following service areas:																
• Core Area (including Brainerd, East Ridge, Fort Oglethorpe, M-1, M-5, M-6)	41.46	42.88	47.35	52.77	83,030	103,787	6,919	85,874	107,341	7,156	94,825	118,532	7,902	105,680	132,098	8,808
• South Chickamauga Cr.	19.79	21.28	24.50	27.55	39,632	49,540	3,303	42,616	53,270	3,551	49,065	61,331	4,089	55,172	68,966	4,598
• Collegedale (M-3)	1.20	1.33	1.63	1.96	2,403	3,004	200	2,664	3,329	222	3,265	4,080	272	3,925	4,906	327
• Tiftonia	1.17	1.24	1.37	1.49	2,343	2,929	195	2,483	3,104	207	2,744	3,430	229	2,984	3,730	249
• Soddy-Daisy/ N. Chickamauga Creek	5.57	6.12	7.34	8.52	11,155	13,943	930	12,256	15,320	1,022	14,699	18,374	1,225	17,062	21,328	1,422
• Red Bank (M-9)	2.05	2.17	2.35	2.56	4,105	5,133	342	4,346	5,432	362	4,706	5,883	392	5,127	6,408	427
• Signal Mtn. (M-11)	0.67	0.71	0.83	0.96	1,342	1,677	112	1,421	1,777	118	1,662	2,078	139	1,923	2,403	160
Regional Total	71.91	75.73	85.37	95.81	144,010	180,013	12,001	151,660	189,575	12,638	170,966	213,708	14,248	191,873	239,841	15,989
Ringgold (M-10)	0.73	0.80	0.92	1.06	1,462	1,827	122	1,602	2,003	134	1,842	2,303	154	2,123	2,654	177
Trenton (M-13)	0.45	0.48	0.56	0.63	901	1,126	75	961	1,202	80	1,121	1,402	93	1,262	1,577	105
Whitwell (M-14)	0.28	0.29	0.29	0.30	561	701	47	581	726	48	581	726	48	601	751	50

TABLE III-9
PROJECTED FLOWS AND LOADS FOR DOMESTIC DISCHARGERS

Discharger Name and Number	Flows (mgd)				Loads (lb/day)											
					1975			1980			1990			2000		
	1975	1980	1990	2000	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N
Boynton Elem. School (D-1)	.017	.019	.022	.025	34.0	42.5	0.71	38.0	47.5	0.79	44.0	55.0	0.92	50.0	62.6	1.04
Brookvale Estates (D-2)	.009	.010	.011	.011	18.0	22.5	0.38	20.0	25.0	0.42	22.0	27.5	0.46	22.0	27.5	0.46
Brown Jr. & Sr. High Schools (D-3)	.065	.072	.090	0.10	130	163	2.71	144	180	3.00	180	225	3.75	200	250	4.17
Cedar Creek MHP (D-4)	.012	.013	.016	.018	24.0	30.0	0.50	26.0	32.5	0.54	32.0	40.0	0.67	36.0	45.0	0.75
Chattanooga Area Voc. Tech. School (D-5)	.080	.076	.074	.071	160	200	3.34	152	190	3.17	148	185	3.09	142	178	2.96
Chattanooga Power Service Ctr. (D-6)	.004	.004	.005	.006	8.0	10.0	0.17	8.0	10.0	0.17	10.0	12.5	0.21	12.0	15.0	0.25
Chattanooga St. Tech. Com. College (D-7)	.009	.009	.008	.007	18.0	22.5	0.38	18.0	22.5	0.38	16.0	20.0	0.33	14.0	17.5	0.29
Covenant College (D-9)	.016	.018	.019	.020	32.0	40.0	0.67	36.0	45.0	0.75	38.0	47.5	0.79	40.0	50.0	0.83
Granny's Restaurant (D-13)	.001	.001	.001	.001	2.0	2.5	0.04	2.0	2.5	0.04	2.0	2.5	0.04	2.0	2.5	0.04
Hamilton Co. Nursing Home (D-17)	.088	.098	.118	.138	176	220	3.67	196	245	4.09	236	295	4.92	276	345	5.75
Highway 58 Shopping Ctr. (D-18)	.006	.007	.008	.010	12.0	15.0	0.25	14.0	17.5	0.29	16.0	20.0	0.33	20.0	25.0	0.42
Hixson High School (D-19)	.028	.032	.039	.045	56.0	70.1	1.17	64.0	80.1	1.33	78.1	97.6	1.63	90.1	113	1.88

TABLE III-9
PROJECTED FLOWS AND LOADS FOR DOMESTIC DISCHARGERS (Continued)

Discharger Name and Number	Flows (mgd)				Loads (lb/day)											
					1975			1980			1990			2000		
	1975	1980	1990	2000	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N
Hixson Jr. High School (D-20)	.038	.043	.052	.061	76.1	95.1	1.58	86.1	108	1.79	104	130	2.17	122	153	2.54
Holiday Inn (D-21)	.005	.005	.006	.006	10.0	12.5	0.21	10.0	12.5	0.21	12.0	15.0	0.25	12.0	15.0	0.25
K-Mart (D-24)	.017	.016	.016	.015	34.0	42.5	0.71	32.0	40.0	0.67	32.0	40.0	0.67	30.0	37.6	0.63
LaDel Mobile Home Valley (D-26)	.021	.022	.024	.025	42.0	52.5	0.88	44.0	55.0	0.92	48.0	60.0	1.00	50.0	62.6	1.04
Lakeshore Country Club Apts. (D-27)	.030	.034	.042	.047	60.0	75.1	1.25	68.1	85.1	1.42	84.1	105	1.75	94.1	118	1.96
Loret Resort Villa (D-29)	.020	.023	.028	.033	40.0	50.0	0.83	46.0	57.5	0.96	56.1	70.1	1.17	66.1	82.6	1.38
Mitchell Acres Subd. (D-33)	.015	.016	.018	.020	30.0	37.5	0.63	32.0	40.0	0.67	36.0	45.0	0.75	40.0	50.0	0.83
Morris Estates Subd. (D-34)	.014	.014	.015	.015	28.0	35.0	0.58	28.0	35.0	0.58	30.0	37.5	0.63	30.0	37.5	0.63
Northgate Mall (D-36)	.122	.136	.165	.194	244	305	5.09	272	340	5.67	330	413	6.88	388	485	8.09
North Twinbrook Subd. (D-37)	.002	.003	.003	.004	4.0	5.0	.08	6.0	7.5	0.13	6.0	7.5	0.13	8.0	10.0	0.17
Ooltewah Elem. School (D-39)	.018	.020	.025	.030	36.0	45.0	0.75	40.0	50.0	0.83	50.0	62.6	1.04	60.0	75.[illegible]	1.25
Red Food Stores (D-44)	.005	.006	.008	.009	10.0	12.5	0.21	12.0	15.0	0.25	16.0	20.0	0.33	18.0	22.5	0.38
Signal Plaza Shopping Ctr. (D-51)	.003	.003	.004	.004	6.0	7.5	0.13	6.0	7.5	0.13	8.0	10.0	0.17	8.0	10.0	0.17

TABLE III-9
PROJECTED FLOWS AND LOADS FOR DOMESTIC DISCHARGERS (Continued)

Discharger Name and Number	Flows (mgd)				Loads (lb/day)											
					1975			1980			1990			2000		
	1975	1980	1990	2000	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N
Tenn. Dept. of Trans. I-24, Welcome Station (D-56)	.017	.018	.019	.020	34.0	42.5	0.71	36.0	45.0	0.75	38.0	47.5	0.79	40.0	50.0	0.83
Rest Area (D-57)	.040	.042	.045	.047	80.1	100	1.67	84.1	105	1.75	90.1	113	1.88	94.1	118	1.96
TVA Chickamauga Dam Hydro Plant (D-58)	.001	.001	.002	.002	2.0	2.5	0.04	2.0	2.5	0.04	4.0	5.0	0.08	4.0	5.0	0.08
TVA Nickajack Hydro Plant (D-59)	.004	.005	.006	.007	8.0	10.0	0.17	10.0	12.5	0.21	12.0	15.0	0.25	14.0	17.5	0.29
TVA Raccoon Mtn. Proj. STP No. 1 (D-60)	.001	.001	.001	.001	2.0	2.5	0.04	2.0	2.5	0.04	2.0	2.5	0.04	2.0	2.5	0.04
TVA Raccoon Mtn. Proj. STP No. 2 (D-61)	.001	.001	.002	.002	2.0	2.5	0.04	2.0	2.5	0.04	4.0	5.0	0.08	4.0	5.0	0.08
TVA Raccoon Mtn. Proj. STP No. 3 (D-62)	.001	.001	.002	.002	2.0	2.5	0.04	2.0	2.5	0.04	4.0	5.0	0.08	4.0	5.0	0.08
TVA Sequoyah Nuc. Plant Unit 1 (D-64)	.002	.002	.002	.003	4.0	5.0	0.08	4.0	5.0	0.08	4.0	5.0	0.08	6.0	7.5	0.13
TVA Sequoyah Nuc. Plant Unit 1A (D-65)	.002	.002	.002	.003	4.0	2.5	0.08	4.0	5.0	0.08	4.0	5.0	0.08	6.0	7.5	0.13
TVA Sequoyah Nuc. Plant Unit 2 (D-66)	.019	.021	.024	.028	38.0	47.5	0.79	42.0	52.5	0.88	48.0	60.1	1.00	56.0	70.1	1.17
Union Oil Serv. Sta. (D-69)	.001	.001	.001	.001	2.0	2.5	0.04	2.0	2.5	0.04	2.0	2.5	0.04	2.0	2.5	0.04

TABLE III-9
PROJECTED FLOWS AND LOADS FOR DOMESTIC DISCHARGERS (Continued)

Discharger Name and Number	Flows (mgd)				Loads (lb/day)											
					1975			1980			1990			2000		
	1975	1980	1990	2000	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N	BOD_5	TSS	NH_3-N
Valley View Elem. Sch. (D-72)	.011	.011	.012	.013	22.0	27.5	0.46	22.0	27.5	0.46	24.0	30.0	0.50	26.0	32.5	0.54
Walker County Correctional Inst. (D-74)	.025	.027	.030	.033	50.0	62.6	1.04	54.0	67.6	1.13	60.0	75.1	1.25	66.1	82.6	1.38
Westside School (D-75)	.013	.014	.015	.017	26.0	32.5	0.54	28.0	35.0	0.58	30.0	37.5	0.63	34.0	42.5	0.71

BOD_5 = 240 mg/l
TSS = 300 mg/l
NH_3-N = 5 mg/l

3. Discharger Permits

The current effluent limitations delineated by the NPDES permits for the municipal, domestic, and industrial point sources in the study area are presented in Tables III-10, III-11, and III-12. A listing of the state of Tennessee permits for these dischargers is presented in Appendix A. Both of these listings have been updated from those presented in the applicable 201 plans to reflect the current standing of all dischargers.

E. EUTROPHICATION POTENTIAL OF CHICKAMAUGA AND NICKAJACK RESERVOIRS

The purpose of this section is to document information presented in the U.S. EPA's National Eutrophication Survey, together with the 1976 TVA report on the Quality of Water in Nickajack Reservoir, and information obtained by the Tennessee Department of Public Health with respect to the eutrophication potential of the Chickamauga and Nickajack Reservoirs in the CARCOG/SETDD 208 Study Area. This section contains a brief description of the reservoirs in the study area, a discussion of the applicability of existing data to evaluate eutrophication potential, and how this information will be related to possible nutrient limitations which may be imposed on major dischargers within the CARCOG/SETDD 208 Study Area in the future. It should be noted that the main interest in eutrophication potential in the study area is centered around Nickajack Reservoir, since the Moccasin Bend Treatment Plant discharges into it. The two major reservoirs in the CARCOG/SETDD 208 Areawide Waste Treatment Management Planning Area, the Chickamauga Reservoir and the Nickajack Reservoir, are shown in Figure III-7. Chickamauga Dam is located at Tennessee River mile 471.0 near Chattanooga. The entire reservoir has a total backwater length of about 59 miles with approximately 810 miles of shoreline bounding the reservoir at full pool, containing an area of 34,500 acres and a useful controlled storage of 329,400 acre-feet. The total drainage area above Chickamauga Dam is 20,790 square miles. There are no major wastewater treatment plant discharges into the portion of the Chickamauga Reservoir which lies in the CARCOG/SETDD 208 Study Area and, except for isolated instances of nuisance milfoil growths, few observations of eutrophic conditions have been documented.

Nickajack Dam is located on the Tennessee River near the junction of the boundaries of Alabama, Georgia, and Tennessee at Tennessee River mile 424.7. This dam, completed in 1967, is located 6.4 miles downstream from the old Hales Bar Dam site. It impounds Nickajack Reservoir (formerly Hales Bar Reservoir), which extends 46.3 miles upstream to Chickamauga Dam at Chattanooga, Tennessee. The reservoir is about 55 feet deep at the dam, and with the lake at full pool level, 634.0 feet above mean sea level, the water surface covers 10,370 acres or about 16.7 square miles. Nickajack Reservoir is the smallest

TABLE III-10
PERMIT CRITERIA FOR MUNICIPAL DISCHARGERS

Effluent Limitations: Monthly Average / Weekly Average

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	Flow (mgd)	BOD_5 (lb/day)	BOD_5 (mg/l)	TSS (lb/day)	TSS (mg/l)	NH_3-N (lb/day)	NH_3-N (mg/l)	DO (mg/l)	Fecal Coliforms (colonies/100 ml)	Other
Brainerd (M-1)	TN0024228	7/1/77	6/30/82	4.4	443/664	12/8	1100/1650	30/45	117/176	3.2/4.8		200/400	1,2,3**
Chickamauga (M-2)	GA0020478			5.0/6.25	1670/3130	40/60	1670/3130	40/60					1,2,3
Collegedale (M-3)	TN0028002	12/16/75	1/30/81		19.4[4]	10[5]	29[4]	15[5]	9.7[4]	5.0[5]	5.0		1,2,3
Dunlap (M-4)[6]					125[4]	30[5]	167[4]	40[5]	21[4]	5.0[5]			1,2,3
East Ridge (M-5)	TN0023884	6/25/74	6/30/79	3.0	750/1125	30/45	750/1125	30/45				200/400	1,2,3
Fort Oglethorpe (M-6)	GA0020257		12/19/79	2/2.5	500/938	30/45	500/938	30/45				200/400	1,2,3
Moccasin Bend (M-8)	TN0024210	5/20/77	6/30/82	60.0	49,039/59,547	140/170	42,033/52,542	120/150	2,500[4]	5.0[5]		200/400	1,2,3
Red Bank (M-9)	TN0020516	7/1/77	6/30/82	1.5	375/562	30/45	375/562	30/45				200/400	1,2,3
Signal Mountain (M-11)	TN0021211	5/20/77	6/30/82	0.4	100/150	30/45	100/150	30/45					1,2,3
South Pittsburg (M-12)[6]					250[4]	30[5]	334[4]	40[5]	4.2[4]	5.0[5]			1,2,3

TABLE III-10
PERMIT CRITERIA FOR MUNICIPAL DISCHARGERS

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	Flow (mgd)	BOD_5 (lb/day)	BOD_5 (mg/l)	TSS (lb/day)	TSS (mg/l)	NH_3-N (lb/day)	NH_3-N (mg/l)	DO (mg/l)	Fecal Coliforms (colonies/100 ml)	Other
				Effluent Limitations (Monthly Average / Weekly Average)									
Trenton (M-13)	GA0026221		6/30/79	0.32 / 0.40	80 / 150	30 / 45	80 / 150	30 / 45					1,2,3

**1 - No discharge of floating solids or visible foam.
2 - Effluent shall cause no visible sheen or receiving water.
3 - pH 6.0 to 9.0.
4 - Daily total.
5 - Daily average.
6 - Permit not yet issued, effluent limitations have been communicated to appropriate officials.

TABLE III-11
PERMIT CRITERIA FOR DOMESTIC DISCHARGERS

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	Flow (mgd)	Effluent Limitations ($\frac{\text{Daily Average}}{\text{Daily Maximum}}$): BOD_5 (mg/l)	TSS (mg/l)	DO (mg/l)	Fecal Coliforms (colonies/100 ml)	Other
Brown Jr. & Sr. High School (D-3)	TN0026701	12/29/75	1/29/81						
Chattanooga Area Voc. Tech. School (D-5)	TN0023116	12/30/74	1/29/80	.013	30/45/60[4]	30/45/60[4]		200/400	1,3 **
Covenant College (D-9)	GA0023558		10/14/79	0.05	30[5]/45	30[5]/45		200/400	3
Days Inn (D-10)	GA0022411		10/31/79	.0165	30[5]/45	30[5]/45		200/400	3
Dunlap Water Treatment Plant (D-11)	TN0021946	1/25/74	1/7/79						1
Granny's Restaurant (D-13)	GA0023906		11/30/79	.004[5]/.005	30[5]/45	30[5]/45			3
Hamilton Co. Nursing Home (D-17)	TN0026751	6/30/75	8/14/80		10/20	15/30	5.0	200/400	1,2,3,7,8
Hixson High School (D-19)	TN0026735	12/29/75	1/29/81						
Hixson Jr. High School (D-20)	TN0026743	6/30/75	8/14/80		10/20	15/30	5.0	200/400	1,2,3,7,8
I-75 Tourist Welcome Center (D-22)	GA0022951		10/23/79						
Loret Resort Villa (Harrison) (D-29)	TN0022829	12/30/74	12/9/80	0.04	30/45/60[4]	30/45/60[4]		200/400	1,3, NH_3-N: 5/7.5/10[4] mg/l Sett: 0.5 ml/l, daily maximum

TABLE III-11
PERMIT CRITERIA FOR DOMESTIC DISCHARGERS (Continued)

Effluent Limitations: Daily Average / Daily Maximum

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	Flow (mgd)	BOD_5 (mg/l)	TSS (mg/l)	DO (mg/l)	Fecal Coliforms (colonies/100 ml)	Other
(Chattanooga) (D-30)	TN0004618	12/31/73	12/31/78		10[6]/13.3	13.3[6]/16.6	5.0	200/400	1,3 Cl: 0.5 to 2.0 mg/l
Northgate Mall (D-36)	TN0002208	2/11/74	2/13/79		10/15	15/30	5.0	200/400	
Ooltewah Elementary School (D-39)	TN0026719	6/30/75	8/14/80		10/20	15/30	5.0	200/400	1,2,3,7,8
Powell Mobile Home Park (D-42)	GA0029734		10/14/79	0.03	30/45	30/45		200/400	3
Red Bank Water Treatment Plant (D-43)	TN0020516	7/1/77	6/30/82						
Rock City Gardens (D-45)	GA0029726		10/15/79	.017	30/45	30/45		200/400	3
Sandmont Nursing Home (D-46)	Permit applied for.								
Savannah Valley Utility District (D-47)	TN0029327	6/29/76	7/29/81						
Signal Plaza Shopping Center (D-51)	TN0022969	3/21/75	5/4/80	.009	10/15/20[4]	30/45/60[4]	5.0	200/400	1,3 NH_3-N: 1.6/2.4/3.2[4] mg/l
Soddy-Daisy Water Treatment Plant (D-52)	TN0004341	1/10/74	12/31/78		30	30/40			3, Fe: 10 mg/l SO_4: 1400 mg/l Al: 250 mg/l

TABLE III-11
PERMIT CRITERIA FOR DOMESTIC DISCHARGERS (Continued)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	Flow (mgd)	Effluent Limitations (Daily Average / Daily Maximum) BOD_5 (mg/l)	TSS (mg/l)	DO (mg/l)	Fecal Coliforms (colonies/100 ml)	Other
South Pittsburg Water Treatment Plant (D-53)	TN0024295	10/22/74	12/31/79						
Tennessee Department of Transportation I-24 Welcome Station (D-56)	TN0030295	12/27/76	1/27/82						
Tennessee Dept. of Transporation I-24 Rest Area (Marion Co.) (D-57)	TN0027626	6/30/75	8/14/80						
TVA Chickamauga Hydro Plant (D-58)	TN0027413	6/30/75	8/14/80						
TVA Nickajack Hydro Plant (D-59)	TN0027472	6/30/75	8/14/80						
TVA Raccoon Mtn. Project									
(STP No. 1) (D-60)	TN0021024	12/5/73	12/31/78						
(STP No. 2) (D-61)	TN0021032	12/5/73	12/31/78						
(STP No. 3) (D-62	TN0020397	12/5/73	12/31/78						
TVA Sequoyah Nuclear Plant									
(STP) (D-63)	TN0023485	7/15/74	7/31/79						
(Unit 1) (D-64)	TN0021059	12/5/73	12/31/78						
(Unit 1A) (D-65)	TN0026450								
(Unit 2) (D-66)	TN0021041	12/5/73	12/31/78						
(Unit 3) (D-67)	TN0020150	12/5/73	12/31/78						
(Cooling Water) (D-68)	TN0030171	2/20/77	3/19/82						
Union '76 Truck Stop (D-70)	Permit applied for.								
Valley View Elementary School (D-72)	TN0026727	6/30/75	8/14/80						

TABLE III-11
PERMIT CRITERIA FOR DOMESTIC DISCHARGERS (Continued)

Effluent Limitations: Daily Average / Daily Maximum

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	Flow (mgd)	BOD_5 (mg/l)	TSS (mg/l)	DO (mg/l)	Fecal Coliforms (colonies/100 ml)	Other
Whitwell Water Treatment Plant (D-76)	TN0005517	1/10/74	12/31/78						
Wildwood Sanitarium (D-77)	GA0022764		12/5/79	.0095	30/45	30/45		200/400	3

**1 - No discharge of floating solids or visible foam.
2 - Effluent shall cause no visible sheen on receiving water.
3 - pH 6.0 to 9.0.
4 - Monthly average/weekly average/daily maximum.
5 - Monthly average/weekly average.
6 - same as 5 in lb/day.
7 - Settleable solids: 1 ml/l, daily maximum.
8 - TKN: 1.6/3.2

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS

Effluent Limitations: Daily Average / Daily Maximum — lb/day (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD_5*	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
Alco Chemical Co. (I-6)	TN0002798	4/26/74	6/1/79													1,2,4**
Allen Coal Mine (I-7)	TN0029840	9/23/77	10/24/82			(35.0)/(70.0)					(3.5)/(7.0)					1,2,3,7
American Cyanamid (I-10)	TN0026760	5/12/75	1/9/81													1,2
American Electrical Industries (I-12)	TN002542	10/9/73	10/7/78													1,2,4
American Oil Co. (I-13)	TN0002577	9/7/73	10/7/78			5/10	/(1.0)									1,2
E. T. Barwick Industries, Inc. (I-16)	GA0001236		4/2/79	166/250	6000/8000	552/712		(5.0)		35.5/53.3		/1.7		/2.2		1,2 Sulfide: /1.3
Big Fork Mining (I-19)	TN0029700	9/23/77	10/24/82			(35.0)/(70.0)					(3.5)/(7.0)					1,2,3,7
Blue Springs Trout Farm (I-20)	TN0005282	6/30/75	8/14/80			(1.5)/	(0.1)									1
Caldwell & Seals Coal (I-22)	TN0031542					(35.0)/(70.0)					(3.5)/(7.0)					1,2,3,7
Central Soya Co. (I-23)	TN0003557	2/11/74	2/13/79	85/24	290/1073	116/268			14.5/80.5	5.8/8.0						1,2
C. F. Industries (I-24)	TN0002267	4/26/74	6/1/79	13/20		31/105			50/75	40/70	52/100	0.52/1.0				1,3 Organic N: 16/33 NO_2-N: 52/100

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations: Daily Average / Daily Maximum — lb/day (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD_5*	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
Chattem Drug and Chemical Co. (I-29)	TN0002780	4/26/74	6/1/79													1,2,4
Cities Service Oil Co. (I-31)	TN0022438	11/23/76	2/10/80						(30)/(60)							
Combustion Engineering (I-36)	TN0003514	11/9/73	9/30/78													1,2,4
Cutter Laboratories, Inc. (I-40)	TN0001481	2/11/74	2/13/79	2/3	3/7	3/7										1,2
DeSoto, Inc. (I-42)	TN0005711	12/28/73	9/30/78									/10	(0.2)/(0.2)			1,2 Zinc: 1/2
Dixie Sand and Gravel Co. (I-45)	TN0004707	Permit under appeal.														
Dixie Yarns, Inc. (Lupton City Plant) (I-46)	TN0002453	12/31/73	12/31/78	29.5/48	118/146	48/61						/0.12	/0.12			1,2 P: 5/9
(Candlewick and Turbo Div.) (I-47)			9/30/79	3.3/5		3.3/5										1,2,6
Outfall 002				/2.25								/0.075				1,2
Outfall 003				/8								/0.27				1,2
Outfall 004																1,2

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations: Daily Average / Daily Maximum — lb/day / lb/day; (mg/l) / (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD$_5^*$	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
E. I. Dupont deNemours & Co. (I-49)	TN0002844	12/31/73	12/31/78	1600/2000	2600/3700	1700/3000				62/177				5/11		1,2
Exxon Co. (I-53)	TN0028533	11/5/76	1/20/82						(30)/(60)							
GAF Corporation (I-55)	TN0003492	4/26/74	6/1/79	288/288	1440/1440	718/1800				288/360		1.5/1.8				1,2
General Portland, Inc. (I-59)	TN0001821	2/11/74	2/13/79			11/11								0.4/0.5		1,2
Outfall 2						7/7								0.5/0.7		1,2 TKN: 1.2/1.8 Cn: .0008/.001
(Signal Mtn. Div.) (I-60)	TN0001830	12/31/73	12/31/78		250/500	250/500	(0.5)		125/250							1,2 Mn: /1.78
Grand Sheet Metal Co. (I-67)	TN0002836	4/26/74	6/1/79													1,2
Jiffy Car Wash (I-78)	TN0004736					(30)/(50)			(10)/(15)							1,2
L & N Railroad (I-82)	TN0004588	11/20/73	9/30/78	(10)/(15)		(10)/(15)	/(0.1)		(10)/(15)			/(0.05)		/(0.1)	(0.35)/(0.7)	1,2,5 Cu: (0.2)/(0.4)
McDowell Div. Corp. (I-85)	TN0029513	7/22/77	8/22/82			(30)/(60)			(10)/(15)				(0.2)/(0.2)			1,2

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations: Daily Average / Daily Maximum — lb/day (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD_5*	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
McKee Baking Co. (I-86)	TN0003204	11/27/74	1/3/80	(200)/(400)		(100)/(150)	/(0.1)	(5.0)								1,2
Mead Co. - Chattanooga Coke and Chemicals Co. (I-87)	TN0001635	4/26/74	6/1/79	19.9/30	59/80	2.2/3				14/20						1,2
Missouri Portland Cement Co. (I-90)	TN0030902	1/31/78	3/1/83									(1.0)/(1.0)	(0.2)/(0.2)			1,2,6 Zn: (0.5)/(1.0)
Murphy Mtn. Mining (I-93)	TN0031062					(35.0)/(70.0)					(3.5)/(7.0)					1,2,3,7
Earl Patton Coal Co. (I-97)	TN0030970	10/28/77	11/28/82			(35.0)/(70.0)					(3.5)/(7.0)					1,2,3,7
Phelps Dodge Brass Co. (I-99)	TN0003395		7/1/79	0.3/0.45		2.3/3.5		(5.0)	0.64/0.93	0.22/0.33			(0.5)/(2.0)			1,2,5 TKN: 1.2/1.8
Outfall 2												(5)/(10)	(0.2)/(0.2)			1,2,6 Zn: (1)/(2)
Outfall 3						(55)/(110)						(5)/(10)	(0.2)/(0.2)			1,2,6 Zn: (1)/(2)
Polysar Latex (I-101)	TN0002861	11/27/74	1/13/80	11.2/17.6		4/6.5	/(0.5)		11.2/17.6	/0.33						1,2 Styrene: /0.33 Latex: /0.49 Dis. Solids: /813
Outfall 002																1,2,4,6

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations: Daily Average / Daily Maximum — lb/day (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD_5*	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
Ray-Ser Dying Co. (I-110)	TN0028339	12/19/75	1/26/81	(10)/(15)	92/101	(15)/(20)		(6.0)		(1.6)/(2.5)		(.05)/(.07)		0.14/0.29	(0.2)/(0.3)	1 pH 6.5-8.5 SO_4: 0.29/0.58
Reilly Tar and Chemical Co. (I-113)	TN0002828	4/26/74	6/1/79	1.5/2.5		1.5/2.5			0.6/0.9	0.5/0.7				0.5/0.7		1,2 TKN: 1.2/1.8 Cn: .0008/.001
Rockwell International (I-115)	TN0001902	4/26/74	6/1/79	5.6/9	40/80	56/85			9/18	0.9/2	2/3					1,2 Pb: .09/.18 Zn: .18/.28
Roper Corp. (I-116)	TN0003603	2/11/74	2/13/79	17/35	124/249	53/107					/2.6	/.08				1,2 Zn: /0.17 Mn: /1.78
Salem Carpet Mills (I-122)	GA0030988	12/31/75	7/15/80	3.0/(45)	4.5/(45)											1,2,5
Selox Corporation (I-123)	TN0004031	12/31/73	12/31/78	1.75/2.62		2.62/3.5			1.75/2.62			/.008		/.0175		1,2 N: 1.75/2.62 P: /.008 Zn: /.0175 Cu: /.008
Sequatchie Valley Coal (I-124)	TN0029459	9/23/77	10/24/82			(35)/(70)					(3.5)/(7.0)					1,2,3,7

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations: Daily Average/Daily Maximum lb/day (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD_5*	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
Shell Oil Co. (I-126)	TN0001562	8/30/74	10/21/79						/(15)							1,2
Jessie Shepley Coal (I-127)	TN0031437					(35)/(70)					(3.5)/(7.0)					1,2,3,7
Shu-Ter Mining Co. (I-128)	TN0031186	12/28/77	1/3/83			(35)/(70)					(3.5)/(7.0)					1,2,3,7
Southern Energy Resources (I-130)	TN0030716	10/28/77	11/28/82			(35)/(70)					(3.5)/(7.0)					1,2,3,7
Southern Railway Co. (I-133)	TN0002071	9/23/74	9/30/78	(10)/(15)		(10)/(15)	/(0.1)		(10)/(15)			/(0.05)		/.001	(0.35)/(0.7)	5 Cu: (0.2)/(0.4)
Southern Wood Piedmont Co. (I-134)	TN0030716	10/28/77	11/28/82	(10)/(15)		(40)/(50)	/(1.0)	(5.0)	(10)/(15)	(1.6)/(2.4)				(0.1)/(0.15)		1,2
Standard Brands Chemical Industries, Inc. (I-136)	GA0000051		4/2/79	30.7/60.8		8.15/22.6	/(0.1)			35.5/53.3						1,2
D. M. Steward Mfg. (I-139)	TN0004774		6/1/79	1.2/1.8	3/6	0.3/0.9				0.2/0.4						1,2
Stone Man, Inc. (I-140)	TN0022764	11/27/74	11/27/79	(40)/(50)			/(0.5)									1,2
Sycamore Mining (I-145)	TN0031259	1/27/78	2/27/83			(35)/(70)					(3.5)/(7.0)					1,2,3,7
Tennessee-American Water Co. (I-147)	TN0002578	1/10/74	12/31/78	(30)		(30)/(40)	/(0.5)				(10)					1,2 Al: (250) SO_4: (1400)
Tennessee Consolidated Coal Co. (Va. Mining #18) (I-150)	TN0028436	9/23/77	10/24/82			(35)/(70)					(3.5)/(7.0)					1,2,3,7

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations $\frac{\text{Daily Average}}{\text{Daily Maximum}}$ $\frac{\text{lb/day}}{\text{lb/day}}$ $\frac{\text{(mg/l)}}{\text{(mg/l)}}$

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD$_5^*$	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
(Marion Co. Coal) (I-151)	TN0028398	9/23/77	10/24/82			(35)/(70)					(3.5)/(7.0)					1,2,3,7
(Chestnut #23) (I-152)	TN0028461															
(Grundy #24) (I-153)	TN0028410	9/23/77	10/24/82	}		As above										
(Grundy #28) (I-154)	TN0030961	10/28/77	11/28/82													
(Grundy #30) (I-155)	TN0028428															
(Walnut Coal #25) (I-156)	TN0028452															
(Mary Lee Coal #27) (I-157)	TN0028479															
Tennessee Metallurgical Co. (I-160)	TN0001511	4/1/76	9/30/78									(1.0)/(1.0)	(0.2)/(0.2)			1,2,6 Zn: (0.5)/(1.0)
TVA Chattanooga Power Service Center (I-161)	TN0020290	1/31/74	3/31/79													
Texaco, Inc. (I-163)	TN0022241	8/30/74	10/21/79			/(40)			/(15)			/(1)				1,2 Fl: /(10)
Texaco, Inc. (I-164)	TN0022233	8/30/74	10/21/79				As above									
U.S. Army Reserve Ctr. (I-169)	TN0030589	6/3/77	7/1/82			(25)/(40)			(10)/(15)							1,2
U.S. Volunteer Army Ammunition Plant (I-170)	TN0002313	4/26/74	4/30/79	66/170	/(20)	(30)/(60)	/1.7		(10)/(15)	(0.1)/(0.5)	/(0.3)	(0.33)/(0.83)		.007/.017		1 pH 6.5-8.5 Cu: 0.13/0.33 TDS: (750)/(1000) Pb: 0.33/0.83 NO_2 + NO_3-N: /170 Mn: /0.83 SO_4: /4200 P: /1.7 Hg: (.002)/(.005) TNT: (0.3)/(0.5)

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations: Daily Average lb/day (mg/l) / Daily Maximum lb/day (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD5*	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
U.S. Pipe and Foundry Co. (Pressure Pipe Div.) (I-171)	TN0002429	12/31/73	12/31/78	2/10		60/93			45/75	7.5/15	2.1/9.4			0.5/1		1,2
Outfall 002				5/8		26/41	/(0.5)		20/33	3/7	0.99/4.15			0.74/1.48		1,2
(Soil Pipe Div.) (I-172)	TN0003808	12/31/73	12/31/78	51/125		290/414			217/333	36/66	36/83			0.27/0.54		1,2
Velsical Chemical Corp. (I-175)	TN0025895			(10)/(20)		(15)/(20)	/(1.0)		(20)/(30)					(0.1)/(0.1)		1,2
Vulcan Materials Co. (I-177)	TN0003077	2/11/74	2/13/79			(40)/(50)	/(0.5)									1,2
Walnut Ridge Coal Co. (I-179)	TN0026336	9/23/77	10/24/82			(35)/(70)					(3.5)/(7.0)					1,2,3,7
Wheland Foundry (I-181)	TN0002437	6/28/74	10/10/79	3/6	16/50	43/75				0.83/2.5	3.3/5					1,2
Outfall 002 (I-182)																1,2,4
Outfall 003 (I-183)				1/2.5	111/150	17/25				1.35/2	17,388/25,000					1,2
Outfall 004 (I-184)				1/2.5		37/56				0.6/1.8	2.4/3.6					1,2
Outfalls 005,006 (I-185,I-186)						/(50)					/(10)					1,2

TABLE III-12
PERMIT CRITERIA FOR INDUSTRIAL DISCHARGERS (Continued)

Effluent Limitations: Daily Average lb/day (mg/l) / Daily Maximum lb/day (mg/l)

Discharger Name and Number	NPDES Number	Issue Date	Expiration Date	BOD_5*	COD	TSS	Sett. (ml/l)	D.O.	O & G	NH_3-N	Fe	Cr	Cl	Phe.	Sur.	Other
Yates Bleachery Co. (I-188)	GA0000019		6/27/79	258 / 387		585 / 1170	(1)					1.29 / 2.58				1,2

*Key to abbreviations follows:

** 1 - No discharge of floating solids or visible foam.
2 - pH 6.0 to 9.0
3 - Manganese: (2.0) / (4.0)
4 - Non-contact cooling water only.
5 - Fecal coliforms: 200 / 400 colonies/100 ml
6 - Temperature: 35 / 38 °C
7 - Alkalinity shall be greater than acidity at all times.

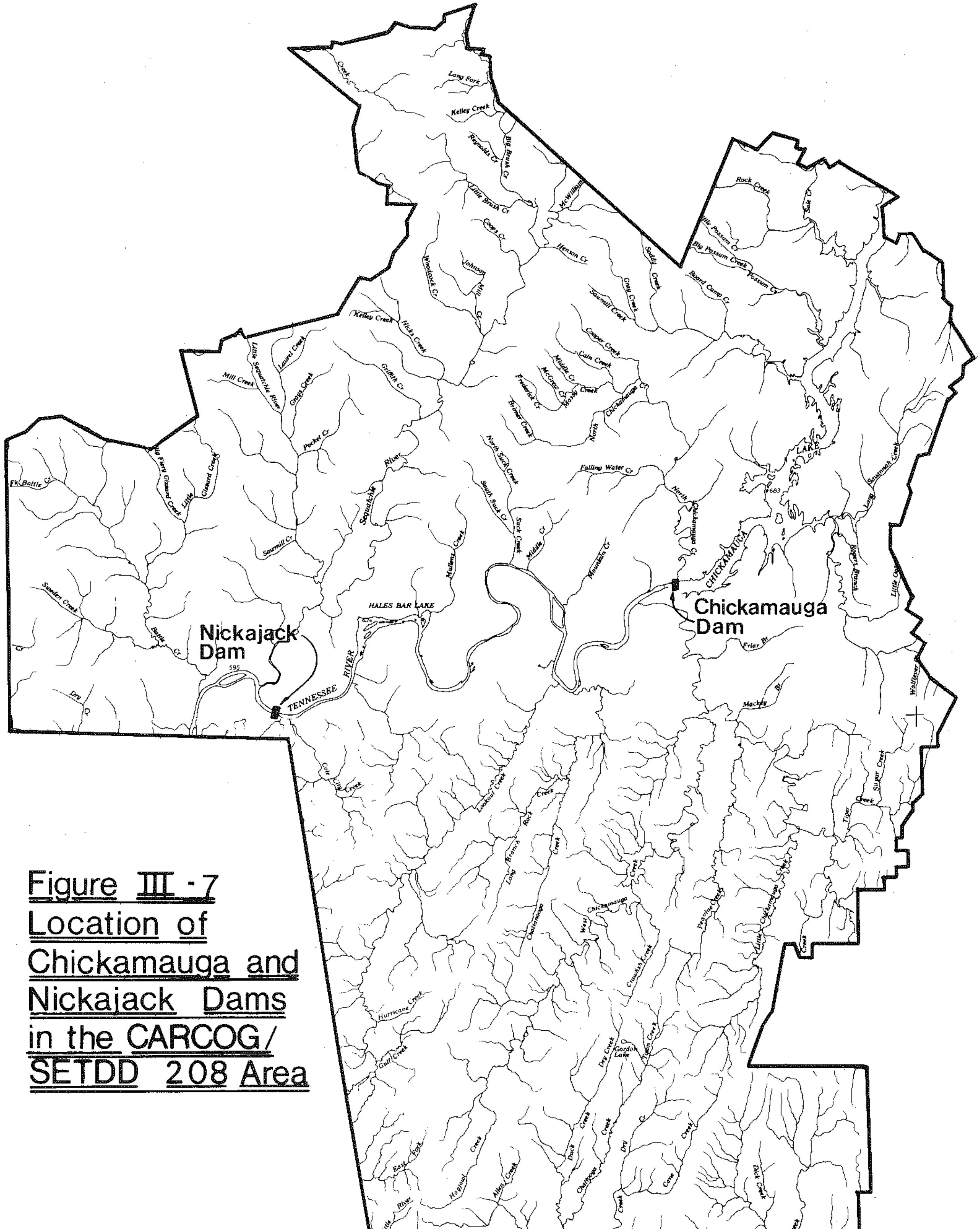


Figure III-7
Location of Chickamauga and Nickajack Dams in the CARCOG/SETDD 208 Area

impoundment on the main stem of the Tennessee River and has little capacity for controlled storage of water. Consequently, it often resembles a slowly flowing river more than a lake. The total drainage area of the Tennessee River system above Nickajack Dam is 21,870 square miles.

In addition to replacing Hales Bar Dam, which had developed leaks, Nickajack Reservoir was developed for a variety of coordinated uses, primarily for flood control, commercial navigation, and power generation, but including benefits for recreation, domestic and industrial water supply, waste disposal, and other public and private uses.

Nickajack Reservoir serves as the receiving water for the Moccasin Bend Wastewater Treatment Facility, together with numerous other municipal, domestic, and industrial waste discharges. The reservoir is also the receiving stream for grossly polluted tributary water-courses, such as Citico and Chattanooga Creeks which also receive various wastewater discharges. Recently, high levels of turbidity together with reports of nuisance growths of milfoil have been reported thoughout Nickajack Reservoir. For these reasons, together with data presented in several reports including the 1976 TVA report on the water quality in Nickajack Reservoir and the U.S. EPA National Eutrophication Survey, several questions have been raised with regard to the eutrophication potential of Nickajack Reservoir.

1. Definition of Eutrophication

The age of a lake or river is measured by its state of biological activity. Its rate of aging is measured by the rate of increase in productivity, the rate of change in types of aquatic life, the rate of increase in dissolved chemical content, the rate of decreased water transparency, and the rate of sedimentation of the lake or river. There are basically three ages of lakes and rivers: oligotrophic (young), mesotrophic (mature), and eutrophic (old).

Water bodies progress naturally from an oligotrophic state, in which the concentration of organic matter is low and algal growth is limited, to an eutrophic state. This eutrophication or natural aging process usually occurs over a period of many centuries. However, man can hasten the process by adding nutrients such as phosphorus and nitrogen, and organic matter to water. The predominant sources of added nutrients are wastewater effluents and agricultural runoff.

The change from oligotrophy to eutrophy involves a great increase in the amount of plankton, the small plants and animals which live in the open water, and these affect the usefulness of the water to man. An eutrophic water body is one rich in nutrients and organic matter; consequently, it sustains a high rate of biosynthesis and nutrient turnover. The quality of an eutrophic water system is often aesthetically displeasing and unsuitable for man's uses. Food fishes are replaced by a succession of course fishes, and planktonic algae and weed growth increase significantly.

It is important to note that it is extremely difficult to develop a detailed classification with regard to aging of lakes and rivers and to clearly determine that apparent changes in any such classification have been accelerated by human activities. The general opinion is that, while the broad outlines are clear, each lake or river has its own individuality. Unless alterations produced by pollution are very striking, or detailed records of the previous condition and rate of change of a particular lake or river are available, it is very difficult to assess how much of the alteration is natural and how much has been caused by human activities.

One method which is widely utilized in attempting to classify lakes and rivers is the use of a lake model. Lake models are most often called input-output models because they attempt to relate the input of a constituent to a lake or the concentration of the constituent in the lake with the physical properties of the lake, such as mean depth and hydraulic retention time. The constituent most frequently considered in these models is phosphorus. The input-output approach has evolved based primarily on the work of Vollenweider and is sometimes referred to as the Vollenweider Approach. The Vollenweider formulation was developed on large lakes in the northern United States and Canada, and therefore its use on reservoirs is sometimes questioned. This is the case for both the Chickamauga and Nickajack Reservoirs. In many ways, both of these reservoirs have characteristics of both lakes and rivers; therefore, the use of a lake model to determine eutrophic potential in them does not necessarily apply. In many instances, these reservoirs exhibit swiftly moving flows down the center channel while bank areas may be characterized by extensive shallow lagoon and overbank areas. In order to facilitate the classification of lakes and reservoirs which exhibit these types of flow characteristics, the EPA National Environmental Research Center has presented the following preliminary data derived from their on-going National Eutrophication Survey (Table III-13).

TABLE III-13
TROPHIC STATE/PHOSPHORUS LEVEL RELATIONSHIP

Lake/Reservoir Trophic State	Mean Phosphorus (ug/l)	Mean Total Phosphorus Range (ug/l)
Very Pure (Oligotrophic)	8	5 - 16
Good Condition (Mesotrophic)	16	8 - 39
Starting to go Bad (Meso-Eutrophic)	27	11 - 45
Bad Situation (Eutrophic)	127	10 - 1890
Going Dead (Hypereutrophic)	519	50 - 3480

Based upon the above criteria, a tentative classification system of the trophic state of southeastern lakes has been developed. This system is based upon phosphorus levels in the lakes and reservoirs and is presented in Table III-14. It is important to note that this classification system, developed by the U.S. EPA, is only a tentative system and is presented for information only. It is intended only to assist in the classification of publicly owned freshwater lakes by eutrophic conditions.

TABLE III-14
TROPHIC STATE CLASSIFICATION SYSTEM

Mean Phosphorus Range (ug/l)	Classification
0 - 12	Oligotrophic
>12 - 22	Mesotrophic
>22 - 77	Meso-Eutrophic
>77 - 323	Eutrophic
> 323	Hyper-Eutrophic

2. U.S. EPA National Eutrophication Survey

One important source to be documented with regard to the eutrophication potential of reservoirs in the CARCOG/SETDD 208 Study Area is National Eutrophication Survey (Working Paper No. 446). The information contained in this section is taken directly from portions of that document.

Lake Water Quality Summary

Chickamauga and Nickajack Reservoirs were sampled three times during the open water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from each station on the lakes and from a number of depths at each station. During each visit, a depth-integrated sample was collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first visit to each water body, an 18.9 liter depth-integrated sample was composited for algal assays. Maximum depths (expressed in meters) sampled were as follows:

Chickamauga Reservoir		Nickajack Reservoir	
Station Number	Depth (m)	Station Number	Depth (m)
1	16.5	1	15.8
2	19.8	2	21.3
3	14.0	3	11.3
4	10.4	4	11.9
5	7.6		
6	12.2		

Tables III-15 and III-16 present a portion of the physical/chemical and biological characteristics, respectively, which were obtained during this survey. Table III-17 illustrates the results of the limited nutrient study. In this limited nutrient study the control yields the assay algae, Selenastrum capricornutum, indicate that the potential primary productivity was moderately high in Nickajack Reservoir at the time of sampling, probably due to the proximity of this reservoir to the city of Chattanooga. The potential for primary production was moderately low in the Chickamauga impoundment. In both impoundments, the increase in yield with the addition of phosphorus, and the lack of response when only nitrogen was added, indicate phosphorus limitation. Maximum growth potential was achieved with the simultaneous addition of both phosphorus and nitrogen.

The ratio of inorganic nitrogen to orthophosphorus in lake data was 27:1 or greater in Chickamauga Reservoir. A minimum N:P ratio of 14:1 is considered necessary for phosphorus limitation to occur.

Mean N:P ratios for Nickajack Reservoir were 14:1 and 13:1 during May and August sampling, suggesting colimitation or near nitrogen limitation, but 17:1 in the October sample, indicating phosphorus limitation at that time.

Nutrient Loadings

For the determination of nutrient loadings, the Tennessee National Guard collected monthly near-surface grab samples from each of the tributaries indicated in Tables III-18, III-19, and III-20. These tables indicate the annual total phosphorus loadings, the annual total nitrogen loadings, and the mean annual nonpoint nutrient export by subdrainage area, respectively.

Nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" were estimated by using the mean annual nutrient loads, in $Kg/Km^2/yr$ for Long Savannah Creek, Gunstocker Creek, Candies Creek, Rogers Creek, Sewee Creek, and Soddy Creek (Chickamauga); Suck Creek and Mullens Creek (Nickajack); and multiplying the means by the appropriate drainage areas in km^2.

Yearly Loadings

In Table III-21, the existing phosphorus annual loadings are compared to the relationship proposed by Vollenweider. Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his oligotrophic loading is that which would result in the receiving water remaining oligotrophic if morphometry is permitted. A mesotrophic loading should be considered one between eutrophic and oligotrophic.

TABLE III-15
PHYSICAL AND CHEMICAL CHARACTERISTICS

Parameter	(5/23/73) N*	Range	Median	Max Depth Range (Meters)	(8/23/73) N*	Range	Median	Max Depth Range (Meters)	(10/29/73) N*	Range	Median	Max Depth Range (Meters)
CHICKAMAUGA RESERVOIR												
Temperature (Deg Cent)												
0.-1.5 M Depth	6	28.0-38.0	36.0	0.0-0.0	12	22.9-42.0	28.1	0.0-1.5	12	17.1-39.0	26.5	0.0-1.5
Max Depth**	6	18.0-19.2	18.9	6.4-18.6	6	22.8-25.9	25.7	4.6-13.7	6	17.1-20.0	19.6	4.6-13.7
Dissolved Oxygen (mg/l)												
0.-1.5 M Depth	-	--	--	--	5	5.6-6.0	6.0	1.5-1.5	5	6.6-7.0	7.0	1.5-1.5
Max Depth**	6	6.8-8.0	7.5	6.4-18.6	6	5.6-6.0	5.7	4.6-13.7	6	6.6-7.0	6.8	4.6-13.7
Conductivity (UMHOS)												
0.-1.5 M Depth	6	140.-160.	158.	0.0-0.0	12	118.-176.	170.	0.0-1.5	12	95.-172.	161.	0.0-1.5
Max Depth**	6	120.-165.	153.	6.4-18.6	6	118.-176.	169.	4.6-13.7	6	95.-171.	162.	4.6-13.7
pH (Standard Units)												
0.-1.5 M Depth	6	7.2-7.6	7.4	0.0-0.0	12	7.1-7.6	7.5	0.0-1.5	12	7.2-7.6	7.5	0.0-1.5
Max Depth**	6	7.1-7.5	7.3	6.4-18.6	6	7.0-7.5	7.4	4.6-13.7	6	7.2-7.6	7.5	4.6-13.7
Total Alkalinity (mg/l)												
0.-1.5 M Depth	6	43.-71.	53.	0.0-0.0	12	26.-66.	60.	0.0-1.5	12	22.-67.	59.	0.0-1.5
Max Depth**	6	46.-72.	52.	6.4-18.6	6	26.-61.	60.	4.6-13.7	6	22.-67.	59.	4.6-13.7
Total P (mg/l)												
0.-1.5 M Depth	6	0.026-0.043	0.031	0.0-0.0	12	0.018-0.039	0.025	0.0-1.5	12	0.032-0.046	0.037	0.0-1.5
Max Depth**	6	0.031-0.036	0.032	6.4-18.6	6	0.023-0.047	0.027	4.6-13.7	6	0.035-0.047	0.039	4.6-13.7
Dissolved Ortho P (mg/l)												
0.-1.5 M Depth	6	0.005-0.015	0.011	0.0-0.0	12	0.004-0.014	0.010	0.0-1.5	12	0.004-0.018	0.013	0.0-1.5
Max Depth**	6	0.002-0.015	0.012	6.4-18.6	6	0.004-0.016	0.008	4.6-13.7	6	0.007-0.016	0.014	4.6-13.7

TABLE III-15
PHYSICAL AND CHEMICAL CHARACTERISTICS (Continued)

Parameter	N*	Range (5/23/73)	Median	Max Depth Range (Meters)	N*	Range (8/23/73)	Median	Max Depth Range (Meters)	N*	Range (10/28/73)	Median	Max Depth Range (Meters)
CHICKAMAUGA RESERVOIR												
NO_2-N + NO_3-N (mg/l)												
0.-1.5 M Depth	6	0.180-0.440	0.395	0.0-0.0	12	0.160-0.430	0.365	0.0-1.5	12	0.200-0.350	0.335	0.0-1.5
Max Depth**	6	0.190-0.430	0.395	6.4-18.6	6	0.190-0.380	0.360	4.6-13.7	6	0.210-0.360	0.335	4.6-13.7
Ammonia (mg/l)												
0.-1.5 M Depth	6	0.050-0.100	0.075	0.0-0.0	12	0.060-0.100	0.075	0.0-1.5	12	0.050-0.060	0.060	0.0-1.5
Max Depth**	6	0.070-0.120	0.090	6.4-18.6	6	0.070-0.100	0.085	4.6-13.7	6	0.050-0.060	0.060	4.6-13.7
Kjeldahl N (mg/l)												
0.-1.5 M Depth	6	0.400-0.700	0.550	0.0-0.0	12	0.200-0.600	0.300	0.0-1.5	12	0.200-0.400	0.250	0.0-1.5
Max Depth **	6	0.200-0.600	0.300	6.4-18.6	6	0.200-0.300	0.200	4.6-13.7	6	0.200-0.200	0.200	4.6-13.7
NICKAJACK RESERVOIR		(5/23/73)				(8/18/73)				(10/20/73)		
Temperature (Deg Cent)												
0.-1.5 M Depth	4	18.0-33.0	30.0	0.0-0.0	7	26.6-48.0	36.0	0.0-1.5	7	18.5-84.0	39.0	0.0-1.5
Max Depth**	4	19.3-19.4	19.3	8.2-20.1	4	26.5-26.7	26.6	6.4-14.3	4	18.4-46.0	18.8	0.0-14.6
Dissolved Oxygen (mg/l)												
0.-1.5 M Depth	0	--	--	--	4	5.3-6.0	5.5	0.0-1.5	4	6.6-7.0	6.7	0.0-1.5
Max Depth**	4	7.4-7.6	7.5	8.2-20.1	4	5.4-5.4	5.4	6.4-14.3	4	6.6-7.2	6.8	0.0-14.6
Conductivity (UMHOS)												
0.-1.5 M Depth	4	160.-315.	165.	0.0-0.0	7	158.-173.	162.	0.0-1.5	7	161.-171.	166.	0.0-1.5
Max Depth**	4	155.-160.	160.	8.2-20.1	4	159.-169.	162.	6.4-14.3	4	160.-166.	166.	0.0-14.6
pH (Standard Units)												
0.-1.5 M Depth	4	7.2-7.4	7.2	0.0-0.0	6	6.4-7.2	6.6	0.0-1.5	7	7.4-7.5	7.4	0.0-1.5
Max Depth**	4	7.1-7.4	7.1	8.2-20.1	4	6.3-6.9	6.5	6.4-14.3	4	7.3-7.4	7.4	0.0-14.6

TABLE III-15
PHYSICAL AND CHEMICAL CHARACTERISTICS (Continued)

Parameter	(5/23/73) N*	Range	Median	Max Depth Range (Meters)	(8/18/73) N*	Range	Median	Max Depth Range (Meters)	(10/29/73) N*	Range	Median	Max Depth Range (Meters)
NICKAJACK RESERVOIR												
Total Alkalinity (mg/l)												
0.-1.5 M Depth	4	55.-73.	57.	0.0-0.0	6	50.-60.	55.	0.0-1.5	7	58.-62.	59.	0.0-1.5
Max Depth**	4	54.-64.	58.	8.2-20.1	4	51.-56.	52.	6.4-14.3	4	57.-59.	58.	0.0-14.6
Total P (mg/l)												
0.-1.5 M Depth	4	0.044-0.570	0.054	0.0-0.0	6	0.035-0.442	0.037	0.0-1.5	7	0.047-0.086	0.052	0.0-1.5
Max Depth**	4	0.041-0.058	0.051	8.2-20.1	4	0.029-0.073	0.038	6.4-14.3	4	0.050-0.062	0.055	0.0-14.6
Dissolved Ortho P (mg/l)												
0.-1.5 M Depth	4	0.019-0.355	0.030	0.0-0.0	6	0.021-0.259	0.025	0.0-1.5	7	0.025-0.035	0.029	0.0-1.5
Max Depth**	4	0.017-0.031	0.021	8.2-20.1	4	0.017-0.043	0.020	6.4-14.3	4	0.023-0.031	0.028	0.0-14.6
NO_2-N + NO_3-N (mg/l)												
0.-1.5 M Depth	4	0.420-0.460	0.440	0.0-0.0	6	0.390-0.470	0.400	0.0-1.5	7	0.350-0.390	0.370	0.0-1.5
Max Depth**	4	0.420-0.440	0.435	8.2-20.1	4	0.390-0.440	0.405	6.4-14.3	4	0.350-0.380	0.370	0.0-14.6
Ammonia (mg/l)												
0.-1.5 M Depth	4	0.090-2.290	0.115	0.0-0.0	6	0.080-0.120	0.095	0.0-1.5	7	0.070-0.120	0.090	0.0-1.5
Max Depth**	4	0.080-0.120	0.105	8.2-20.1	4	0.070-0.120	0.080	6.4-14.3	4	0.070-0.100	0.090	0.0-14.6
Kjeldahl N (mg/l)												
0.-1.5 M Depth	4	0.300-3.000	0.600	0.0-0.0	6	0.300-1.600	0.650	0.0-1.5	7	0.200-0.400	0.200	0.0-1.5
Max Depth**	4	0.200-0.400	0.400	8.2-20.1	4	0.300-0.400	0.300	6.4-14.3	4	0.200-0.400	0.200	0.0-14.6

*N = Number of Samples

**Maximum depth sampled at each site.

TABLE III-16
BIOLOGICAL CHARACTERISTICS

1. Phytoplankton -

Chickamauga Reservoir

Sampling Date		Dominant Genera	Algal Units per ml
05/23/73	1.	*Flagellates*	438
	2.	*Melosira*	305
	3.	*Dinobryon*	204
	4.	*Cyclotella*	112
	5.	*Datylococcopsis*	71
		Other genera	215
		Total	1,345
08/23/73	1.	Flagellates	241
	2.	*Raphidiopsis*	201
	3.	*Synedra*	121
	4.	*Melosira*	107
	5.	*Nitzschia*	94
		Other genera	309
		Total	1,073
10/29/73	1.	Flagellates	974
	2.	*Melosira*	220
	3.	*Synedra*	79
	4.	*Scenedesmus*	47
	5.	*Navicula*	32
		Other genera	46
		Total	1,398

Nickajack Reservoir

Sampling Date		Dominant Genera	Algal Units per ml
05/23/73	1.	*Melosira*	867
	2.	*Flagellates*	606
	3.	*Cyclotella*	119
	4.	*Dactylococcopsis*	87
	5.	*Coscinodiscus*	43
		Other genera	151
		Total	1,873
08/18/73	1.	Flagellates	1,303
	2.	*Melosira*	318
	3.	*Cyclotella*	143
	4.	*Fragilaria*	143
	5.	*Cryptomonas*	95
		Other genera	319
		Total	2,321
10/30/73	1.	Flagellates	409
	2.	Pennate Diatom	85
	3.	*Oscillatoria*	28
	4.	*Centric Diatom*	28
	5.	*Navicula*	14
		Other genera	--
		Total	564

TABLE III-16
BIOLOGICAL CHARACTERISTICS (Continued)

2. Chlorophyll *a*

Chickamauga Reservoir

Sampling Date	Station Number	Chlorophyll *a* (μg/l)
05/23/73	1	3.0
	2	5.8
	3	5.0
	4	2.2
08/23/73	1	3.7
	2	4.1
	3	3.8
	4	3.2
	5	4.3
	6	3.6
10/29/73	1	2.3
	2	2.3
	3	1.6
	4	2.1
	5	2.3
	6	1.2

Nickajack Reservoir

Sampling Date	Station Number	Chlorophyll *a* (μg/l)
05/23/73	1	3.2
	2	3.4
	3	2.4
	4	2.4
08/18/73	1	5.6
	2	3.3
	3	3.8
	4	4.1
10/30/73	1	1.0
	2	1.3
	3	1.1
	4	1.3

TABLE III-17
LIMITING NUTRIENT STUDY

Spike (mg/l)	Chickamauga Reservoir Ortho P Conc. (mg/l)	Chickamauga Reservoir Inorganic N Conc. (mg/l)	Chickamauga Reservoir Maximum Yield (mg/l-dry wt.)	Nickajack Reservoir Ortho P Conc. (mg/l)	Nickajack Reservoir Inorganic N Conc. (mg/l)	Nickajack Reservoir Maximum Yield (mg/l-dry wt.)
	Stations 1,2, & 3			Stations 1, 2, 3, & 4		
Control	0.012	0.426	0.3	0.020	0.514	5.1
0.05 P	0.062	0.426	10.9	0.070	0.514	9.2
0.05 P + 1.0 N	0.062	1.426	22.7	0.070	1.514	16.9
1.00 N	0.012	1.426	0.2	0.020	1.514	5.3
	Stations 4, 5, & 6					
Control	0.012	0.378	0.6			
0.05 P	0.062	0.378	10.5			
0.05 P + 1.0 N	0.062	1.378	20.5			
1.00 N	0.012	1.378	0.4			

TABLE III-18
ANNUAL TOTAL PHOSPHORUS LOADING - AVERAGE YEAR

Chickamauga Reservoir

	kg P/yr	% of total
1. Inputs		
Source		
a. Tributaries (nonpoint load) -		
B(1) Unnamed Creek	215	<0.1
C(1) Wolftever Creek	12,145	0.9
D(1) Long Savannah Creek	1,710	0.1
E(1) Gunstocker Creek	900	0.1
F(1) Candies Creek	11,455	0.9
G(1) South Mouse Creek	2,065	0.2
H(1) Hiawassee River	131,880	10.1
J(1) North Mouse Creek	6,815	0.5
K(1) Spring Creek	1,025	0.1
L(1) Rogers Creek	2,510	0.2
M(1) Goodfield Creek	1,135	0.1
N(1) Sewee Creek	6,880	0.5
P(1) Tennessee River	1,044,160	79.8
R(1) Little Richland Creek	1,055	0.1
T(1) Richland Creek	4,205	0.3
U(1) Sale Creek	3,170	0.2
V(1) Soddy Creek	930	0.1
b. Minor tributaries and immediate drainage (nonpoint load) -	11,395	0.9
c. Known municipal STP's -		
Cleveland	34,020	2.6
Dayton	4,840	0.4
U.S. Military Reservation #1	795	0.1
Watts Bar Steam Plant	55	<0.1
Collegedale	3,435	0.3
Athens	17,010	1.3
d. Septic tanks -	45	<0.1
e. Direct precipitation -	2,505	0.2
Totals	1,306,355	100.0
2. Output - Tennessee River	1,101,375	
3. Net annual P accumulation -	204,980	

TABLE III-18
ANNUAL TOTAL PHOSPHORUS LOADING - AVERAGE YEAR (Continued)

Nickajack Reservoir

1. Inputs

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A(1) Tennessee River	1,161,545	66.9
B(1) North Chickamauga Creek	5,465	0.3
C(1) Stringers Creek	1,380	0.1
D(1) Mountain Creek	815	<0.1
E(1) Suck Creek	395	<0.1
F(1) Cole City Creek	1,365	0.1
G(1) Running Water Creek	1,065	0.1
H(1) Lookout Creek	18,765	1.1
J(1) Chattanooga Creek	34,375	2.0
K(1) Citico Creek	2,215	0.1
L(1) South Chickamauga Creek	127,315	7.3
M(1) Dry Creek	95	<0.1
N(1) Butcher Creek	25	<0.1
P(1) Ellis Gap Creek	15	<0.1
Q(1) Bill McNabb Gulf	20	<0.1
R(1) Unnamed Creek	10	<0.1
T(1) Mullens Creek	210	<0.1
b. Minor tributaries and immediate drainage (nonpoint load) -	1,445	0.1
c. Known municipal STP's -		
Moccasin Bend (Chattanooga)	297,870	17.2
Red Bank/White Oak	7,935	0.5
Signal Mountain	2,265	0.1
Brainerd (Chattanooga)	44,875	2.6
East Ridge	23,370	1.4
Chattanooga Vocational and Technical School	455	<0.1
Lupton City	1,700	0.1
d. Septic tanks -	60	<0.1
e. Direct precipitation -	735	<0.1
Totals	1,735,785	100.0

2. Output - Tennessee River 1,554,460

3. Net annual P accumulation - 181,325

TABLE III-19
ANNUAL TOTAL NITROGEN LOADING - AVERAGE YEAR

Chickamauga Reservoir

1. Inputs

Source	kg N/yr	% of total
a. Tributaries (nonpoint load)		
B(1) Unnamed Creek	53,010	0.1
C(1) Wolftever Creek	132,855	0.3
D(1) Long Savannah Creek	51,875	0.1
E(1) Gunstocker Creek	17,210	<0.1
F(1) Candies Creek	137,355	0.3
G(1) South Mouse Creek	41,115	0.1
H(1) Hiawassee River	2,882,840	6.2
J(1) North Mouse Creek	167,625	0.4
K(1) Spring Creek	18,320	<0.1
L(1) Rogers Creek	53,040	0.1
M(1) Goodfield Creek	28,135	0.1
N(1) Sewee Creek	120,090	0.3
P(1) Tennessee River	41,729,505	90.0
R(1) Little Richland Creek	37,155	0.1
T(1) Richland Creek	83,700	0.2
U(1) Sale Creek	190,005	0.4
V(1) Soddy Creek	49,055	0.1
b. Minor tributaries and immediate drainage (nonpoint load) -	226,780	0.5
c. Known municipal STP's -		
Cleveland	102,030	0.2
Dayton	10,355	<0.1
U.S. Military Reservation #1	2,380	<0.1
Watts Bar Steam Plant	165	<0.1
Collegedale	10,310	<0.1
Athens	51,015	0.1
d. Septic tanks -	1,790	<0.1
e. Direct precipitation -	154,655	0.3
Totals	46,352,370	100.0

2. Output - Tennessee River 26,652,990

3. Net annual N accumulation - 19,699,380

TABLE III-19
ANNUAL TOTAL NITROGEN LOADING - AVERAGE YEAR (Continued)

Nickajack Reservoir

1. Inputs

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
A(1) Tennessee River	20,237,570	85.8
B(1) North Chickamauga Creek	197,930	0.8
C(1) Stringers Creek	19,745	0.1
D(1) Mountain Creek	22,150	0.1
E(1) Suck Creek	22,020	0.1
F(1) Cole City Creek	32,685	0.1
G(1) Running Water Creek	22,260	0.1
H(1) Lookout Creek	301,365	1.3
J(1) Chattanooga Creek	308,150	1.3
K(1) Citico Creek	13,560	0.1
L(1) South Chickamauga Creek	1,120,165	4.8
M(1) Dry Creek	14,505	0.1
N(1) Butcher Creek	1,635	<0.1
P(1) Ellis Gap Creek	1,455	<0.1
Q(1) Bill McNabb Gulf	1,335	<0.1
R(1) Unnamed Creek	750	<0.1
T(1) Mullens Creek	23,495	0.1
b. Minor tributaries and immediate drainage (nonpoint load) -	110,330	0.5
c. Known municipal STP's		
Moccasin Bend (Chattanooga)	892,045	3.8
Red Bank/White Oak	23,810	0.1
Signal Mountain	6,800	<0.1
Brainerd (Chattanooga)	96,685	0.4
East Ridge	53,090	0.2
Chattanooga Vocational	1,360	<0.1
and Technical School		
Lupton City	5,100	<0.1
d. Septic tanks -	2,335	<0.1
e. Direct precipitation -	45,310	0.2
Totals	23,577,640	100.0

2. Output - Tennessee River	23,668,705
3. Net annual N export	91,065

TABLE III-20
MEAN ANNUAL NONPOINT NUTRIENT EXPORT BY SUBDRAINAGE AREA

Chickamauga and Nickajack Reservoirs

Tributary	kg P/km^2/yr	kg N/km^2/yr
Unnamed Creek	67	16,565*
Wolftever Creek	46	508
Long Savannah Creek	16	498
Gunstocker Creek	20	387
Candies Creek	39	473
South Mouse Creek	20	398
Hiawassee River	22	484
North Mouse Creek	28	691
Spring Creek	23	408
Rogers Creek	17	367
Goodfield Creek	18	436
Sewee Creek	22	377
Little Richland Creek	22	779
Richland Creek	20	398
Sale Creek	10	632
Soddy Creek	5	288
North Chickamauga Creek	17	631
Stringers Creek	86	1,226
Mountain Creek	24	644
Suck Creek	7	369
Cole City Creek	18	435
Running Water Creek	19	408
Lookout Creek	39	622
Chattanooga Creek	178*	1,592
Citico Creek	284*	1,738
South Chickamauga Creek	106	932
Dry Creek	6	906
Butcher Creek	5	327
Ellis Gap Branch	4	393
Bill McNabb Gulf	5	334
Unnamed Creek	4	326
Mullens Creek	5	546

Note that Vollenweider's model may not be applicable to water bodies with very short retention times or in which light penetration is severely restricted from high concentrations of suspended solids in the surface waters.

TABLE III-21
TOTAL YEARLY PHOSPHORUS LOADING

	$g/m^2/yr$	
	Chickamauga Reservoir	Nickajack Reservoir
Estimated Loading	9.12	41.36
Vollenweider's Eutrophic Loading	3.12	5.07
Vollenweider's Oligotrophic Loading	1.56	2.51

Conclusions From the U.S. EPA National Eutrophication Survey

Trophic Conditions: Chickamauga and Nickajack impoundments are classified as eutrophic based upon this survey data. The reservoirs are characterized by moderately high nutrient levels, low Secchi disc visibility, and turbid, debris filled water. Phytoplankton genera identified were generally pollution tolerant forms. Algal blooms were noted by survey limnologists for both the reservoirs and heavy macrophyte growth was reported at Nickajack Reservoir.

Past studies (Tennessee Valley Authority (TVA), Stream Sanitation Staff, 1964; TVA, Water Quality Branch, 1967) indicate that watercraft with marine toilets are creating a special pollution problem in Tennessee lakes. This regular discharge of raw sewage directly into lakes presents a growing threat to recreational uses of each reservoir.

Rate-Limiting Nutrient: Algal assay results indicate that both Tennessee River impoundments were limited by available phosphorus levels. Spikes with phosphorus, and with phosphorus and nitrogen simultaneously resulted in increases in assay yields. Spikes with nitrogen alone produced no positive growth response.

Ratios of available inorganic nitrogen to orthophosphorus in sampled waters substantiate phosphorus limitation.

Nutrient Controllability: Point sources contributed an estimated 4.7 percent of the total phosphorus load reaching Chickamauga Reservoir. The city of Cleveland contributed 2.6 percent from one plant. The remaining five known plants contributed 2.1 percent of the total load.

Phosphorus loading from point sources was estimated to be 21.8 percent of the total reaching Nickajack Lake. The city of Chattanooga contributed a total of 19.8 percent from two wastewater treatment plants. The remaining five known plants contributed 2.0 percent of the total load.

It should be noted that the percentages of the total phosphorus loads attributable to point sources for Chickamauga and Nickajack Reservoirs do not include a consideration of the quality of phosphorus discharged to the next upstream reservoir from point sources.

Present loading rates of these Tennessee River impoundments were from three to eight times greater than those proposed by Vollenweider as eutrophic for lakes with such volume and retention times. Although Vollenweider's model may not apply to such highly turbid water bodies, or to those with short hydraulic retention times, these loadings are excessive and it is expected that reduction of nonpoint phosphorus loading, as well as known point sources would be required to substantially improve river water quality.

The productivity of these reservoirs, as roughly estimated by the chlorophyll a levels developed, was considerably lower than would be expected based upon nutrient levels. The likely reason for this is the inability to develop phytoplankton levels up to potential with such short retention times and light limitation caused by high suspended solids content.

The mean annual phosphorus loads not attributable to point sources directly discharging to these lakes were about 95.3 percent of the total impacting Nickajack Reservoir. Measured tributaries accounted for all but approximately 2.0 percent of these phosphorus loads.

There are a number of large industrial point sources impacting the reservoirs (Tennessee Department of Public Health, 1974) which were not sampled by the National Eutrophication Survey in 1973, and so are not included in the lake nutrient budgets. Included among these sources is C.F. Industries in Chattanooga which reportedly discharges 60,590 kg ammonia-nitrogen and 30,660 kg nitrate nitrogen per year to Friar Branch of Nickajack Reservoir. Additional study is needed to determine the impact of these sources on the calculated nutrient budgets of the impoundments.

3. TVA Quality of Water in Nickajack Reservoir Report - 1976

Another important source of information, which may be utilized when attempting to evaluate the eutrophication potential of reservoirs in the CARCOG/SETDD 208 Study Area, is the 1976 Tennessee Valley Authority's report entitled Quality of Water in Nickajack Reservoir. This report contains a significant amount of data concerning not only the history and use of Nickajack Reservoir, but also the bacteriological, sanitary/chemical, mineral, and biological quality of the water in the reservoir. The information which follows is taken directly from portions of that report. It should be noted that only a small portion of the information contained in the TVA report, that data which can be directly related to eutrophication potential, is addressed in this section.

Mineral Quality

The mineral quality of water in Nickajack Reservoir was determined by monthly samples collected at 18 stations throughout the reservoir during the calendar year 1973. The two most prominent mineral constituents of interest are nitrogen and phosphorus.

Considerable quantities of nitrogen are added to surface waters by effluents from municipal sewage treatment plants. Secondary sewage treatment removes about half of the nitrogen content of raw sewage. Modern farming methods utilize large amounts of nitrogen fertilizers in various forms to increase crop yields. Surface runoff from fields fertilized with nitrogenous compounds carries all the forms of nitrogen into streams and reservoirs. Runoff from farm areas used for raising cattle, hogs, chickens, and other animals also contains nitrogen from animal wastes.

Nitrogen along with phosphorus, is one of the nutrient minerals that can stimulate excessive growths of aquatic plants in lakes and streams. When conditions such as temperature, water clarity, light intensity, and mineral concentrations are favorable, blooms of plankton or weeds may occur. There has been growing concern about economic and aesthetic losses to resort and recreation areas on lakes and reservoirs caused by the nuisances of unsightliness.

Concentrations of organic nitrogen found in samples collected from the main stream of Nickajack Reservoir were low, averaging about 0.12 mg/l, except at Tennessee River mile 469.9, where they averaged 0.23 mg/l. This higher concentration was most likely caused by a waste outfall nearby. Samples collected on tributary streams were higher in concentrations of organic nitrogen, ranging from less than 0.01 to 2.2 mg/l. Highest values were observed in the heavily polluted Citico and Chattanooga Creeks which averaged 1.02 and 0.80 mg/l, respectively.

Ammonia-nitrogen (NH_3-N) concentrations were low and fairly constant in samples collected from the main stream, averaging about 0.07 mg/l. Except for Citico and Chattanooga Creeks which averaged 1.27 and 1.83 mg/l, respectively, samples collected from tributary streams were also low in ammonia.

The concentration of nitrate- plus nitrite-nitrogen (NO_3-N + NO_2-N) in Nickajack Reservoir averaged 0.43 mg/l in samples collected from the main stream. Stringer Branch and South Chickamauga Creek had relatively high concentrations of nitrate- plus nitrite-nitrogen, averaging 1.19 and 1.16 mg/l, respectively. The cause of the high values in Stringer's Branch, which remained fairly constant, was not evident. The high values in South Chickamauga Creek were likely the result of municipal and industrial wastes.

Phosphorus (P) occurs in natural waters almost solely in the form of phosphate. Phosphorus is essential to the growth of organisms and is often the nutrient that limits the growth of plankton, rooted aquatic plants, and other organisms. It is seldom found in surface waters in concentrations of any human physiological significance; however, the threshold concentration at which phosphorus causes objectionable water quality has not been established. The Environmental Protection Agency has proposed for recreational waters phosphorus values of 0.025 mg/l (0.075 mg/l of posphate) in lakes and reservoirs, and 0.10 mg/l (0.30 mg/l of phosphate) in streams primarily to avoid eutrophication. Concentrations of poly-phosphate greater that 1 mg/l are detrimental to water treatment plants because they interfere with coagulation and flocculation.

Concentrations of total phosphate-phosphorus (PO_4-P) in the main stream of Nickajack Reservoir averaged about 0.05 mg/l. Higher values were observed in Citico, South Chickamauga, and Chattanooga Creeks where concentrations averaged 0.72, 0.34, and 0.24 mg/l, respectively.

Concentrations of soluble phosphate-phosphorus were low and fairly uniform throughout Nickajack Reservoir. Values ranged from less than 0.01 to 0.28 mg/l and averaged about 0.03 mg/l. Concentrations were somewhat higher in Citico and South Chickamauga Creeks.

Biological Conditions

Knowledge of the diversity of aquatic life in a stream is useful in evaluating the quality of water because aquatic life is affected by and, in turn, has an effect upon water quality. Studies were made in 1973 to determine the general water quality conditions of Nickajack Reservoir. Samples for the study were collected monthly at seven stations. All stations were located between Nickajack and Chickamauga Dams at Tennessee River miles (TRM) 425.5, 435.4, 457.1, 459.0, 465.4, 469.9, and 471.0. Populations of phytoplankton, zooplankton, and macroinvertebrates were sampled to evaluate water quality conditions.

Phytoplankton: A biological population has two measurable characteristics: its standing stock or existing mass at one particular time and its productivity or addition of new mass per unit of time. Primary productivity values show daily phytoplankton carbon fixation rates in a column of water that is 1 square meter in area and extends from the surface through 5 meters, which is generally the lower limit of the photic zone in Nickajack Reservoir. These values, obtained from monthly surveys at the indicated river miles, represent photosynthetically active cell products in the epilimnion.

The mean productivity for the seven stations on Nickajack Reservoir dring 1973 was 205.69 mg C/m^2/day. Overall, TRM 425.5 was the most productive of the seven stations, averaging 307.0 mg C/m^2/day for the year. The other stations averaged lower rates of fixation. Early spring and late summer months were the most productive, and the winter months were the least productive.

The standing stock of phytoplankton cells per liter were calculated as the mean value from four different depths sampled in the epilimnetic waters--the surface, 1, 3, and 5 meters. Total cells per liter ranged from a high of over 873,000 cells/l at TRM 471.0 in August to a low of less than 66,000 cells/l at TRM 425.5 in December. Diatoms (Chrysophyta) were usually the dominant group, ranging from 12.0 to 100.0 percent of the total phytoplankton; green algae (Chlorophyta) were next in dominance ranging from 0.0 to 69.4 percent; blue-greens (Cyanophyta) were third in dominance ranging from 0.0 to 38.4 percent; euglenoids (Euglenophyta) ranged from 0.0 to 6.7 percent; and some dinoflagellates (Pyrrophyta) were present comprising as much as 3.4 percent of some samples.

During the entire sampling period, 58 genera of phytoplankton were collected--24 genera belonged to the greens (Chlorophyta); 22 genera were diatoms (Chyrsophyta); 6 genera belonged to the blue-greens (Cyanophytha); 3 genera were euglenoids (Euglenophyta); and 3 genera were dinoflagellates (Pyrrophyta). This high diversity reflects the good quality of water in Nickajack Reservoir.

Results of the investigation of phytoplankton productivity and standing stock results are comparable to those for other main stream Tennessee River reservoirs and make a suitable biological base for a balanced ecological system within Nickajack Reservoir. Nutrient levels (nitrate and phosphate) are sufficient to support phytoplankton growth throughout the reservoir. Physical factors such as decreased turbulence, retention time, and aging of the water were more favorable for phytoplankton growth near Nickajack Dam. These factors probably had the greatest effect on phytoplankton productivity and standing stock. The low production in the winter was caused by low incident light and a cooler water temperature. The dominance of diatoms, followed by green and then blue-green algae, shows a well balanced group of desirable algae that indicates good water quality.

Zooplankton: The three major groups of zooplankton found in the Nickajack reservoir were Rotifera, Cladocera, and Copepoda. The maximum population of rotifers, more than 55,000/m^3, was found at TRM 471.0 in August. Rotifer counts were high at all stations in May, although the populations at TRM 425.5 and TRM 471.0 were almost always higher than those at intermediate stations. During the year, 42 genera of rotifers were collected from Nickajack Reservoir. Caldocera was dominant at most of the stations in May and June. From January to December, 26 genera of Cladocera were collected from the reservoir. Copepoda was dominant only at TRM 471.0 in November and at TRM 459.0 in December. During the year, 24 taxa of Copepoda were collected from the reservoir. A total of 91 taxa of zooplankton was collected during the entire survey period. This diversity indicates the good quality of water in Nickajack Reservoir. The zooplankton population ranged from 0 organisms/m^3 in January at TRM 457.1 to 123,858 organisms/m^3 in May at TRM 469.9.

Zooplankton were also more abundant near the dam. Because zooplankton depend largely upon phytoplankton as a food supply, their abundance is naturally related to the abundance of phytoplankton and indicates the same water quality conditions as does the abundance of phytoplankton.

Fish Populations: The fish population of Nickajack Reservoir was inventoried during July, 1972. Four cove areas were sampled between TRM 437.5 and TRM 424.7. These coves ranged in area from 1.2 to 2.4 surface acres, and the average depths ranged from 2.3 to 3.5 feet.

The survey showed an average of 1,959 fish and 269.9 pounds per surface acre in Nickajack Reservoir. The population was made up mainly of forage fish (126.7 lb/ac) followed by rough fish (72.3 lb/ac) and game fish (70.9 lb/ac). The dominant forage fish by weight were gizzard shad, which composed 97.2 percent of the total weight of forage fish obtained. Carp were the dominant rough fish (46.7 percent), and bluegill were the dominant game fish (69.9 percent).

Nickajack Reservoir, in comparison with inventory samples from Chickamauga Reservoir, upstream, and Guntersville Reservoir, downstream, had an average standing crop intermediate between the other two lakes (Table III-22). The composition of the standing crop was quite different from that in these lakes, however. Numbers of game and rough fish per acre were higher and numbers of forage fish were lower in Nickajack than in either Chickamauga or Guntersville. Young-of-year sizes of all fish groups made up a much smaller proportion of the total sample in Nickajack than in the adjacent lakes.

TABLE III-22
FISH POPULATION DATA

Reservoir and Sample Year	Standing Crop (lb/ac)	Composition by Fish Classes (%)			Size Distribution for (All Fish) Classes (%)		
		Game	Rough	Forage	Young-of-year	Intermediate	Harvestable
Chickamauga (1970)	181	24	7	69	84	7	9
Nickajack (1972)	270	47	18	35	28	37	35
Guntersville (1971)	361	29	4	67	75	5	20

4. Conclusions From the 1976 TVA Quality of Water in Nickajack Reservoir Report

The mineral quality of water in Nickajack Reservoir was determined by monthly samples collected from the same 18 stations. Results show the water was suitable for domestic and most industrial uses after appropriate treatment. The water can be classified as soft to moderately hard. Concentrations of nitrate-nitrogen and phosphate-phosphorus were low except in Citico, Chattanooga, and South Chickamauga Creeks. Citico and Chattanooga Creeks were found to be among the worst polluted streams in the Tennessee Valley.

Biological conditions in Nickajack Reservoir were assessed from samples collected at seven stations in the main river channel. Primary phytoplankton productivity varied in response, primarily to water temperature and light conditions, with downstream stations tending to be the most productive during early spring and late summer. Concentrations of chlorophyll a were low and concentrated in the upper layer of water near the downstream end of the reservoir.

5. Conclusions

There were two primary sources of information presented in this section regarding the eutrophication potential of reservoirs in the CARCOG/SETDD 208 Study Area: the U.S. EPA's National Eutrophication Survey and TVA's Quality of Water in Nickajack Reservoir. There are two important factors regarding these reports which should be noted. First, only the Eutrophication Survey specifically addressed the eutrophication potential of Chickamauga and Nickajack Reservoirs. TVA's report was primarily concerned with the various aspects of water quality in Nickajack Reservoir and its tributaries. Second, only portions of each report are presented in this section. Both the Eutrophication Survey and Water Quality in Nickajack Reservoir reports contain additional data and discussions which should be fully examined.

With regard to the data contained in each report which may be directly related to trophic state, it appears that both surveys report similar results. The data indicates that phosphorus is the limiting nutrient and that phosphorus concentrations averaging approximately 0.050 and 0.033 mg/l can be expected in Nickajack and Chickamauga Reservoirs, respectively. According to the EPA tentative classification system, this would indicate that both reservoirs are well into the meso-eutrophic classification.

Data from both reports concerning biological conditions indicates that biological indicators, particularly phytoplankton, were generally pollution tolerant forms. The eutrophication survey reported algal blooms which also have been documented by Tennessee Department of Public Health staff. This data would also indicate a meso-eutrophic to eutrophic condition in both reservoirs.

In addressing how the information contained in this section may be related to possible nutrient limitations which may be imposed on major dischargers in the CARCOG/SETDD 208 Study Area, it is necessary to establish the position of the Tennessee Department of Public Health, Division of Water Quality Control. The updated state effluent limitations for the Moccasin Bend Wastewater Treatment Plant include a discharge limitation for phosphorus for both 1988 and 1998 projected flows. However, for both projected flows, the phosphorus limitation is noted by an asterisk and conditioned as follows:

> "Limits on the concentration and total amounts of phosphorus in the wastewater discharge will not be immediately in effect. The city of Chattanooga will be notified when these limits are to become effective. Until then, the design of the new sewage treatment facilities must include provisions for eventually adding any necessary further treatment works to meet the required limits."

This phosphorus discharge limitation condition appears to be a sound approach to future action which may be necessary to prevent wide-spread, undesirable eutrophic conditions in Nickajack Reservoir. Available data indicates that occasional nuisance eutrophic conditions presently occur in both reservoirs. Since it has been estimated that approximately 17.2 percent of the phosphorus loading into Nickajack Reservoir is from the Moccasin Bend Wastewater Treatment Plant, it appears that future phosphorus limitations at this facility may be necessary. However, it is obvious that phosphorus removal by all municipal dischargers alone will not correct the apparent eutrophication problems in Chickamauga and Nickajack Reservoirs. Correction procedures must include comprehensive rural and urban runoff control strategies, together with strict limitations to other point sources of pollution.

It is recommended that additional information be obtained by both TVA and the state of Tennessee in an effort to continually monitor the eutrophication potential of the reservoirs in the CARCOG/SETDD 208 Study Area. This recommendation of additional studies is detailed in the continuing planning process section of Chapter IX - Areawide Management Plan.

F. DRINKING WATER INTAKES

In this section of the plan, all major municipal drinking water intake locations are listed. Specific attention is focused in this section on the drinking water intake problems associated with the Tennessee-American Water Company in Chattanooga. State of Tennessee information documenting spills upstream from the intake is listed together with information from the 1972 Task Force Report. The current order under which the Tennessee-American Water Company will address this intake problem is documented.

1. Major Municipal Water Intakes

Within the CARCOG/SETDD 208 Study Area there is a total of 20 major municipal water supply systems which utilize raw water from the Lower Tennessee River Basin. Nine of these systems, depicted in Figure III-8, use surface water as their source. The remaining eleven facilities use water derived from springs or wells. Table III-23 lists the major municipal water supply systems within the study area and provides information regarding the size, type, and location of these systems. Additionally, there are numerous other small domestic water supply systems located throughout the area such as schools, camps, private homes, and others.

2. Drinking Water Intake Problems Associated with the Tennessee-American Water Company

Tennessee-American Water Company is a regional investor-owned water utility system serving over a quarter million people in Chattanooga and surrounding metropolitan areas. In 1977, the company delivered, on an average, 51.64 million gallons of water a day to its 61,000 customers.

The source of supply for the company is the Tennessee River which has been utilized for this purpose for over 100 years. The existing intake is located at mile 465.5 on the left bank of Nickajack Lake (see Figure III-9). The intake facilities have occupied this site for approximately 80 years. The existing intake system, constructed in 1941, has a rated capacity of 80 million gallons per day.

Prior to 1960, the company experienced little problem with taste and odor associated with raw water quality in this reach of the Tennessee River. However, after 1960, rapid industrialization of the watershed above the water company intakes resulted in an increased incidence of chemical waste discharges and spills. This industrial development resulted in taste and odor problems at the water treatment plant not previously encountered which, occasionally, caused taste and odor in the distribution system. Some of these incidences of chemical waste discharges and spills are documented in the following section.

In both 1964 and again in 1970, the Tennessee-American Water Company expanded its chlorination capacity, activated powdered carbon feed, and potassium permanganate feed systems.

Documentation of Spills

It is important that documentation of spills and wastewater discharges into the Tennessee River upstream from the Tennessee-American be listed in order that a more complete understanding of the existing water intake problems may be obtained. As stated earlier, industrialization of the watershed above the water company intakes has increasingly become a source of hazardous waste spills and wastewater discharges. Table III-24 lists the major spills and pollution incidents which have occurred upstream of the Chattanooga water intakes and briefly describes

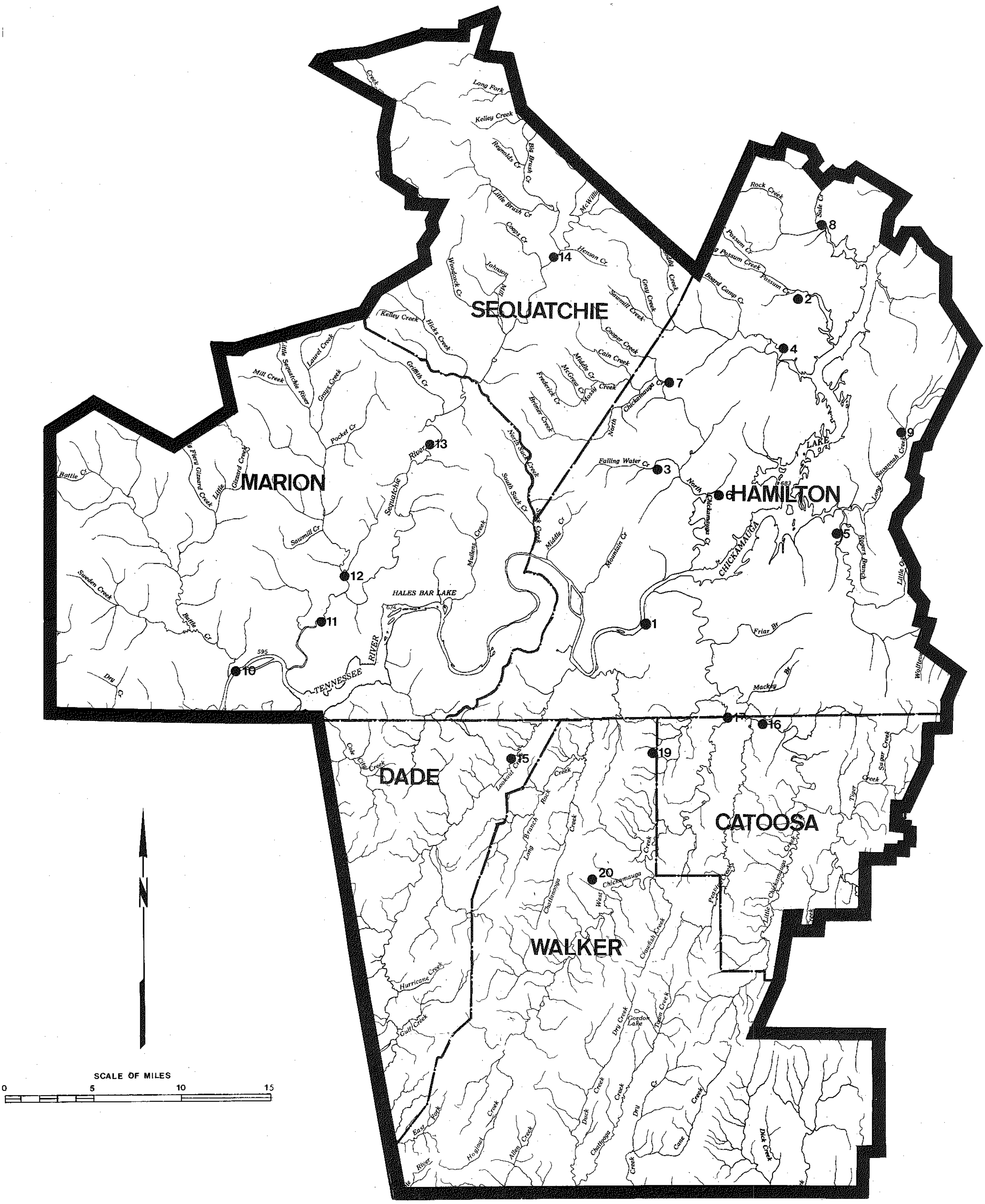


FIGURE III-8

MAJOR MUNICIPAL WATER INTAKES IN THE CARCOG/SETDD 208 AREA

TABLE III-23
MAJOR MUNICIPAL WATER INTAKES WITHIN THE
CARCOG/SETDD 208 STUDY AREA

Location Code	Utility Name	Source	Estimated Number of Connections
HAMILTON CO., TENN.			
1	Tennessee-American Water Company	Tennessee River (Nickajack Reservoir)	100,000
2	Union-Fork Bakewell	Well	400
3	Walden's Ridge	Well	1,500
4	Soddy-Daisy	Spring/Well	2,700
5	Eastside	Spring/Well	6,000
6	Hixson	Spring/Well	1,800
7	Mowbray	Montlake and Well	380
8	Sale Creek	Well	300
9	Savannah Valley	Well	926
MARION CO., TENN.			
10	South Pittsburg	Tennessee River (Nickajack Reservoir)	1,442
11	Jasper	Sequatchie River and Spring	1,400
12	Sequatchie	Spring	165
13	Whitwell	Sequatchie River	800
SEQUATCHIE CO., TENN.			
14	Dunlap	Sequatchie River	1,025
DADE CO., GA.			
15	Dade County	Lookout Creek	2,700
CATOOSA CO., GA.			
16	Ringgold	South Chickamauga Creek	900

TABLE III-23
MAJOR MUNICIPAL WATER INTAKES WITHIN THE
CARCOG/SETDD 208 STUDY AREA (Continued)

Location Code	Utility Name	Source	Estimated Number of Connections
CATOOSA CO., GA.			
17	Catoosa County	Wells/Springs	--
18	Fort Oglethorpe	Tennessee-American Water Company	--
WALKER CO., GA.			
19	Chickamauga	Springs	--
20	Kensington	Wells/Spring	--

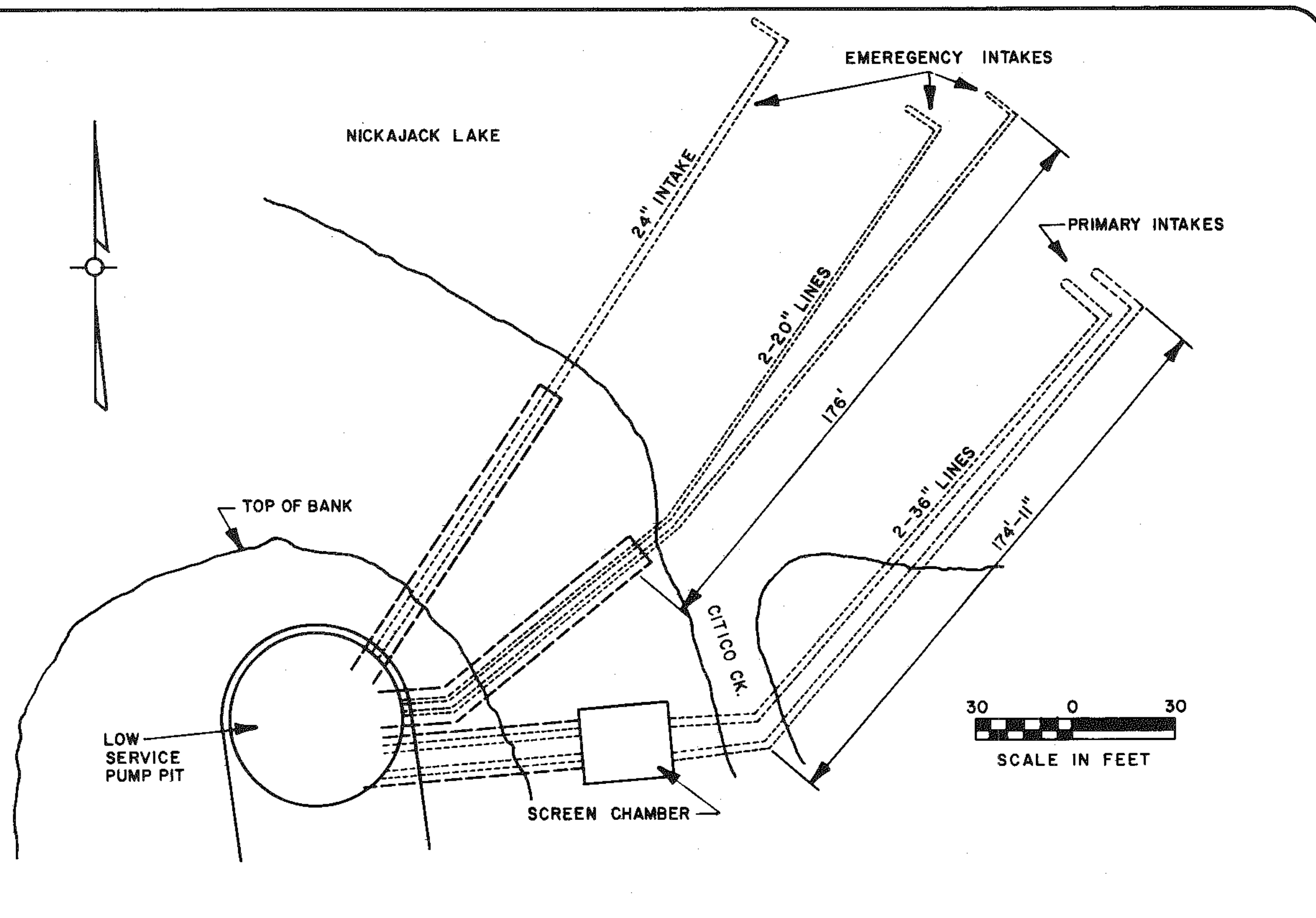


Figure III-9: Location of Tennessee-American Water Company Intakes in Nickajack Lake

TABLE III-24
SPILLS AND POLLUTION INCIDENTS UPSTREAM OF THE TENNESSEE-AMERICAN WATER COMPANY INTAKES AT CHATTANOOGA, TENNESSEE

Date	Source of Spill	Description of Incident
Mid 1960's	GAF Corporation	styrene spilled from transport truck
Late 1960's	GAF Corporation and Farmer's Chemical Assoc.	periodic release of ammonia compounds
1971	Industrial Plating Co.	chromium plating solution spilled into dry tributary of Citico Creek
1972	Roxbury Carpet Mills	bypassing dye and domestic waste into South Chickamauga Creek
1973	Orchard Knob in Citico Creek Basin	100,000 gpd raw sewage discharge diverted to storm sewer for one month
	GAF Corporation	partial bypass of wastewater due to equipment failure
1974	Central Soya Company	150 gallons of soybean oil spilled into storm sewer
	Alco Chemical Company	diisobutylamine spilled into cooling water ditch leading to South Chickamauga
	Amnicola lift station	100 gpm bypass of latex wastewater
1975	Alco Chemical Company	100 gallons of diisobutylamine 500 pounds of acrylic acid
1976	CF Industries	pumping of wastewater from holding pond
	Brainerd Wastewater Treatment Plant	sewage bypass pumped into storm sewer
	Skyland International Corporation	hydrogen peroxide into storm sewer
	Alco Chemical Company	diisobutylamine

TABLE III-24
SPILLS AND POLLUTION INCIDENTS UPSTREAM OF THE TENNESSEE-AMERICAN WATER COMPANY INTAKES AT CHATTANOOGA, TENNESSEE (Continued)

Date	Source of Spill	Description of Incident
1977	E. I. duPont	high strength ammonia wastewater and carbon black slurry spill
	Lutex Chemical Company	naphthalene spilled into storm sewer
	Alco Chemical Company	two spills of raw wastewater from storage pond and wastewater lagoon
	Southern Railroad	PCB contaminated storm water runoff
	Brainerd Wastewater Treatment Plant	64,000 gallon raw sewage bypass
	Cumberland Corporation	fuel oil tank spill into Citico Creek
	Unknown source	phthalate ester spill causing taste and odor problems

the incident. The majority of this information was obtained from the Tennessee Department of Public Health in Chattanooga. This list is not intended to document all the spills which have occurred in the past several years, but rather is presented to indicate to some extent the magnitude of the problem.

Task Force Report

In 1972, the commissioner of the Tennessee Department of Public Health established a task force to assist in making a study of the water supply source serving the city of Chattanooga. In 1973, the task force issued its final report. The conclusions of the task force were summarized as follows:

- The quality of the Tennessee River at the Citico water intake is adversely affected by the discharge of waste into Citico Creek, South Chickamauga Creek, and into the river immediately above the intake.
- The quality is poorest during periods of low flow in the river and following a spill from a waste contributor upstream from the intake.
- There appears to be inadequate coordination between building permit issuance and approval of wastewater discharge plans, thus allowing a developer or industry to construct facilities without knowledge of restrictions and requirements on wastewater treatment and discharge.
- There is insufficient data available to conclusively show that waste discharges or potential discharges constitute an imminent danger to the health of Chattanooga water consumers.
- There are occasional problems with the public water supply in the form of undesirable tastes and odors. Further investigation could reveal ways to combat these problems.
- The water supply source serving Chattanooga has many characteristics shared by sources for other heavily industrialized communities. Continued surveillance and monitoring are needed, and public concern must be maintained for orderly, controlled industrial development in the Citico Creek, South Chickamauga Creek, and immediate upstream environs of the Tennessee River.

Recommendations of the task force are itemized as follows:

- That the Tennessee Department of Public Health enforce existing laws on water pollution to the maximum degree possible.
- That the Tennessee Valley Authority give consideration to flow regulation from Chickamauga and Nickajack Dams to minimize the problem at the raw water intake.

- That the commissioner request the Chattanooga City Commission and the Hamilton County Council to review carefully all rezoning requests (as they relate to the Hamilton County Land Use Plan) which would involve industrial construction and resulting industrial wastes. Further, the procedures for granting building permits in Chattanooga and Hamilton County should require Health Department approval of wastewater discharge plans prior to the issuance of a building permit and consequent commitment of building funds by the permit applicant.

- That the commissioner refuse to permit any new discharges that will adversely affect raw water quality at the water supply intake.

- That the commissioner issue an order to the city water company requiring that it:

  - Make a study of inplant methods which could be employed to control taste and odor in the water produced by the city water company treatment plant.

  - Make a study of stream characteristics adjacent to the water supply intake to determine the possibility of obtaining water of higher quality than is now being utilized.

  - Make a study of early warning systems which might be used to detect hazardous waste spills above the intake.

  - Make a study to indicate feasibility of constructing additional on-line water storage to allow for discontinuation of raw water pumping during spill episodes.

  - Complete all studies and forward them to the commissioner not later than twelve months following receipt of the commissioner's order.

As a result of the task force recommendation in 1973, the commissioner of Tennessee Department of Public Health issued a complaint and order to the water company to make the following studies:

- Inplant methods which can be feasibly and practically employed to control taste and odor in the water treated by Tennessee-American Water Company.

- Stream characteristics adjacent to the existing water supply intake pipes, stream characteristics of the waters of the Tennessee River between South Chickamauga Creek and the Chickamauga Dam, and in the immediate vicinity above the Chickamauga Dam for the purpose of determining an optimum location for water intake pipes.

- Early warning systems which may be used to detect hazardous water spills above the intake and alert the company's water plant operators to the presence of water borne hazardous materials.

- The feasibility and construction of additional on-line water storage to allow for discontinuance of raw water pumping during spill episodes until hazardous water can flow past the intake pipes.

Upon receipt of the order, the water company undertook an investigation of the studies required. The report of the studies was finalized in June, 1976. The water company concluded in its final report that based upon the water sampling program it conducted with TVA on the source of supply, there was not conclusive data to warrant moving the intakes from their existing location.

Tennessee Department of Public Health Order

Based upon the task force report, the water company's report, and extensive data which exists in their files, the Tennessee Department of Public Health stated that it was their opinion that the present water intakes are not suitably located. This position was based upon, among other things, the following factors:

- The threat of spills temporarily rendering the water quality unsuitable at the raw water source is greater at the present intake location than at any other site surveyed on the Tennessee River.

- The water company report contained no data reflecting conditions during spill episodes in the Tennessee River or its tributaries upstream from the present water supply intakes. Based on present knowledge, the threat of spills remains the greatest adverse aspect of the present intake location. Further, it is our judgement that this threat will continue to increase in years ahead as industrial development in the South Chickamauga Creek and Amnicola areas continues.

- The Tennessee-American Water Company does not have treatment facilities capable of removing all pollutants which have the potential of causing serious short-term taste and odor problems within the finished water supply.

- The Tennessee-American Water Company distribution system lacks sufficient finished storage to continue to serve its customers in the event spills of pollutants rendering the Tennessee River at the present intake location temporarily unsuitable as a raw water supply source for more than one-half day.

- Knowledge and data is very limited on many specific toxic chemicals, both organic and inorganic, which are known to be handled and/or manufactured in the immediate drainage area upstream of the present intake location. Because of the great diversity of the manufacturing and chemical handling in this area, there are a great number of substances in this area which could cause acute water quality problems by spills, or, as more likely, chronic long-term water quality degradation by smaller and more frequent releases.

- The data in the final water company report show that levels of turbidity, fecal coliform, and total organic carbon are significantly higher at the present intake location than at other stations examined in the Tennessee River except the station at the mouth of South Chickamauga Creek. In addition, other parameters, such as specific conductance, iron, manganese, and calcium are slightly higher than found at the other stations in the river.

- It is safe to assume that increased virus counts will be associated with the increased coliform counts found at the present intake location. The effectiveness of the existing treatment process on virus removal is not fully known.

- The basic treatment process is not designed to remove total organic carbon, although some may be removed depending on the type of physical characteristics of the compounds involved. Powdered activated carbon which the company has the capability of feeding will remove organic carbon compounds, but the carbon feed is not used unless it is known that a spill or adverse condition exists. Therefore, the carbon cannot be counted on to routinely remove the higher concentrations of total organic carbon found at the present intake location.

Based upon these factors, the commissioner of the Tennessee Department of Public Health ordered the Tennessee-American Water Company to do the following:

- Install adequate facilities and equipment for carbon filtration, an early warning system, and additional carbon feed.

- Extend the main water intake at the present location (Mile 465.5 of the Tennessee River) to a location at or near midstream.

- Within five years of the effective date of the order, provide an additional 5.79 million gallons of finshed water storage and further, in addition to the above requirement, continue to provide additional finished water storage as soon as possible.

Following receipt of the order, water company personnel and officials of the Tennessee Department of Public Health had several meetings discussing the propriety of moving the intakes without the benefit of experience with the use of carbon filtration to control taste and odor. Consequently, the commissioner did in June of 1977, amend the original order, dated March 17, 1977, to delay moving the water company intake to midstream for one year from the date of completion of the carbon filtration, early warning system, and additional carbon feeding facilities or March 15, 1978, whichever occurs first. The amended order also specified that upon completion of the facilities mentioned above, but no later than March 15, 1978, the water company shall undertake a study of the effectiveness of those facilities in treating contaminants found or expected to be found in Chattanooga's drinking water. This study will continue for one year from the above date.

In December, 1977, the Tennessee-American Water Company requested an extension of time until September 15, 1978 to install an automatic total organic carbon monitor, an activated carbon slurry feed system, and granular activated carbon filter media as ordered by the Tennessee Department of Public Health. This request was granted in January, 1978.

Present Situation

At the present time, the Tennessee-American Water Company is in the process of installing carbon filter media and a carbon slurry feed system. The proposed completion date of this project is September 1, 1978. The water company did, in 1977, install a total organic carbon monitor for the purpose of providing early warning detection of spills or discharge incidents which would have the potential for creating a taste and odor problem. After six months of experimentation, it was concluded the particular TOC monitor being utilized was not sensitive enough to detect low concentrations of TOC. The water company is presently in the process of obtaining another type of organics monitor and anticipates delivery of this unit by late 1978.

Presently, the water company has under design 2.2 million gallons of additional distribution storage. It is projected that construction of this storage will commence in 1979. In 1979, an additional 2.2 million gallons of distribution storage will be designed with construction to commence in 1980.

The impact of the proposed amendments to the Interim Primary Drinking Water Regulations to control organic contaminants is not fully known. Presently, the water company feels that their effluent water quality meets the proposed standards for trihalomethanes. Part two of the proposed regulations calls for some water systems to install granular activated carbon to remove synthetic organics. The Tennessee-American Water Company is one of the water systems designated by the U.S. Environmental Protection Agency to install granular activated carbon filter media. If in fact the proposed standards are enacted, the water company has stated that is will do what is necessary to meet the standards. Quite possibly, the company will need to employ post carbon contactors to meet the standards.

G. STREAM STANDARDS

One of the basic tasks required by the 208 planning process, as set forth by the U.S. Environmental Protection Agency, is a review of stream standards with regard to water quality goals. The initial step in accomplishing this fundamental task is the understanding of its relationship to the 1983 goals of the Act.

Section 101 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) delineates the goals and policies of the Act. This section establishes as a national objective the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. The achievement of this objective is supported by several broad national goals and policies. One of these policies is the achievement of water quality, where attainable, which provides for the protection and propagation of fish, shellfish, and wildlife and which allows body contact water recreation by July 1, 1983. It is suggested that one of the most expedient methods to accomplish the 1983 goals of the Act is to institute allowable stream concentration regulations pertaining to constituents which relate to total body contact recreation and fish, shellfish, and wildlife propagation.

Water quality constituents which directly reflect these 1983 goals of the Act include dissolved oxygen, ammonia-nitrogen, and fecal coliforms. Dissolved oxygen in natural water bodies is a critical limiting factor for the propagation and maintenance of fish populations and other aquatic life. Concentrations of dissolved oxygen in natural waters are an important indicator of existing water quality and the ability of a water body to support well balanced fish populations and other aquatic fauna. In contrast, ammonia-nitrogen has not been a restricted water quality criterion, but the current state of the art, with respect to ammonia-nitrogen toxicity, has been sufficiently documented to allow for the establishment of acceptable levels of ammonia-nitrogen in natural waters to protect freshwater aquatic life. Concerning attainment of the 1983 goal of swimmable waters, the water quality criterion which directly relates to total body contact recreation from a public health aspect is the concentration of fecal coliform bacteria in natural waters.

Additionally, Section 304(a) of the Act (PL 92-500) mandated that the Environmental Protection Agency publish water quality criteria accurately reflecting the latest scientific knowledge on the kind and extent of all identifiable effects on health and welfare which may be expected from the presence of pollutants in any body of water. EPA initially made this document, "Quality Criteria for Water," available to the public in October, 1973. The information presented, including revisions to date, represents EPA's current definition of the 1983 goals of the Act. The parameters covered by the "Quality Criteria for Water" are as follows:

- Aesthetics
- Alkalinity
- Ammonia
- Arsenic
- Barium
- Beryllium
- Boron
- Cadmium
- Chlorine
- Chromium
- Coliform Bacteria
- Color
- Copper
- Cyanide
- Gases, Total Dissolved
- Hardness
- Iron
- Lead
- Manganese
- Mercury
- Mixing Zones
- Nickel
- Nitrates, Nitrites
- Oil and Grease
- Oxygen, Dissolved
- Pesticides
    - Aldrin-Dieldrin
    - Chlordane
    - Chlorophenoxy Herbicides
    - DDT
    - Demeton
    - Endosulfan
    - Endrin
    - Guthion
    - Heptachlor
    - Lindane
    - Melathion
    - Methoxychlor
    - Mirex
    - Parathion
    - Toxaphene
- pH
- Phenol
- Phosphorus
- Phthalate Esters
- Polychlorinated Biphenyls
- Radioactive Substances
- Selenium
- Silver
- Solids (Dissolved) and Salinity
- Solids (Suspended) and Turbidity
- Sulfides, Hydrogen Sulfide
- Tainting Substances
- Temperature
- Zinc

These water quality criteria developed by EPA do not serve as regulations. However, they do serve to form the foundation for judgement in numerous programs which are based upon water quality considerations. One of the most significant of these programs is the water quality standards developed by the states under Sectin 303 of the Act and approved by EPA. The water quality standards developed by the individual states should be based upon the water quality criteria, appropriately modified to suit local conditions. Local conditions which warrant consideration include actual and projected uses of the water, natural background levels of particular constituents, the presence or absence of sensitive important species, characteristics of the local biological community, temperature and weather, flow characteristics, and synergistic or antagonistic effects of combinations of pollutants.

1. Georgia's Water Quality Standards

Water quality standards for the state of Georgia surface waters are published in the June, 1974 supplement of the Rules and Regulations for Water Quality Control, Georgia Department of Natural Resources, Environmental Protection Division, Chapter 391-3-6. Water quality requirements for the following use classifications have been developed.

- Drinking water supplies
- Recreation
- Fishing, propagation of fish, shellfish, game and other aquatic life
- Agricultural
- Industrial
- Navigation
- Wild River
- Scenic River
- Urban stream

Table III-25 indicates applicable water quality standards for these designated stream classifications. The Georgia EPD has also established "General Criteria for All Waters" which are applicable to all surface waters, including those which have been designated one of the classifications listed above, at all places and at all times. Table III-26 lists these general water quality criteria.

2. Tennessee's Water Quality Standards

Water quality standards for the state of Tennessee surface waters are published in the Rules of the Tennessee Department of Public Health, Bureau of Environmental Health Services, Division of Water Quality Control, Chapter 1200-4-3; General Water Quality Criteria for the Definition; and Control of Pollution in the Waters of Tennessee. Water quality requirements for the following use classifications have been developed.

- Domestic water supply
- Industrial water supply
- Fish and aquatic life
- Recreation
- Irrigation
- Livestock water and wildlife
- Navigation

Table III-27 indicates applicable water quality standards for these designated stream classifications.

3. Recommendations

An important water quality criterion that should be discussed is ammonia-nitrogen. It has been known for many years that undissociated ammonia (NH_3), resulting from the presence of ammonia in water, is toxic to many fish species. The problem with establishing a numerical limit for ammonia is the equilibrium relationship between NH_3, NH_4^+, and OH^- and the fact that the toxicity of ammonia is extremely dependent upon pH and temperature. The U.S. Environmental Protection Agency in its revised "Quality Criteria for Water" recommends a 0.02 mg/l un-ionized ammonia limitation for the protection of freashwater aquatic life. As indicated in Table III-28, based upon normal stream conditions for the summer (20^oC and pH of 7.0 to 7.5), a specific numerical in-stream ammonia-nitrogen limitation ranging from 1.6 mg/l to 5.1 mg/l would be the applicable water quality standard. It should

TABLE III-25
STATE OF GEORGIA
WATER QUALITY STANDARDS

Drinking Water Supplies

A. Sources Requiring Only Disinfection

1. Fecal Coliforms - not to exceed a geometric mean of 50/100 ml based on at least four samples taken over a 30 day period, and not to exceed 200/100 ml in more than 5% of the samples taken in a 90 day period.

2. Other - No floating or settleable solids, sludge deposits, taste, odor, or color associated with any waste discharge permitted.

B. Sources Requiring Conventional Treatment

1. Dissolved Oxygen - For those waters designated as trout streams, a daily average of 6.0 mg/l and no less than 5.0 mg/l at all times. For all other waters, a daily average of 5.0 mg/l and no less than 4.0 mg/l at all times.

2. pH - 6.0 - 8.5.

3. Fecal Coliforms - not to exceed a geometric mean of 1000/100 ml based upon four samples taken over a 30 day period, and not to exceed a maximum of 4000/100 ml.

4. Temperature - not to exceed 90^{o}F. Not to be elevated more than 5^{o}F, except in estuarine waters, not more than 1.5^{o}F. No change in temperature allowed for designated trout or smallmouth bass streams.

5. Other - no material permitted that would, after treatment, exceed any other state and/or federal regulations.

Recreation

1. Dissolved Oxygen - Same as for drinking water requiring treatment.

2. pH - 6.0 - 8.5.

3. Fecal Coliforms - not to exceed a geometric mean of 100/100 ml for coastal waters and 200/100 ml for other waters. The mean is applied to four samples taken over a 30 day period at intervals of less than 24 hours. Where natural levels exceed these figures, the limit is 300/100 ml for lakes and 500/100 ml for streams.

TABLE III-25
STATE OF GEORGIA
WATER QUALITY STANDARDS (Continued)

Recreation

4. Temperature - Same as for drinking water requiring treatment.

5. Other - no toxic wastes or deleterious materials allowed in concentrations harmful to man, fish, game or aquatic life.

Fishing, Propagation of Shellfish, Game And Other Aquatic Life

1. Dissolved Oxygen - Same as for drinking water requiring treatment.

2. pH - 6.0 - 8.5.

3. Fecal Coliforms - not to exceed a geometric mean of 1000/100 ml based on at least four samples taken over a 30 day period, and not to exceed a maximum of 4000/100 ml.

4. Temperature - Same as for drinking water requiring treatment.

5. Other - Same as for recreation. Shellfish harvesting areas must meet state and/or federal regulations concerning bacterial quality.

Agriculture

1. Dissolved Oxygen - Not less than 3.0 mg/l at all times.

2. pH - 6.0 - 8.5.

3. Fecal Coliforms - not to exceed a geometric mean of 5000/100 ml based on at least four samples from a 30 day period.

4. Temperature - Same as for drinking water requiring treatment.

5. Other - No toxic wastes or deleterious materials allowed in concentrations that would prevent this designated use or fish survival.

Industrial

1. Dissolved Oxygen - Not less than 3.0 mg/l at all times.

2. pH - 6.0 - 8.5.

3. Temperature - Same as for drinking water requiring treatment.

4. Other - Same as for agriculture.

TABLE III-25
STATE OF GEORGIA
WATER QUALITY STANDARDS (Continued)

Navigation

1. Dissolved Oxygen - Not less than 3.0 mg/l at all times.
2. pH - 6.0 - 8.5.
3. Fecal Coliforms - Same as for agriculture.
4. Temperature - Same as for drinking water requiring treatment.
5. Other - Same as for agriculture.

Wild River and Scenic River

1. Other - There shall be no alteration of natural water quality from any source.

Urban Stream

1. Dissolved Oxygen - Not less than 3.0 mg/l at all times.
2. pH - 6.0 - 8.5.
3. Fecal Coliforms - Not to exceed a geometric mean of 200/100 ml based on four samples from a 30 day period, and not to exceed a maximum of 5000/100 ml.
4. Other - Same as for drinking water requiring disinfection. No toxics, acids or corrosives allowed.

TABLE III-26
GENERAL WATER QUALITY CRITERIA FOR GEORGIA

- All waters shall be free from materials associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits that become putrescent, unsightly or otherwise objectionable.
- All waters shall be free from oil, scum and floating debris associated with municipal or domestic sewage, industrial waste or other discharges in amounts sufficient to be unsightly or to interfere with legitimate water uses.
- All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.
- All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life.
- Applicable State and Federal requirements and regulations for the discharge of radioactive substances shall be met at all times.
- No man-made physical or other alteration of stream beds that may violate established water quality standards, or reduce the waste assimilative capacity of the streams, will be permitted without the expressed approval of the Environmental Protection Division.

TABLE III-27
STATE OF TENNESSEE
WATER QUALITY STANDARDS

Domestic Water Supply

1. Dissolved Oxygen - must be present in levels sufficient to prevent odors of decomposition.

2. pH - 6.0 - 9.0 shall not vary more than one unit in 24 hours.

3. Hardness or Mineral Compounds - no additions of hardness or minerals that will impair this use of the water.

4. Solids, Floating Materials and Deposits - no visible oil, scum, solids, foam, or materials leading to the formation of slimes, bottom deposits or sludge banks.

5. Turbidity or Color - no turbidity or color shall be added in amounts that cannot be reduced by conventional treatment.

6. Temperature - The maximum temperature change shall be 3°C. The maximum temperature shall be 30.5°C, and the maximum rate of change shall not exceed 2°C per hour. Temperature to be measured at mid-depth or five feet, whichever is less.

7. Fecal Coliforms - The geometric mean shall not exceed 1000/100 ml based on a minimum of 10 samples over a 30 day period with sampling intervals of not less than 12 hours.

8. Taste or Odor - No substances may be added which will result in taste or odor which cannot be removed by conventional treatment.

9. Toxic Substances - No toxics which affect the health and safety of man or animals or which impair the safe use of water supplies may be added.

10. Other - Total dissolved solids not to exceed 500 mg/l. No other pollutants may be added to the water in quantities that may be detrimental to public health or impair this use of the water.

Industrial Water Supply

1. Same as for domestic water supplies.

2. pH - Same as for domestic water supplies.

3. Hardness or Mineral Compounds - Same as for domestic water supplies.

TABLE III-27
STATE OF TENNESSEE
WATER QUALITY STANDARDS (Continued)

Industrial Water Supply

4. Solids, Floating Materials and Deposits - Same as for domestic water supplies.

5. Turbidity or Color - Same as for domestic water supplies.

6. Temperature - Same as for domestic water supplies.

7. Taste or Odor - No substances may be added that would result in taste or odor which might prevent this use of the water.

8. Toxic Substances - Toxic substances may not be added in quantities sufficient to impair this use of the water.

9. Other - Same as for domestic water supplies.

Fish and Aquatic Life

1. Dissolved Oxygen - Minimum of 5.0 mg/l, except where irretrievable man-induced conditions or natural background levels cause lower concentrations. Trout streams must have a minimum of 6.0 mg/l. In no cases shall any stream have less than a 3.0 mg/l level.

2. pH - 6.5 - 8.5 shall vary less than one unit in 24 hours.

3. Solids, Floating Materials and Deposits - Same as for domestic water supplies.

4. Turbidity or Color - No turbidity or color may be added in levels that will materially impair this use of water.

5. Temperature - Same as for domestic water supplies.

6. Fecal Coliforms - Same as for domestic water supplies.

7. Taste or Odor - Same as for industrial water supplies.

8. Toxic Substances - Same as for industrial water supplies, and stream concentrations of toxics shall not exceed 1/10 of the 96 hour LC_{50} based on available data using the most sensitive organism of the aquatic community.

9. Other - Other pollutants may not be added in quantities sufficient to impair this use of the water.

TABLE III-27
STATE OF TENNESSEE
WATER QUALITY STANDARDS (Continued)

Recreation

1. Dissolved Oxygen - Same as for domestic water supplies.

2. Fecal Coliforms - The geometric mean shall not exceed 200/100 ml based on a minimum of 10 samples collected over a 30 day period at intervals of more than 12 hours. The maximum for any sample may not exceed 1000/100 ml.

2. Taste or Odor - Same as for industrial water supplies.

3. Toxic Substances - Same as for both domestic and industrial water supplies.

4. Other - Same as for fish and aquatic life.

Irrigation

1. Dissolved Oxygen - Same as for domestic water supplies.

2. pH - Same as for domestic water supplies.

3. Solids, Floating Materials and Deposits - Same as for domestic water supplies.

4. Turbidity or Color - No turbidity or color may be added in amounts that will result in any objectionable appearance to the water.

5. Temperature - Same as for domestic water supplies.

6. Toxic Substances - Same as for industrial water supplies.

7. Other - Same as for fish and aquatic life.

Livestock Watering and Wildlife

1. Dissolved Oxygen - Same as for domestic water supplies.

2. pH - Same as for domestic water supplies.

3. Hardness or Mineral Compounds - Same as for domestic water supplies.

4. Solids, Floating Materials and Deposits - Same as for domestic water supplies.

TABLE III-27
STATE OF TENNESSEE
WATER QUALITY STANDARDS (Continued)

Livestock Watering and Wildlife

5. Temperature - Temperature of water shall not be changed to such an extent as to interfere with this use of the water.

6. Toxic Substances - Same as for industrial water supplies.

7. Other - Same as for fish and aquatic life.

Navigation

1. Dissolved Oxygen - Same as for domestic water supplies.

2. Hardness or Mineral Compounds - Same as for domestic water supplies.

3. Solids, Floating Materials and Deposits - Same as for domestic water supplies.

4. Temperature - Same as for livestock watering and wildlife.

5. Toxic Substances - Same as for industrial water supplies.

6. Other - Same as for fish and aquatic life.

TABLE III-28
CONCENTRATIONS OF TOTAL AMMONIA (NH_3 + NH_4) WHICH
CONTAIN AN UN-IONIZED AMMONIA CONCENTRATION OF 0.020 MG/L NH_3

Temper-ature (°C)	pH Value								
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	160.	51.	16.	5.1	1.6	0.53	0.18	0.071	0.03
10	110.	34.	11.	3.4	1.1	0.36	0.13	0.054	0.03
15	73.	23.	7.3	2.3	0.75	0.25	0.093	0.043	0.02
20	50.	16.	5.1	1.6	0.52	0.18	0.070	0.036	0.02
25	35.	11.	3.5	1.1	0.37	0.13	0.055	0.031	0.02
30	25.	7.9	2.5	0.81	0.27	0.099	0.045	0.028	0.02

be noted that neither Georgia nor Tennessee at the present time indicate a numerical limitation for ammonia-nitrogen in their standards.

Presently, streams classified under "General Water Quality Criteria" in Georgia have no specific constituent limitations. It is suggested that one of the most expedient methods to accomplish the 1983 goals of the Act is to institute allowable stream concentration regulations pertaining to constituents relating to body contact recreation, fish, shellfish, and wildlife propagation. Within this framework, it is recommended that an allowable average in-stream ammonia-nitrogen (NH_3-N) concentration, not to exceed 2.0 mg/l as N, be added to the water quality standards of both states. In addition, it should be pointed out that under winter temperatures this recommended instream NH_3-N limitation may not be applicable. Assuming a relatively warm winter stream temperature of 5^oC, it can be seen that an instream NH_3-N limitation of 5.1 mg/l (see Table III-28) would be adequate to limit the un-ionized ammonia concentration to 0.020 mg/l. Consequently, it would appear that the allowable amount of NH_3-N discharged from plants in the CARCOG/SETDD 208 Study Area during winter months could be increased over the recommended summer level of 2 mg/l. It should be noted that at the present time, the state of Tennessee is considering the establishment of numerical limitations for several toxic substances. These include: copper, zinc, lead, nickel, selenium, and silver, all of which are heavy metals.

H. ADDITIONAL WATER QUALITY CONSIDERATIONS

This section addresses three additional water quality considerations: the water quality impact of low dissolved oxygen discharges from Chickamauga Dam, the Sequoyah Nuclear Plant, and the Raccoon Mountain Pumped Storage Plant. The primary sources of the information presented are TVA reports, environmental impact statements, and computer simulations of water quality conditions.

1. The Thermal Impact and Consequence of Sequoyah Nuclear Plant on the Tennessee River

TVA's Sequoyah Nuclear Plant, located at Tennessee River Mile (TRM) 484.5, is scheduled to begin operation in 1978. The state of nuclear power generation technology is such that approximately two-thirds of the heat produced in the reactor is released to the environment. The Final Environmental Statement, Sequoyah Nuclear Plant Units 1 and 2 discusses in detail the plant's heat dissipation systems and the impact of this heat on the Tennessee River. This report summarizes the information contained in TVA's environmental statement.

At the time of initial planning for Sequoyah, the proposed applicable temperature criteria of the state of Tennessee was, "The Temperature of the water shall not exceed 93^oF and the maximum rate of change shall not exceed 3^oF per hour. (The maximum temperature of recognized trout streams shall not exceed 68^oF). In no case shall the maximum temperature rise be more than 10^oF above the stream temperature which shall be measured at an upstream control point."

TVA determined that a diffuser system designed to rapidly mix the heated cooling water with the Chickamauga Reservoir water would be sufficient to meet these criteria. However, EPA disapproved Tennessee's proposed criteria and the following revised criteria was adopted, "The maximum water temperature change shall not exceed 3°C (5.4°F) relative to an upstream control point. The temperature of the water shall not exceed 30.5°C (86.9°F) and the maximum rate of change shall not exceed 2°C (3.6°F) per hour."

In order to predict the impact of the thermal load on the dissolved oxygen resources of the study area, only conservative estimates using critical conditions can be made. TVA has made such estimates assuming two unit operation during the summer with upstream reservoir temperature of 81.5°F and a rise due to thermal discharges of 5.4°F. The dissolved oxygen resource may be affected by: (1) the reduction of dissolved oxygen (D.O.) concentrations in the condensers, (2) the organic load due to entrainment, and (3) the change in stream purification factors.

The solubility of gases in liquids decreases as temperature increases; therefore, the effects of elevating water temperature by 29.5°F in passing through the condensers must be considered. The oxygen saturation concentration in water at 81.5°F is 8.0 mg/l; whereas, if this water were passed through the condensers and heated to 111°F, the saturation concentration would be 6.2 mg/l.

According to TVA, the D.O. concentration in Chickamauga Reservoir above and below the Sequoyah site during the summer months are approximately 6.0 mg/l, in the 75 to 80 percent saturation range. Therefore, during the warmer months of the year even after the temperature is elevated 29.5°F in passing through the condenser, the D.O. concentration is not expected to exceed the saturation limit and should not be lowered.

Another factor which may result in D.O. concentration reductions in water passing through a condenser is the partial vacuum existing at the discharge end of the condenser which is above the hydraulic gradient. This situation is common to all stream plants. Vacuum pumps are installed to remove any accumulated gases; however, TVA experience has shown that very little gas accumulates and needs to be removed from the system.

Therefore, TVA does not anticipate any adverse effects on the D.O. concentrations of the condenser cooling water due to temperature or vacuum effects since no significant quantity of oxygen will be driven off.

Essentially, all plankton and fish larvae passing through the plant cooling water system will be killed. This will result in an organic waste load and oxygen demand in the reservoir downstream from the plant. TVA has determined the organic waste load resulting from the entrainment of phytoplankton and zooplankton using the maximum concentrations of phytoplankton and zooplankton observed in the vicinity of the Sequoyah plant water intake during the period of preoperational biological monitoring. The maximum fish larvae concentrations observed at the intake of Browns Ferry Nuclear Plant were used as an estimate of the fish larvae concentrations at Sequoyah. To estimate the maximum oxygen depression resulting from the entrainment load, the maximum phytoplankton, zooplankton, and fish larvae loads were assumed to occur simultaneously. Furthermore, it was assumed that this simultaneous occurrence coincided with a period of time when the cooling water from both generating units in the plant was being discharged through the diffusers while operating in the open mode. It was also assumed that the total riverflow was 13,700 ft^3/s (minimum streamflow for 2 unit operation with 100 percent mixing), and that a 5.4° rise, from 81.5°F to 86.9°F was produced in the entire flow of the Tennessee River.

Based on the low streamflows, it was assumed that the organic load would exert its ultimate biochemical oxygen demand in the lower end of the Chickamauga Reservoir. In these calculations it was further assumed that no reaeration or reoxygenation of the water would take place in the reservoir either through surface absorption of oxygen or by photosynthesis.

Based on all of these very conservative (worst case) assumptions, the depression in concentration of dissolved oxygen was calculated to be about 0.5 mg/l. The actual D.O. depression resulting from discharge of the entrained organic load is expected to be much less.

Many of the parameters which affect the capacity of streams to assimilate organic wastes are affected by changes in temperature. The principal factors involved in this phenomenon, which are temperature sensitive, are: D.O. saturation, deoxygenation rate (K_1), reaeration rate (K_2), and ultimate BOD (L_a). Since each of these factors are dependent upon the physical-chemical characteristics of the stream water and the specific waste discharge in conjunction with the hydraulics and geometry of the stream reach, it is not possible to identify specific changes in absolute values that will occur as a result of the elevated water temperatures. However, using standard engineering equations, it is possible to determine the relative impact of the maximum expected thermal increases (81.5°F to 86.9°F) as follows: D.O. saturation value, -5.6 percent; deoxygenation rate, +14.7 percent; reaeration rate, +5.6 percent; and ultimate BOD, +5.2 percent.

To provide an estimate of the quantitative effect of these changes on the D.O. resource, an evaluation was made by TVA to determine the overall effects of the elevated stream temperatures on the assimilative capacity of the Tennessee River downstream from Chattanooga in Nickajack Reservoir. This evaluation was based on the Streeter-Phelps equation using conservative assumptions for the stream constants (high deoxygenation rate and low reaeration rate). The streamflow used in this evaluation was assumed to be the minimum flow

(13,700 ft^3/s) required to meet the Tennessee temperature criteria (5.4°F change and 86.9°F maximum) with both units at Sequoyah operating at full load. The added organic load used in the evaluation was 25,000 lbs per day of 5-day 20°C BOD, which is similar to the present total organic load discharged to the surface streams in the metropolitan Chattanooga area. The results of this evaluation show that the overall effects of the maximum elevated stream temperature would reduce the D.O. concentration at the low point of the D.O. sag by about 0.3 mg/l.

Therefore, based on estimations from TVA, the operation of Sequoyah Nuclear Plant could result in a D.O. reduction of 0.5 mg/l due to the organic load from entrainment and 0.3 mg/l due to the thermal load for an overall D.O. depression of 0.8 mg/l. These estimations were made using very conservative consumptions; the actual impact is anticipated to be less than the values indicated. Also, it is not likely that the maximum D.O. depletion from these two factors will occur at the same river location. For these reasons it is not anticipated that the operation of Sequoyah Nuclear Plant will have a significantly adverse effect on stream assimilative capacity and treatment levels in the CARCOG/SETDD 208 Study Area.

2. The Impact of Raccoon Mountain Pumped Storage Project on Flow Reversal in Nickajack Reservoir

Flow reversal in Nickajack Reservoir and its potential impact on water quality at the Tennessee-American Water Company intake have been of considerable interest in recent years. TVA's Raccoon Mountain Pumped Storage Plant will augment or reduce the negative flows depending on its operating mode.

Flows in reservoirs are quite complex, but generally the controlling factors are temperature, upstream and downstream dam operations, and tributaries. Flow reversal can be effected by these factors exerted individually or in combination.

Often, reservoirs become stratified into layers having chemically or thermally induced differences in density. For the more common case of a thermally stratified reservoir, a layer of warm water overlies colder, more dense water. If the downstream dam has a low-level outlet, typical of most hydroelectric dams, and inflowing water is cooler than the ambient temperature, a density underflow can develop. In this case, the cooler more dense water "ducks under" the warmer surface water wedge and flows beneath it all the way to the downstream dam where it is discharged. When inflow into this stratified reservoir ceases, the warmwater wedge then tends to spread out to an even thickness over the reservoir; i.e., the warm water must flow upstream and the cooler water must flow downstream. This is a fairly common situation that has been observed in TVA reservoirs which become stratified.

The size and configuration of Nickajack Reservoir is rather unique due to its location. As the Tennessee River flows through the Cumberland Plateau, a stretch known as the "Grand Canyon of the Tennessee," its width is restricted and the slope is very steep. The unusual slope and width configuration of this reservoir affect the flow characteristics and tend to prevent any thermal stratification from occurring. In order to determine the extent of stratification in Nickajack, TVA has conducted mathematical modeling and field data gathering activities. The results show that virtually no stratification occurs in Nickajack Reservoir under normal flow conditions, and that stratification that may form during periods of zero discharge would be broken up by a very small flow. Therefore, the flow reversal manifested in the reservoir is not caused by stratification.

The present hydraulic characteristics of the Tennessee River in the vicinity of Chattanooga are determined primarily by the operation of Nickajack Dam at Tennessee River Mile (TRM) 425 and Chickamauga Dam at TRM 471. The TVA Act requires that the dam and reservoir system be operated primarily for navigation and flood control purposes and, so far as consistent with these purposes, for generation of power. Therefore, the first step in determining the operating schedule for Chickamauga and Nickajack is to identify the daily volume of water that must be released through each dam to meet flood control and navigation requirements. Once the daily release requirements for each dam are determined, the hour-by-hour releases are scheduled according to the projected generation needs of the power system for the 24-hour period.

Nickajack Reservoir is the smallest impoundment on the main stem of the Tennessee River. Due to its limited storage capacity, Nickajack Dam must be operated in relatively close conjunction with Chickamauga Dam. When there are releases from both dams, no flow reversal occurs in the reservoir. If Chickamauga Dam were to stop generating with continued release at Nickajack, positive flow would still occur. However, under these conditions normal releases from Nickajack cannot continue for an extended period without excessive drawdown of the reservoir. Also, positive flow is promoted if Nickajack were to stop generating and Chickamuga were to continue releasing; however, such conditions would soon result in spillage at Nickajack.

The most significant flow reversal in Nickajack Reservoir occurs when zero releases are occurring at both dams. Apparently, when releases are stopped, the momentum of the flowing water carries it past equilibrium level and a seiche or standing wave is formed causing periods of flow reversal. This condition was documented during the Nickajack Reservoir Assimilative Capacity Study of September, 1974.

TVA conducted the study in cooperation with the Environmental Protection Agency, the Water Quality Control and the Sanitary Engineering Divisions of the Tennessee Department of Public Health, and the city of Chattanooga to determine the waste assimilation capacity of the Tennessee River below the Moccasin Bend waste treatment plant outfall (TRM 458.37). As part of the study, both Chickamauga and Nickajack Dams had zero releases for 10-hour periods starting at 9:00 p.m. and midnight, respectively, on the night of September 20, 1974.

During the waste assimilative capacity study, TVA conducted another study to verify against actual field measurements the transient flow model for Nickajack Lake. The location selected for verification of the flow model was Tennessee River mile 458.4. Velocity measurements were taken in a single vertical section which had been preselected as best representing an average for the total cross section. Velocity measurements were taken almost continuously from 1:00 p.m. September 20, 1974 to midnight September 21, 1974. Based on this verification, the stage, velocity and discharge were computed for the assimilative capacity sampling locations. The computations for river mile 458.0 show that reverse flow occurred twice between midnight and 8:00 a.m. on the morning of September 21, 1974.

The first occurrence lasted approximately 3 hours having a maximum negative flow of 9000 cfs at 1:00 a.m. Positive flow was then regained for a period of 3 hours with a peak of 6000 cfs. Then, reverse flow again was manifested for 2 hours having a maximum of 4000 cfs at roughly 7:00 a.m. Clearly, the computations indicate the formation of a seiche causing flow reversal in the reservoir during periods when both Chickamauga and Nickajack Dams have zero releases.

A simultaneous hourly discharge record at both dams is available for an eight month period from May through December, 1968. These data show that for approximately 5% of the time, zero flow occurs simultaneously at both dams with the potential result of flow reversal.

Tributaries can significantly affect flow characteristics in a reservoir particularly when there is no flow from either dam. Under this condition, the water from the tributary would flow in all directions from its mouth resulting in positive flow above and negative flow below its mouth. The flow pattern of the tributary would also be superimposed on any other flow regime in the reservoir governed by thermal stratification or other hydraulic conditions.

The operation of Raccoon Mountain Pumped Storage Plant in the turbine mode will result in a very large inflow or "artificial tributary" at TRM 444.6. During peaking power generation at Raccoon Mountain, about 20,000 cfs will be discharged to the reservoir. This flow is of the same order of magnitude as the average river flow and therefore has the potential to cause flow reversals far upstream if there is insufficient discharge at either or both dams. Conversely when the Raccoon Mountain Plant is in the pumping mode, approximately 15,000 cfs will be withdrawn from the reservoir promoting positive flow between the plant intake and Chickamauga Dam.

Churchill developed an equation to relate flow at a point in a reservoir to surface area and flows. The equation, shown below, can be used to predict the impact of Raccoon Mountain turbine operation under the critical condition of zero releases from both dams.

$$Q_p = \left(\frac{A_1}{A_T}\right) Q_2 - \left(\frac{A_2}{A_T}\right) Q_1$$

where:

Q_p = Flow at a point (cfs)
A_1 = Reservoir surface area below the point
A_2 = Reservoir surface area above the point
A_T = Total reservoir area
Q_1 = Inflow below point (cfs)
Q_2 = Inflow above point (cfs)

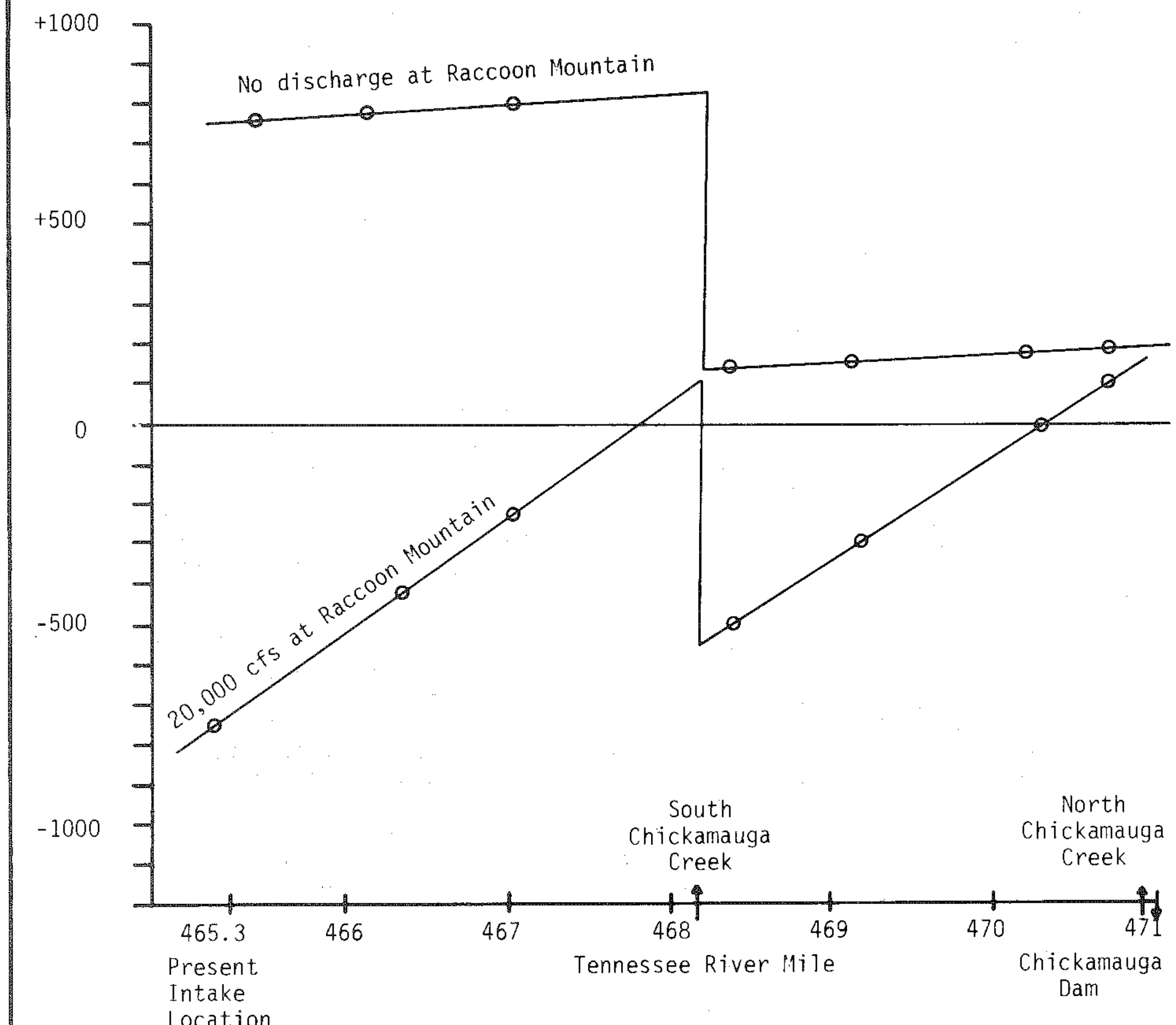
A positive flow indicates flow in a downstream direction. If either Q is outflow, then it is substituted into the equation as a negative flow. In the case of Nickajack Reservoir, the intake location at present is TRM 465.3 with about 92.5 percent of the reservoir surface area downstream of it. The results of calculations made with Churchill's equation are graphed in Figure III-10. Other tributaries considered were Lookout Creek, Chattanooga Creek, South Chickamauga Creek, and North Chickamauga Creek, all at average discharge.

According to Churchill's equation, flow reversal occurs well past the Tennessee-American Water Company intake during periods of zero release from Nickajack and Chickamauga Dams when the Raccoon Mountain Plant is generating. Churchill's equation does not take into consideration the added effects of a simultaneously occurring standing wave. Under this condition, generation at Raccoon Mountain would greatly increase the magnitude of flow reversal.

TVA has used a simulated open channel hydraulics model to predict the flow regime at the Moccasin Bend Treatment Plant outfall, TRM 458.37, during a "typical winter weekday power operation of Chickamauga and Nickajack with and without morning and evening peaking operations of Raccoon Mountain."

For the typical operation modeled, Chickamauga has a low flow of 10,000 cfs during the late night and early morning hours roughly corresponding to a period of zero release at Nickajack Dam. During this period, a reverse flow of approximately 3,000 cfs for one hour develops at the Moccasin Bend outfall without operation of Raccoon Mountain. According to TVA, typical winter weekday operation of Raccoon Mountain will consist of peaking power generation in the morning and evening and pumping during the night. Generation at Raccoon Mountain coincides with generation at both dams, and pumping at

FIGURE III-10
FLOW REGIMES IN NICKAJACK RESERVOIR BASED UPON CHURCHILL'S EQUATION



Flow regime at present Chattanooga water intake and upstream locations based on zero releases at both dams with and without Raccoon Mountain discharge and with average flows in South Chickamauga Creek, North Chickamauga Creek, Lookout Creek, and Chattanooga Creek.

Figure III-10: Flow Regimes in Nickajack Reservoir Based Upon Churchill's Equation

Raccoon Mountain coincides with minimum releases at both dams. The model shows that the pumping operation at Raccoon Mountain during the low dam releases causes continuous positive flow at Moccasin Bend. Therefore, for this "typical operation," Raccoon Mountain will have a beneficial impact on the hydraulic conditions in the reservoir. TVA has refused to model any "worst case" conditions such as discharge at Raccoon Mountain when either or both dams have zero releases on the basis that such conditions are "unlikely."

Flow reversal occurs in Nickajack Reservoir due to tributary inflow and seiche formation during periods of low releases from Nickajack and Chickamauga Dams. Raccoon Mountain has the potential to augment or reduce flow reversal depending on its operating mode. The Tennessee River above the water plant intake is significantly cleaner than below due to the inflow of industrial and municipal wastewater discharges and urban runoff. Citico Creek enters the Tennessee River just below the water company intake. This creek is the receiving stream for a number of industrial discharges and urban runoff and is considered by the state to be in violation of water quality criteria. Immediately below Citico Creek, is the first of 17 overflows for Chattanooga's combined sewer system. Another heavily polluted tributary, Chattanooga Creek, enters at TRM 460.6, and Moccasin Bend Treatment Plant discharges at TRM 458.4.

When this receiving water for Chattanooga's wastes flows upstream, the water quality at the water plant intake can significantly change causing increased costs of treatment and the potential of supply contamination. The Tennessee-American Water Company recently notified TVA that such a condition occurred in February, 1977, when heavy rains in the Chattanooga area coincided with a period of zero release at Chickamauga Dam. The heavy rain resulted in combined sewer overflow, and apparently, the degraded water was carried upstream to the water intake by a reversal of flow in the river which occurred when releases from Chickamauga Dam were shut off.

The impact of flow reversal on the water company or its customers is highly dependent on the water quality in the reservoir and therefore is difficult to assess. "Worst case" conditions would occur during storm events as mentioned earlier, during a wastewater treatment system failure, or after an industrial spill. The impact during a condition of flow reversal could be negligible or quite severe.

As discussed earlier, flow reversal is caused during periods of low releases from Chickamauga and/or Nickajack Dams and flow reversal can be controlled or augmented by the operation of Raccoon Mountain. According to TVA, the exact operation of the Raccoon Mountain project with regard to the operation of Chickamauga and Nickajack Dams will depend upon the system load requirements and a variety of system constraints such as coal supplies, forced outages of large units, etc.

No specific information concerning operation scheduling other than that for the "typical winter weekday" has been released by TVA. In the Final Environmental Statement for Raccoon Mountain Pumped Storage Project, TVA has stated, "Should operations at Chickamauga Dam, Nickajack Dam, and Raccoon Mountain Pumped Storage Project, separately or in combination, result in any new unforeseen problem associated with reversal of flows at the present intake of the Tennessee-American Water Company, TVA would seek to resolve such a problem in a manner consistent with system operating requirements." TVA will not commit to operating the three power plants in a manner which will preclude negative flows because this will decrease the flexibility of the system.

Therefore, it can be assumed that flow reversal will continue to occur periodically at the present water plant intake due to the operating of Chickamauga Dam, Nickajack Dam, and Raccoon Mountain Pumped Storage Project. The significance of the impact of the flow reversal produced during various operating sequences cannot be determined due to a lack of information from TVA.

3. Analysis of Low Dissolved Oxygen Discharges from Chickamauga Dam

This section is intended to evaluate the water quality impact of low dissolved oxygen discharges from Chickamauga Dam on the treatment level necessary for the Moccasin Bend Wastewater Treatment Plant to meet water quality standards in Nickajack Reservoir. To perform this evaluation, a computer analysis using the calibrated RECEIVE model of SWMM was performed to determine the effect of low dissolved oxygen discharges from Chickamauga Dam on water quality downstream from the Moccasin Bend discharge under various treatment levels. A satisfactory model calibration for low flow conditions was achieved for Nickajack Reservoir, based on water quality data collected for a TVA study in 1974, and was documented in Work Task 304.

Initially, water quality records were reviewed to determine the dissolved oxygen levels which could be expected to occur in Chickamauga Dam releases. The available water quality data indicated that the dissolved oxygen concentration of dam releases generally ranged from 3.0 mg/l to 6.0 mg/l.

Treatment levels investigated for the Moccasin Bend Wastewater Treatment Plant were recommended by the Tennessee Department of Public Health, Division of Water Quality Control and can be summarized as follows:

Treatment Level	BOD_5 (mg/l)	NH_3-N (mg/l)	D.O. (mg/l)
A	30.0	20.0	4.0
B	30.0	5.0	4.0

Treatment level A represents conventional secondary treatment; whereas, treatment level B represents the inclusion of nitrification in the treatment process. It should also be noted that the projected 1998 flow for the Moccasin Bend Plant of 90 MGD was used for this investigation.

Computer Analysis

As documented in Work Element 304, calibration of the RECEIVE model for Nickajack Reservoir resulted in the determination of the following coefficients for low flow conditions at a temperature of 23.5°C:

- Reaeration Coefficient
  $Ka = 0.35\ day^{-1}$ base e - mile 454.5 - 470.8
  $Ka = 0.09\ day^{-1}$ base e - mile 425.0 - 454.5

- Deoxygenation Coefficients
  $Kr(BOD) = 0.180\ day^{-1}$ base e
  $Knr(NH_3\text{-}N) = 0.280\ day^{-1}$ base e

The reservoir release rate selected for use was 8500 cfs, which was also used for calibration purposes. Although there are occasional periods of zero release, the selected flow represents the minimum average daily flow which is likely to occur in Nickajack Reservoir. Based upon a review of existing water quality data, the BOD_5 and NH_3-N concentrations selected for the reservoir release were 1.0 mg/l and 0.012 mg/l, respectively. These values were also used for calibration purposes.

Nickajack Reservoir also receives waste discharges from various other point sources and tributaries in the CARCOG/SETDD 208 Study Area. The flow rates and quality constituents utilized for these point sources and tributaries are presented in Table III-29. The twenty-year, three-day (i.e., Q_{20-3}) summer low flow regime was used for the tributary flows since this is the minimum stream flow to which Tennessee's Water Quality Standards apply. Water quality selected for the tributary discharges was based on existing conditions, except in the case of Citico Creek and Chattanooga Creek, where ammonia-nitrogen and dissolved oxygen levels were adjusted to 1.6 mg/l and 5.0 mg/l, respectively, in order to comply with the Tennessee's Water Quality Standards. This adjustment was based on the assumption that these two creeks will meet state standards by 1998.

The computer analysis portion of this investigation consisted of modeling various combinations of dissolved oxygen levels for the reservoir release (8500 cfs) and pollutant loadings associated with the two treatment levels for the Moccasin Bend Wastewater Treatment Plant. In addition, a reservoir release of 6000 cfs with a dissolved oxygen concentration of 3.0 mg/l was modeled using secondary treatment for the Moccasin Bend facility.

TABLE III-29: DISCHARGERS - NICKAJACK RESERVOIR

River Mile	Discharger	Flow (cfs)	BOD_5 (lbs/day)	NH_3-N (lbs/day)	D.O. (mg/l)
453.8	Signal Mountain STP	0.183	17.6	13.7	8.1
454.5	General Portland Cement Co.	2.48	133.4	0	3.0
455.4	Red Bank STP	1.24	98.0	115.0	3.2
457.8	Moccasin Bend STP				
	Treatment Level A	139.2	22513.5	3752.0	4.0
	Treatment Level B	139.2	22513.5	15009.0	4.0
458.7*	Vallev View Elementary School	0.003	0.5	0.3	4.0
461.8	Combustion Engineering Co.	0.19	10.0	0	3.0
	Ross-Meehan Foundries	0.06	3.3	0	3.0
	U.S. Pipe & Foundry #1	0.28	15.0	0	3.0
	U.S. Pipe & Foundry #2	0.31	11.7	50.0	3.0
462.8	Dixie Sand & Gravel Co.	1.18	63.0	0	3.0
	Gilman Paint & Varnish Co.	0.05	2.5	0	3.0
462.8*	American Electrical Industries	0.50	2.7	0	3.0
463.9	Roper Corporation	0.07	3.8	0	3.0
466.5	Tennessee-American Water Co.	1.55	250.2	0	3.0

*Tributary to Nickajack Reservoir

TABLE III-29: DISCHARGERS - NICKAJACK RESERVOIR (Continued)

River Mile	Discharger	Flow (cfs)	BOD_5 (lbs/day)	NH_3-N (lbs/day)	D.O. (mg/l)
467.9	Central Soya Co., Inc.	0.15	163.0	12.3	4.0
468.2	Moccasin Bronze Co.	0.008	1.3	0.6	4.0
	Desota, Inc.	0.05	2.8	0	3.0
469.9	E.I. Dupont DeNemours & Co., Inc.	6.50	1225.9	105.0	4.0
470.4	Chattanooga State Area V-T School	0.02	3.3	1.6	4.0
	Tributaries				
470.8	North Chickamauga Creek	3.9	14.0	0.63	7.0
468.2	South Chickamauga Creek	106	1142.7	229.0	5.0
465.3	Citico Creek	0.2	21.6	1.7	5.0
460.6	Chattanooga Creek	7.2	776.2	62.0	5.0
459.8	Lookout Creek	9.3	115.3	2.0	7.0

Results

The results of modeling Treatment Level A (conventional secondary) with reservoir release dissolved oxygen concentrations of 3.0, 4.0, 5.0, and 6.0 mg/l are presented in Figures III-11 through III-14. A comparison of the resulting dissolved oxygen profiles for each simulation is presented in Figure III-15. No violations of the dissolved oxygen standard of 5.0 mg/l or the ammonia-nitrogen requirement of 1.6 mg/l occur downstream from the Moccasin Bend Wastewater Treatment Plant, regardless of the dissolved oxygen of the reservoir release. As indicated in Figure III-15, the only violations of the 5.0 mg/l dissolved oxygen standard occur upstream of the Moccasin Bend Plant as a result of the low dissolved oxygen concentration in the reservoir releases. In all cases, it appears that reservoir reaeration is sufficient to provide the assimilative capacity required to elevate the dissolved oxygen level to 5.0 mg/l upstream of the Moccasin Bend discharge.

Figures III-16 and III-17 illustrate the results of modeling Treatment Level B (nitrification) with reservoir release dissolved oxygen concentrations of 3.0 mg/l and 5.0 mg/l. Again, no violation of the dissolved oxygen or ammonia-nitrogen standards occurs as indicated in Figure III-18 downstream of the Moccasin Bend discharge. Also, it is interesting to note that nitrification does not significantly affect the minimum dissolved oxygen level as compared to secondary treatment. A comparison of dissolved oxygen profiles for both treatment levels for a reservoir release dissolved oxygen of 3.0 mg/l is illustrated in Figure III-18.

Since no water quality violations occurred downstream from the Moccasin Bend discharge under the conditions discussed above, a reservoir release rate of 6000 cfs with a dissolved oxygen level of 3.0 mg/l was modeled using Treatment Level A - secondary treatment. As indicated in Figure III-19, the decrease in flow did not result in either dissolved oxygen or ammonia-nitrogen violations downstream from the Moccasin Bend discharge.

In response to a request by EPA's Technical Support Branch, two additional computer simulations were performed for Nickajack Reservoir to determine the water quality effects resulting from the discharge of treated effluent from the Moccasin Bend Wastewater Treatment Plant.

A computer simulation was performed for each of the two treatment levels associated with the Moccasin Bend Wastewater Treatment Plant with the following changes in model input:

Reservoir Release = 6000 cfs
Dissolved Oxygen in Reservoir Release = 5.5 mg/l
Dissolved Oxygen Saturation Level = 8.0 mg/l (at 26^{o}C)
K_{nr} = 0.15 day^{-1} base e
K_a = 0.15 day^{-1} base e - mile 460.6 - 470.8
K_a = 0.09 day^{-1} base e - mile 425.0 - 460.6

All other input data remained unchanged.

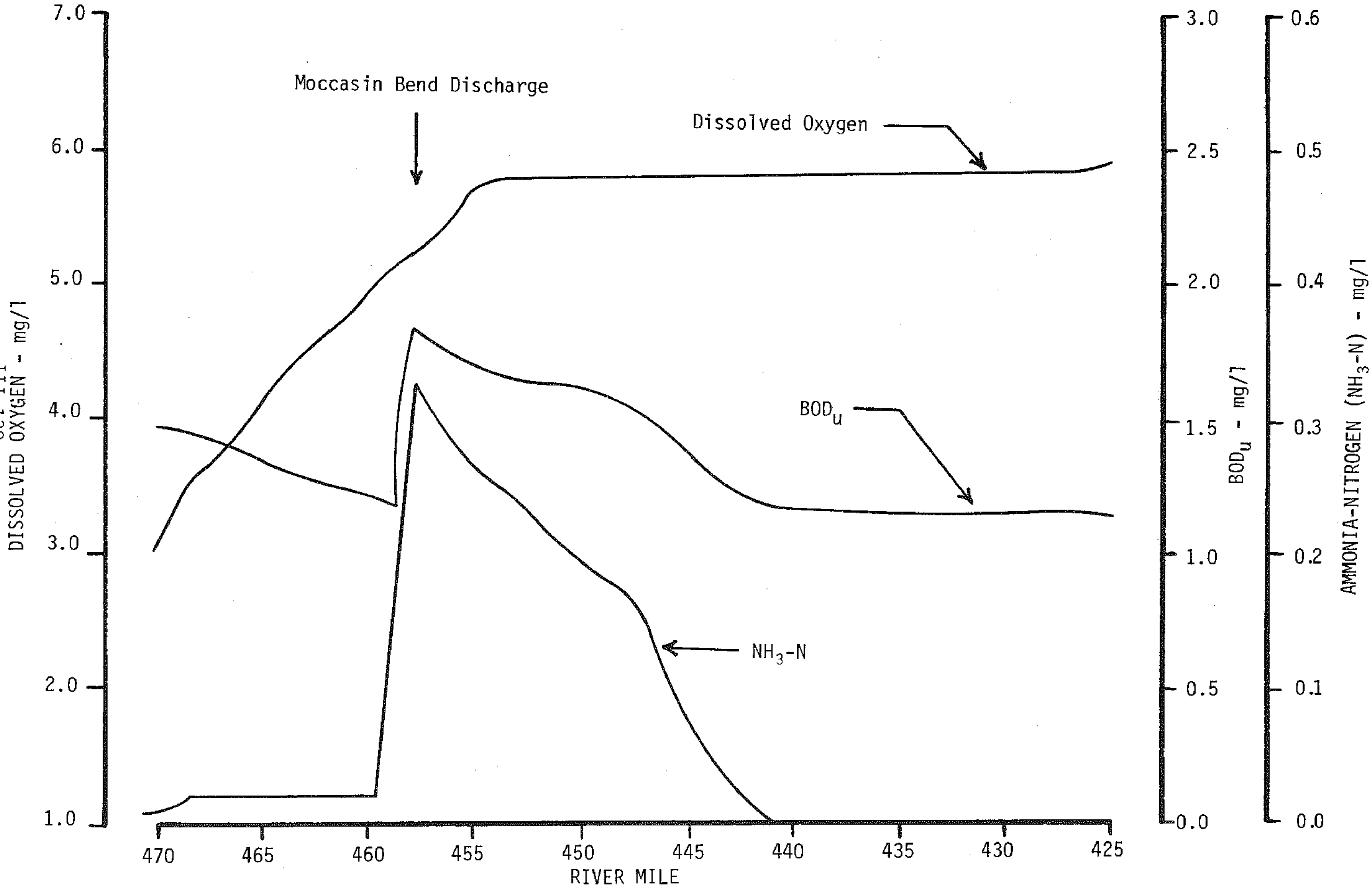


FIGURE III-11: SECONDARY TREATMENT - DISSOLVED OXYGEN = 3.0 mg/l

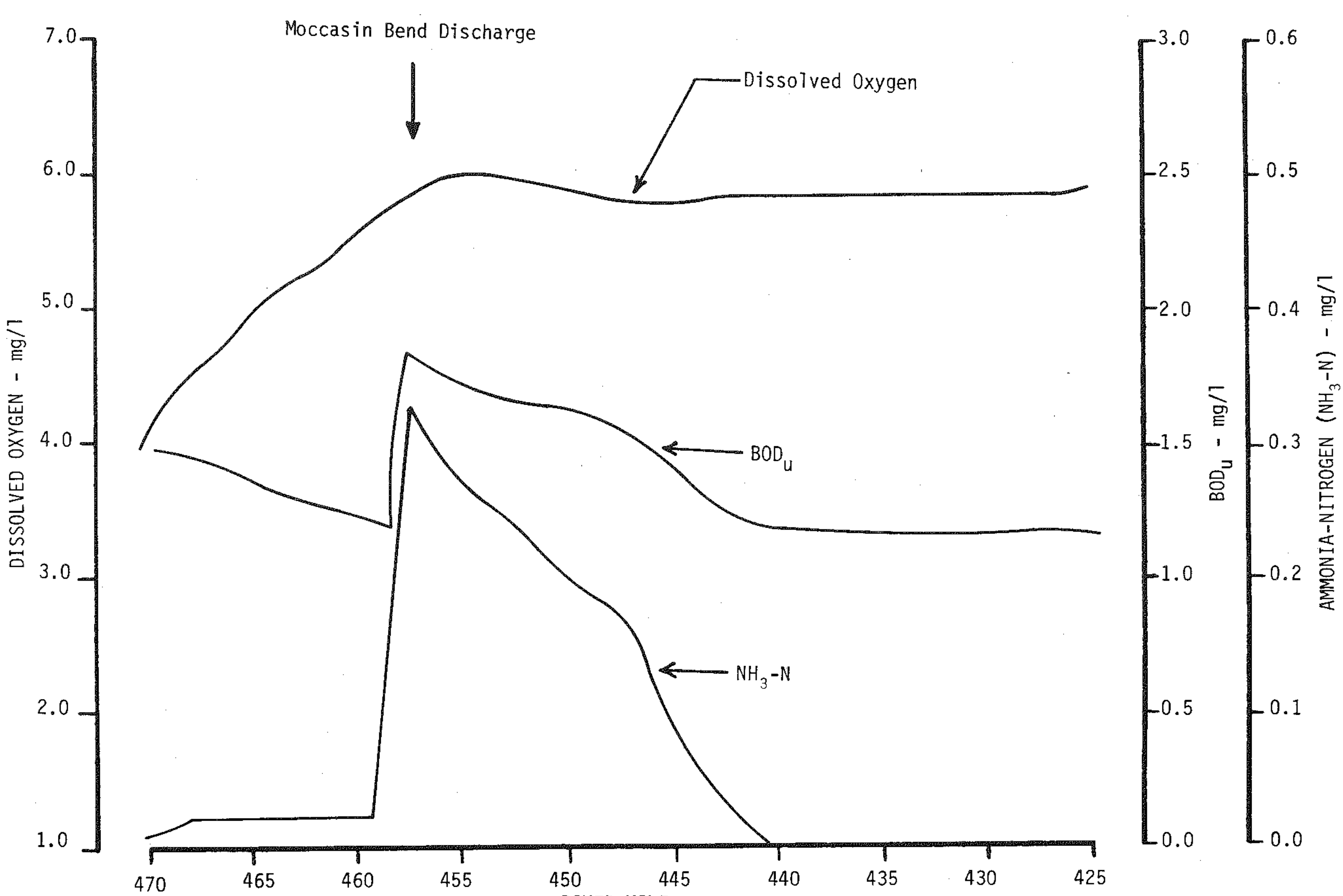


FIGURE III-12: SECONDARY TREATMENT - DISSOLVED OXYGEN = 4.0 mg/l

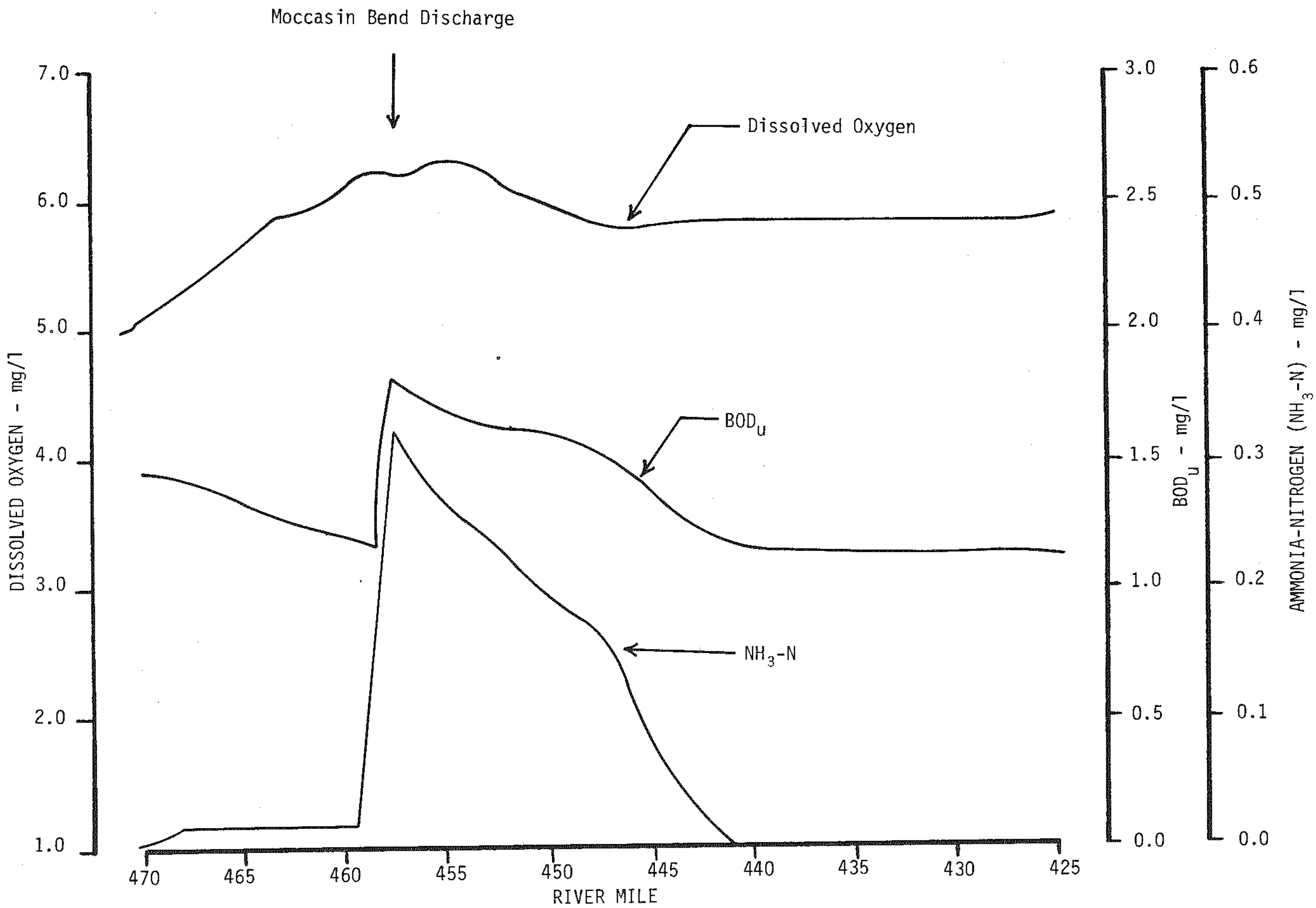


FIGURE III-13: SECONDARY TREATMENT - DISSOLVED OXYGEN = 5.0 mg/l

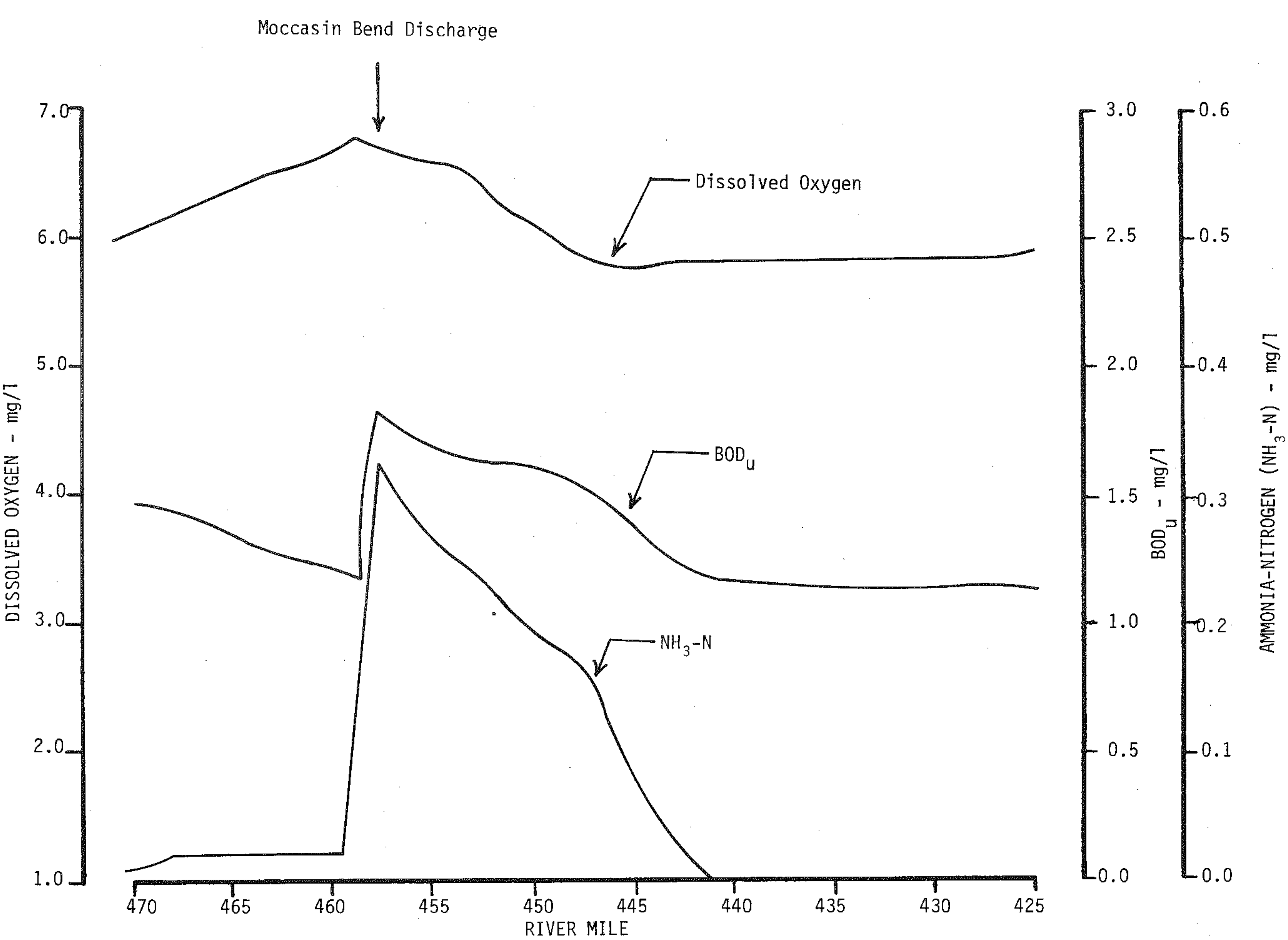


FIGURE III-14: SECONDARY TREATMENT - DISSOLVED OXYGEN = 6.0 mg/l

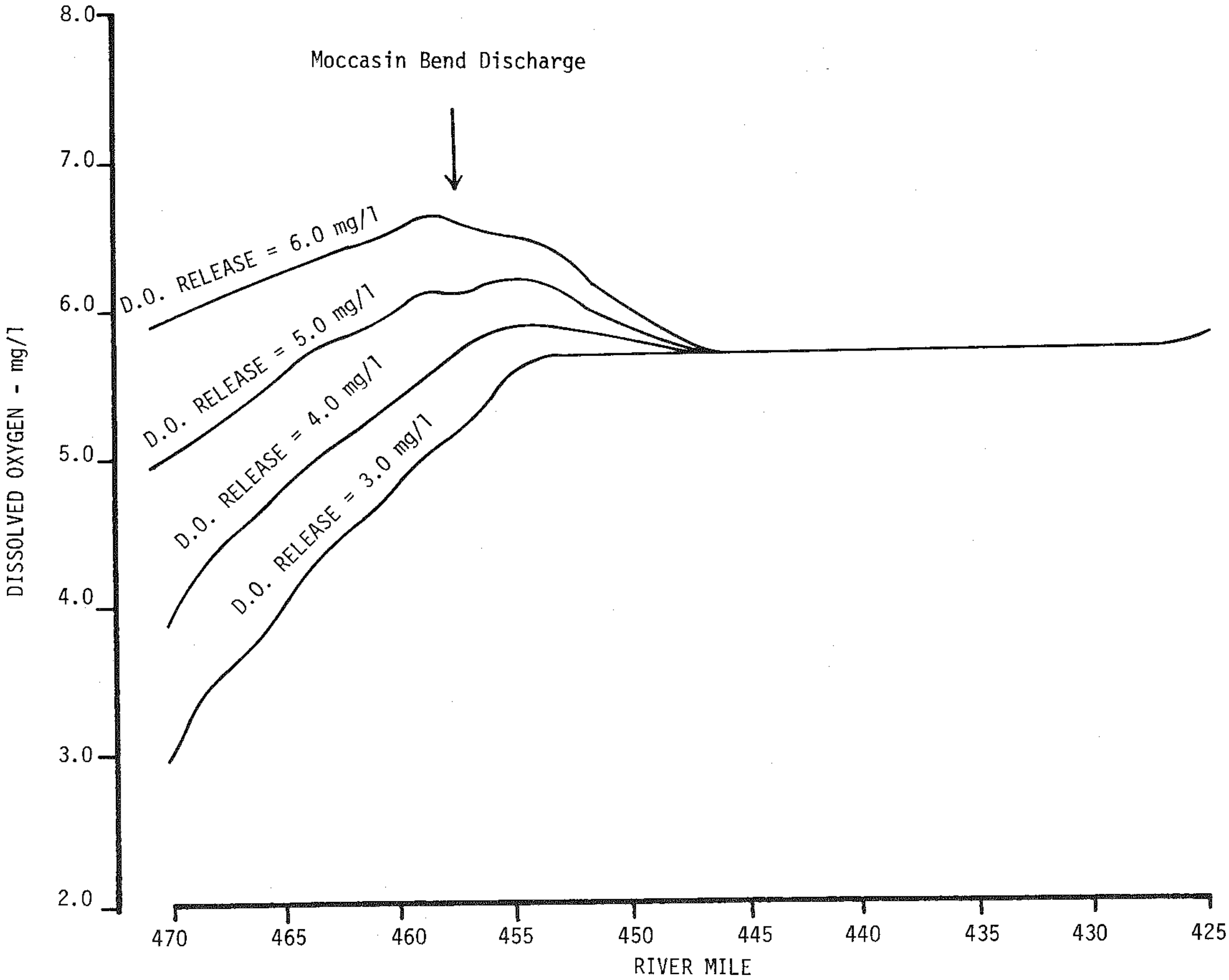


FIGURE III-15: COMPARISON OF DISSOLVED OXYGEN PROFILES FOR SECONDARY TREATMENT

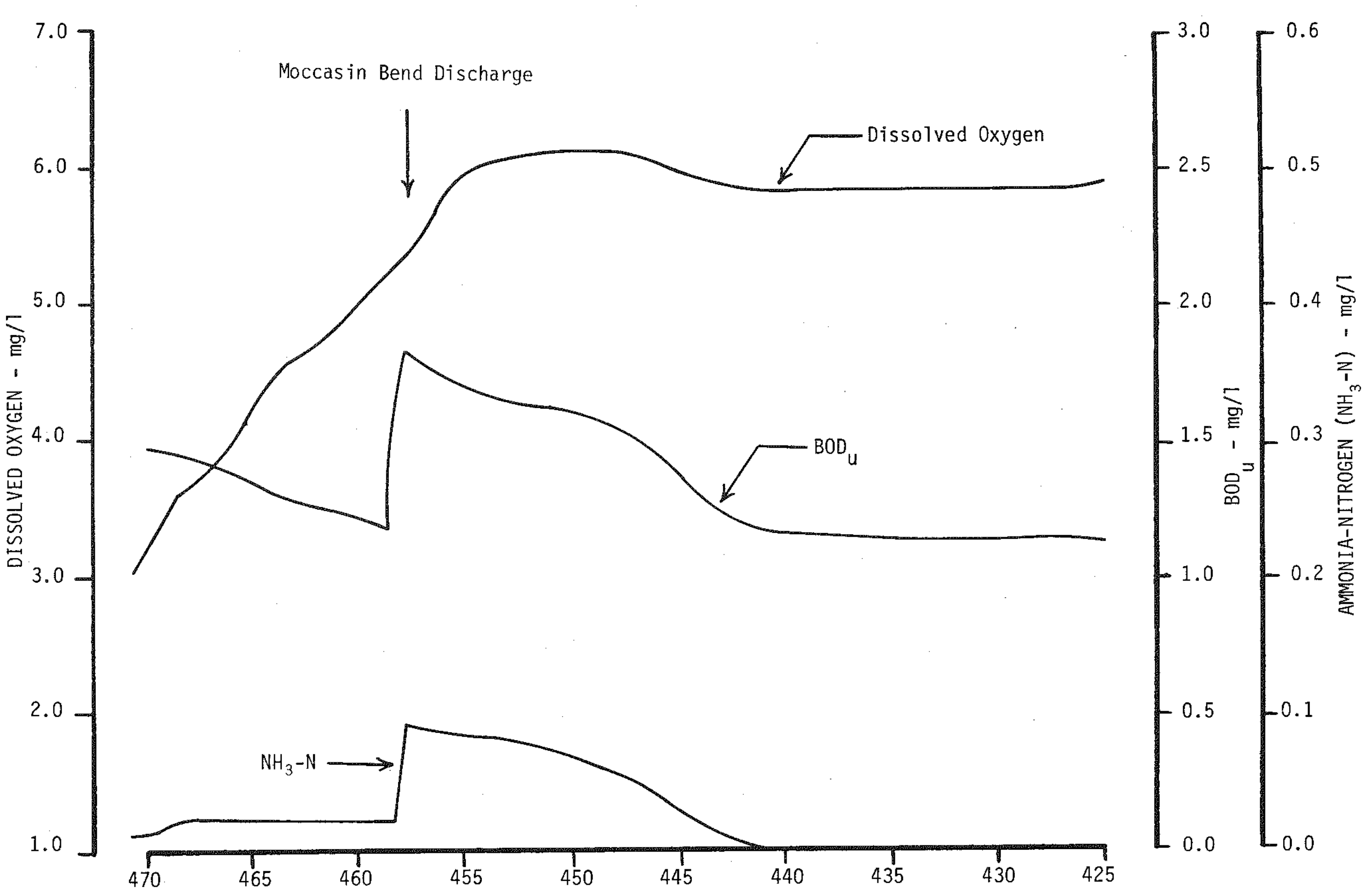


FIGURE III-16: NITRIFICATION - DISSOLVED OXYGEN = 3.0 mg/l

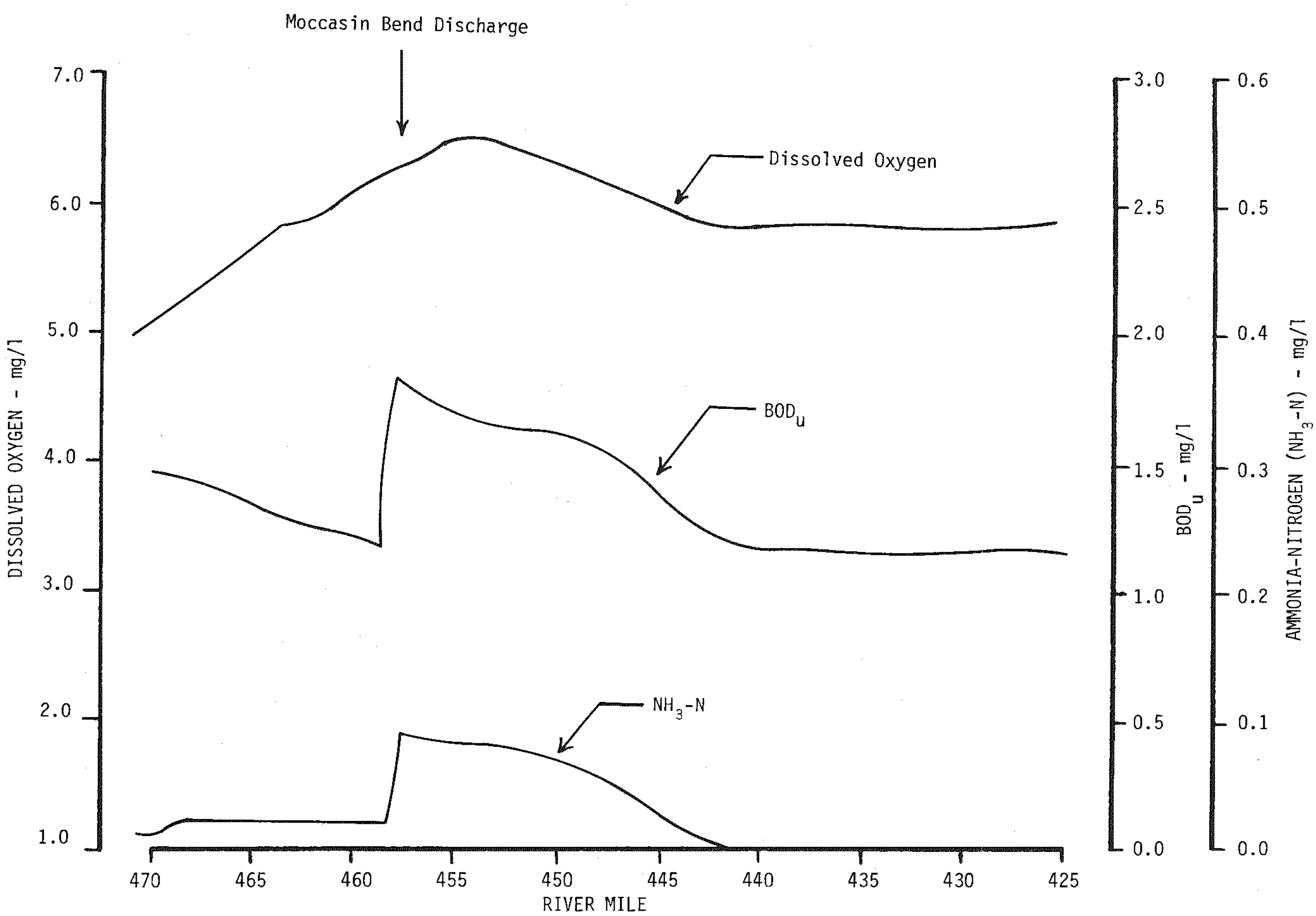


FIGURE III-17: NITRIFICATION - DISSOLVED OXYGEN = 5.0 mg/l

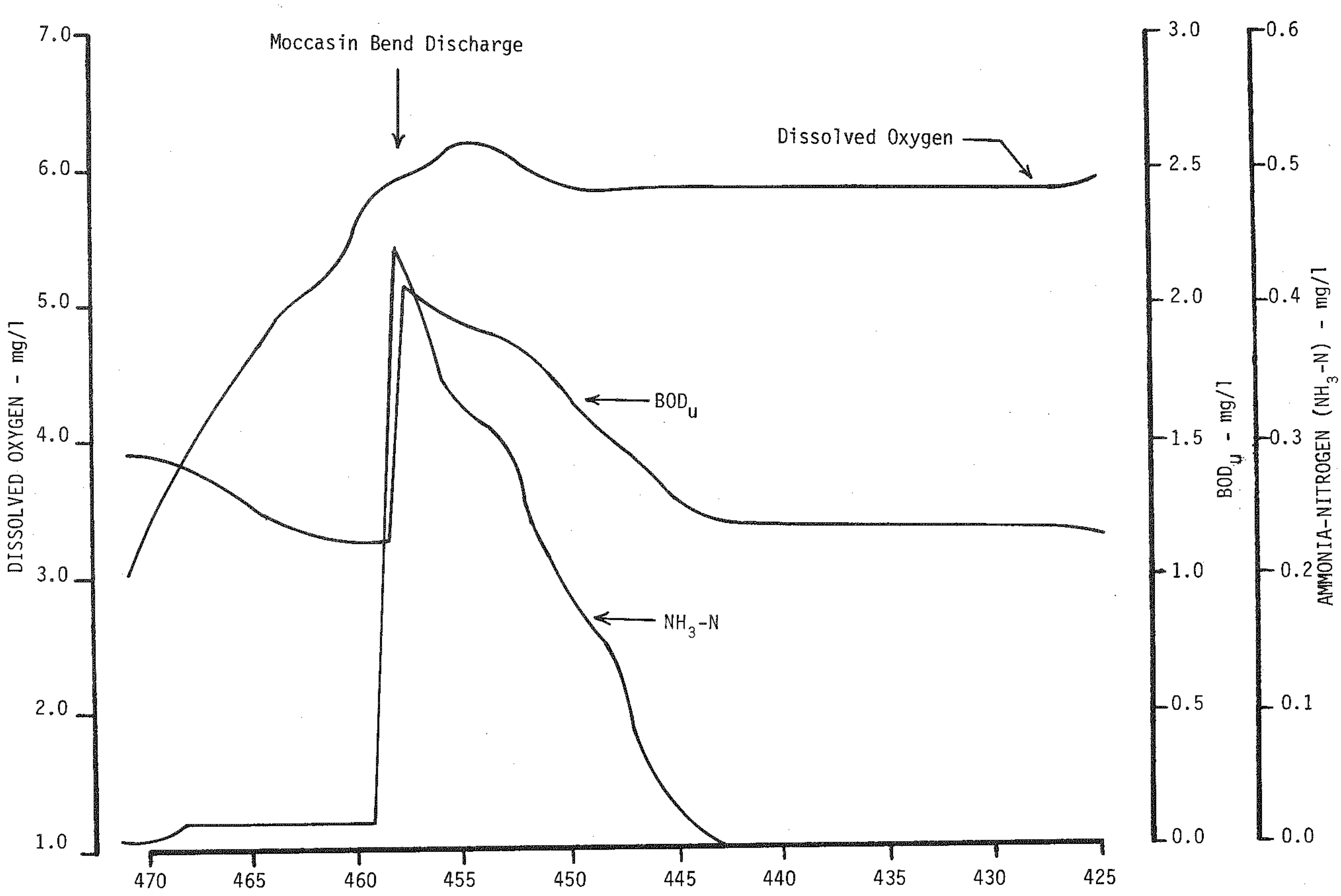


FIGURE III-18: SECONDARY TREATMENT - RESERVOIR RELEASE OF 6000 cfs AT 3.0 mg/l D.O.

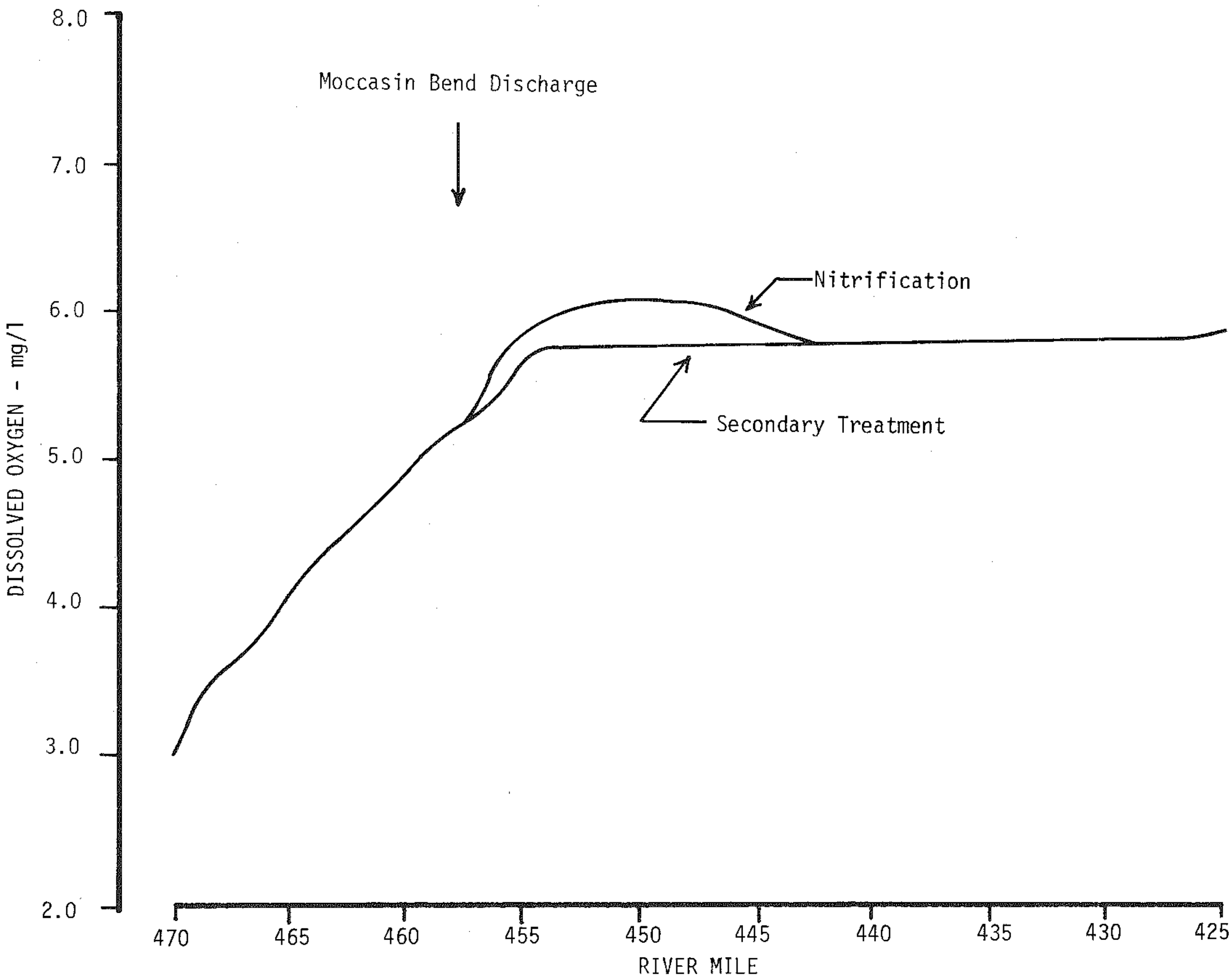


FIGURE III-19: COMPARISON OF SECONDARY TREATMENT AND NITRIFICATION FOR D.O. = 3.0 mg/l

Water quality resulting from implementation of Treatment Level A (conventional secondary) and Treatment Level B (nitrification) for this portion of the analysis is presented in Figures III-20 and III-21, respectively. A comparison of dissolved oxygen profiles resulting from each treatment level is presented in Figure III-22. As indicated, no violations of the dissolved oxygen standard of 5.0 mg/l or the interpreted ammonia-nitrogen requirement of 1.6 mg/l occur downstream from the Moccasin Bend Wastewater Treatment Plant with either treatment level, under the conditions selected for this analysis.

Summary

It appears that the provision of secondary treatment for the Moccasin Bend Wastewater Treatment Plant is adequate to protect the water quality in Nickajack Reservoir, since it results in no violations of dissolved oxygen or ammonia-nitrogen standards under a reservoir release dissolved oxygen level of 3.0 mg/l. This conclusion agrees with the results of the TVA study conducted on Nickajack Reservoir in 1974, which found no violations of water quality standards under the existing conditions of secondary treatment at Moccasin Bend. Although a significant increase in flow from Moccasin Bend is projected for 1998, the high dilution factor (62:1) coupled with adequate reservoir reaeration appears to be sufficient to prevent water quality standards violations downstream from the discharge.

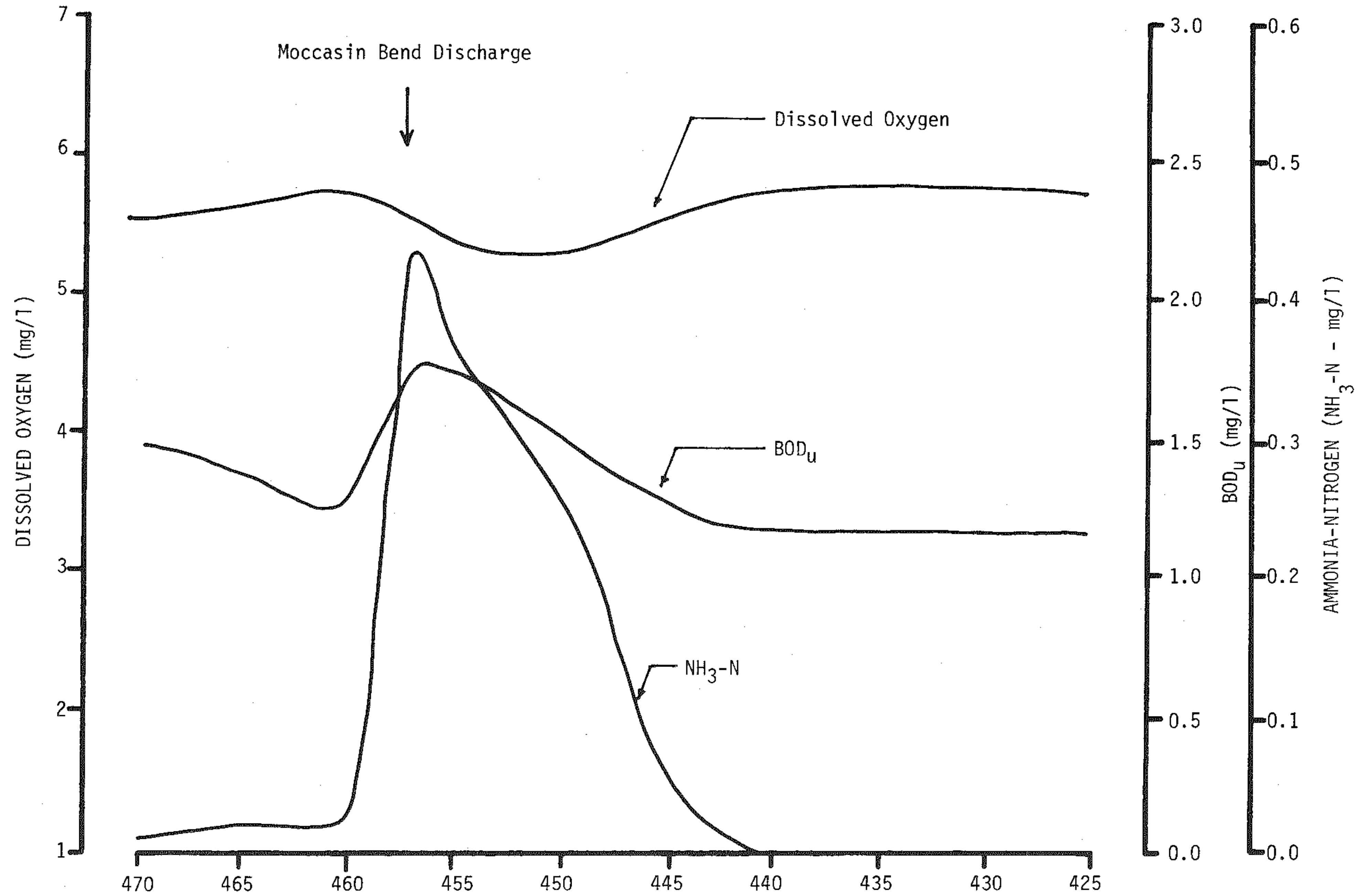


FIGURE III-20: WATER QUALITY - NICKAJACK RESERVOIR UNDER TREATMENT LEVEL A (CONVENTIONAL SECONDARY)

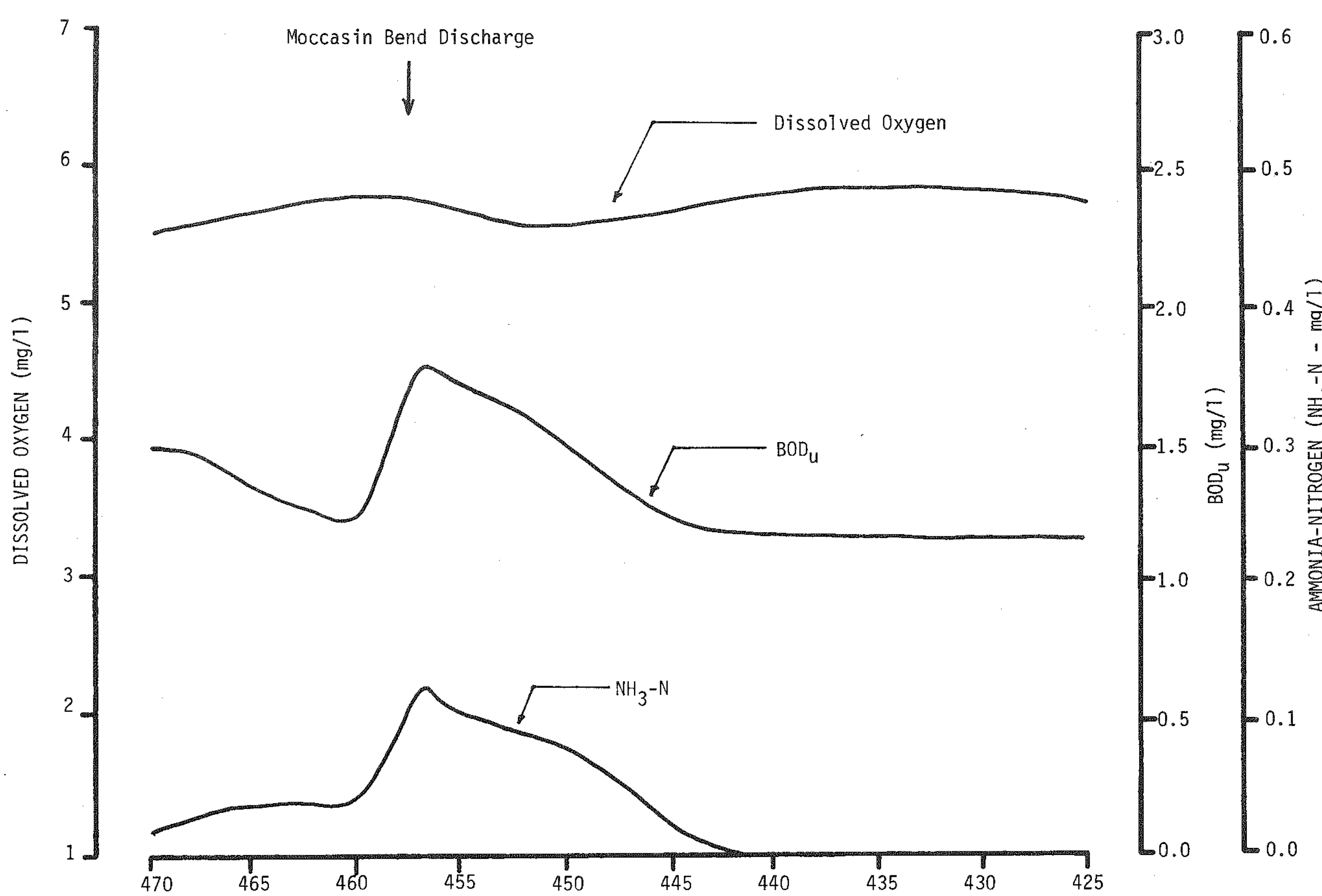


FIGURE III-21: WATER QUALITY - NICKAJACK RESERVOIR UNDER TREATMENT LEVEL B (NITRIFICATION)

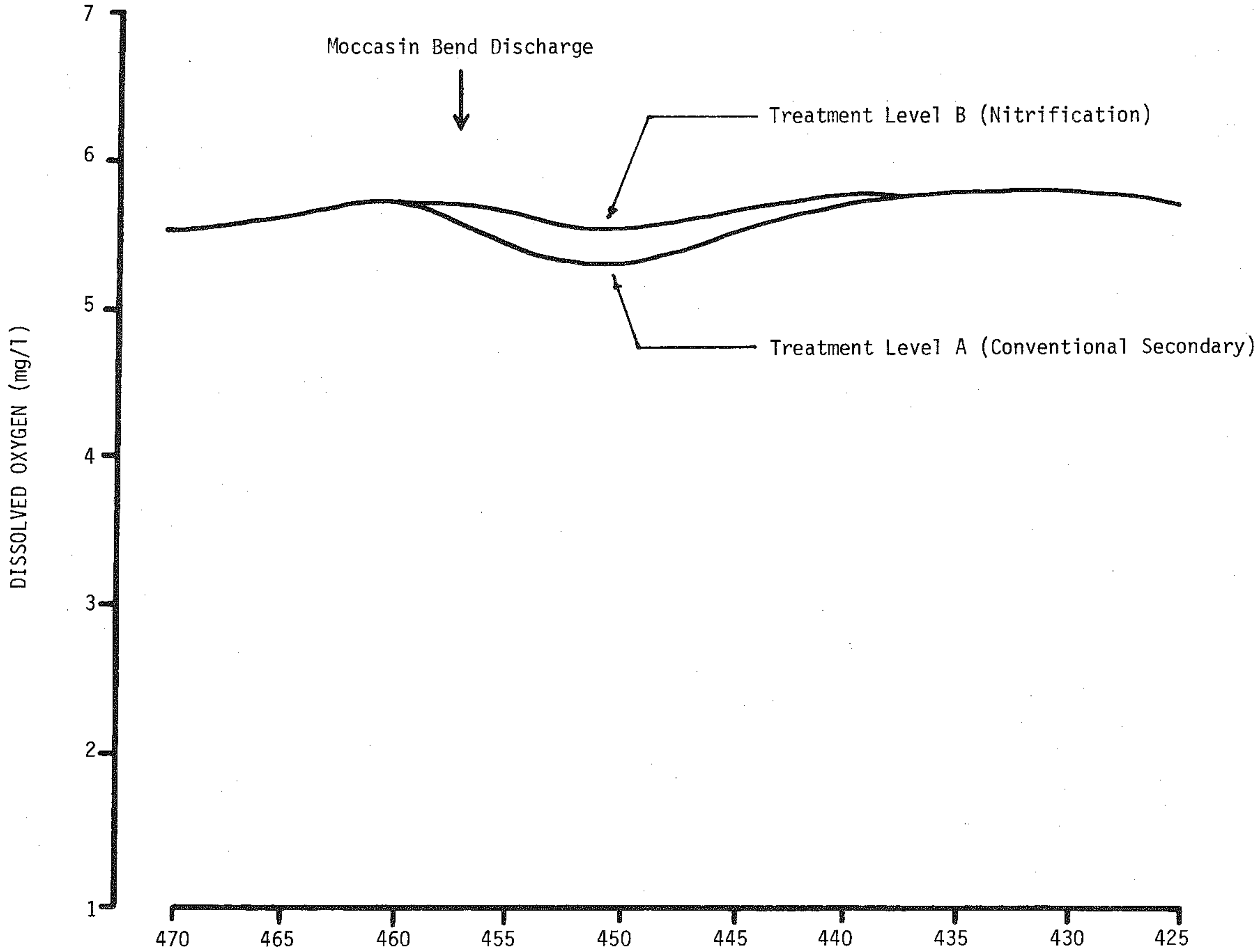


FIGURE III-22: COMPARISON OF DISSOLVED OXYGEN PROFILES FOR TREATMENT LEVELS A AND B IN NICKAJACK RESERVOIR

CHAPTER IV - MUNICIPAL POINT SOURCE AREAWIDE PLAN

IV
MUNICIPAL POINT SOURCE AREAWIDE PLAN

A. INTRODUCTION

This chapter contains a summary of the municipal point source control options outlined in the proposed, ongoing, and completed 201 Wastewater Facilities Plans within the CARCOG/SETDD 208 planning area. These controls have been previously documented in Activity 401 and are presented here in the context of areawide alternative development. Also included in this chapter is a description of the Null Alternative and the Preferred Plan for municipal point sources in the 208 area. Furthermore, a discussion of the regional priorities and projected costs associated with implementing the Preferred Plan is presented. This discussion is based upon the applicable 201 plans and the 106 plans.

B. MUNICIPAL POINT SOURCE CONTROL OPTIONS

The municipal point source control options to be considered are based upon those presented in the 201 Wastewater Facilities Plans for the areas within the CARCOG/SETDD 208 Areawide Waste Treatment Management Planning Area. These areas include:

- The Chattanooga, Tennessee-Georgia, Wastewater Facilities Planning Area.
- The Jasper, Tennessee, Wastewater Facilities Planning Area.
- The Dunlap, Tennessee, Wastewater Facilities Planning Area.
- The Whitwell, Tennessee, Wastewater Facilities Planning Area.
- The South Pittsburg-Kimball, Tennessee, Wastewater Facilities Planning Area.

These areas are shown in Figure IV-1 and include those communities having completed 201 plans or plans under preparation. The following discussion concerning the various municipal point source controls is broken down by these communities.

1. Chattanooga 201 Planning Area

The Chattanooga 201 Planning Area consists of a large part of Hamilton County in Tennessee and the northern portions of Dade, Walker, and Catoosa Counties in Georgia. Included within the 201 area are the municipalities of Chattanooga, East Ridge, Red Bank, Signal Mountain, Soddy-Daisy, Collegedale, Ridgeside, Lakesite, and Lookout Mountain in Tennessee and Trenton, Rossville, Lookout Mountain, Chickamauga, Ringgold, and Fort Oglethorpe in Georgia. In order to facilitate the planning process, the 201 area

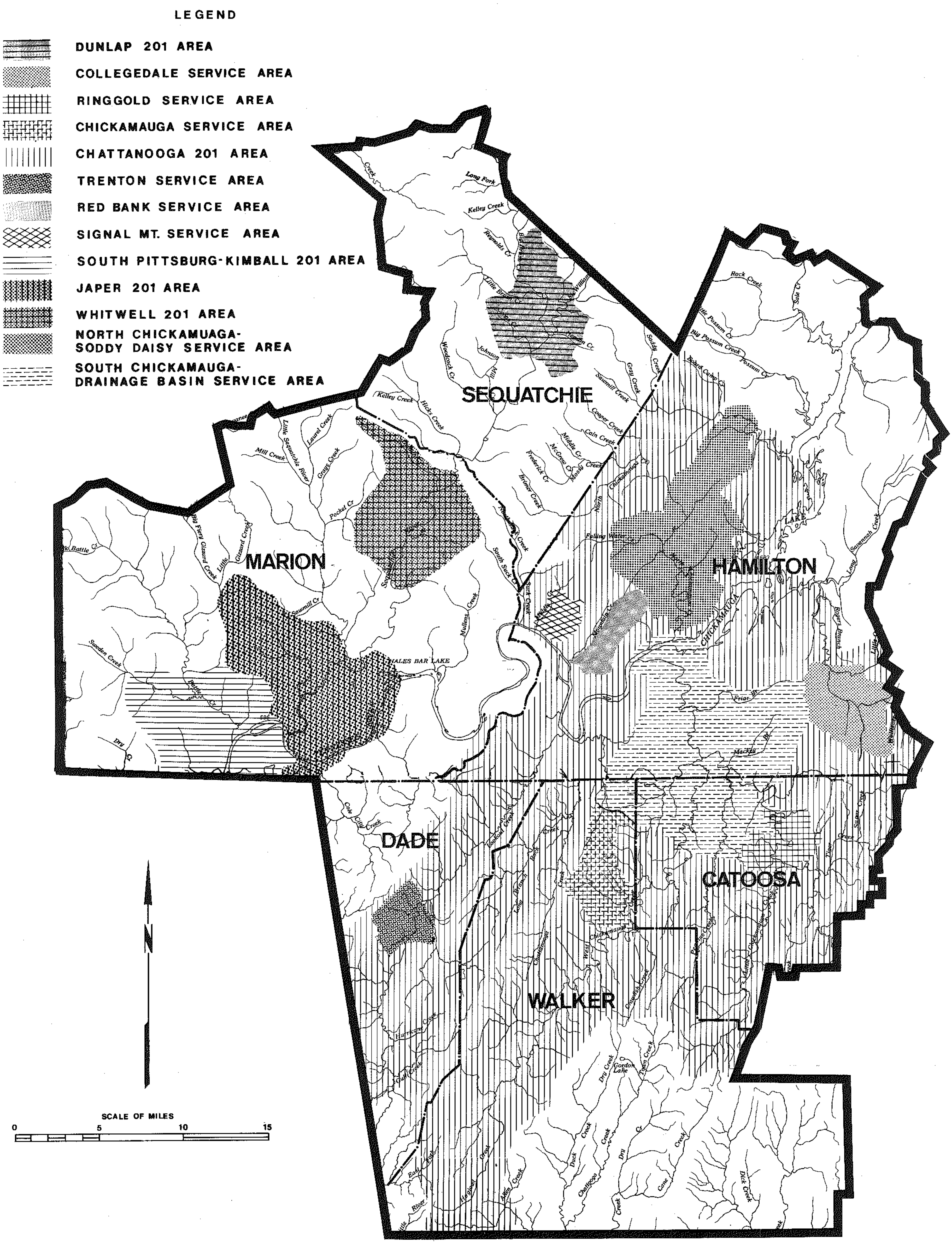


FIGURE IV-1

WASTEWATER FACILITIES PLANNING AREAS IN THE CARCOG / SETDD 208 AREA

has been broken down into separate but integral planning subareas. A point source control plan has been developed for each subarea. These include a Core Area Plan covering the existing sewered areas of the city of Chattanooga and the South Chickamauga Creek drainage basin (including the East Ridge, Rossville, Ringgold, Fort Oglethorpe, Collegedale, Walker County, Catoosa County, and Tiftonia areas), and a series of Supplemental Plans, which outline alternatives for the Soddy-Daisy/North Chickamauga Creek, Signal Mountain, Red Bank, Trenton, and Chickamauga areas (see Figure IV-1). The municipal point source control options described in each of these Plans are outlined below.

Chattanooga Core Area Plan

In the development of the Chattanooga Core Area Plan, several changes in existing point source control practices were considered. These included the expansion and/or regionalization of existing facilities (Brainerd, Collegedale, East Ridge, Fort Oglethorpe, Moccasin Bend) and construction of new treatment plants (Ringgold, Hixson, Wolftever Creek). The various options for each existing plant or sewer service area were combined into two general alternatives for the Core Area. These are described as follows:

Alternative 1 - The One Plant Concept
Collection and transportation of all wastewater from the regional system to an expanded and upgraded treatment facility at the present Moccasin Bend Treatment Plant site.

Alternative 2 - The Two Plant Concept
Collection and transportation of wastewater from the North and South Chickamauga Creek drainage basin service areas to a new treatment facility located in the Amnicola area. Collection and transportation of wastewater from all other areas of the regional system to an expanded and upgraded treatment facility at the present Moccasin Bend Treatment Plant site.

Based upon cost-effectiveness and possible environmental effects, the 201 Wastewater Facilities Plan has selected Alternative 1 as the recommended areawide plan. The specific municipal point source controls to be implemented under the provisions of this plan are fully outlined in the Null Alternative description.

North Chickamauga Creek/Soddy-Daisy Supplemental Plan

Two basic municipal point source control options were considered in this supplement to the Chattanooga 201 plan. These may be described as follows:

Alternative 1 - Collection and transportation of all wastewater from the Soddy-Daisy Service Area to a wastewater treatment facility located within the area.

Alternative 2 - Collection and transportation of all wastewater from the Soddy-Daisy Service Area to the Moccasin Bend regional treatment facility.

Subalternatives regarding the location of the proposed new treatment facility (near Soddy or near Daisy) and the alignment of interceptors (near or away from creek banks) were also developed. Alternative 2 was chosen as the recommended plan based on its cost-effectiveness and minimal adverse environmental effects.

Signal Mountain Supplemental Plan

The Signal Mountain supplement to the Chattanooga 201 plan evaluates two point source control options for this service area. These are: (1) the expansion and improvement of the existing Signal Mountain treatment facility and (2) transportation of wastewater flows to the Moccasin Bend facility for treatment. No final plan has been recommended, due to the lack of superiority of either alternative in the categories evaluated. The "best plan" decision will be made upon completion of the Infiltration/Inflow Evaluation and Rehabilitation Program.

Red Bank Supplemental Plan

Two point source controls were evaluated for the Red Bank Service Area. These alternatives were: (1) the expansion and upgrading of the existing Red Bank facility and (2) regionalization of the Red Bank Treatment Plant with the Moccasin Bend facility in 1979. The recommended plan for the Red Bank Service Area has chosen the second alternative as the most environmentally sound and cost-effective option.

Trenton Supplemental Plan

The two point source control options considered for the Trenton Service Area in the Trenton supplement to the Chattanooga 201 plan were as follows:

Alternative 1 - Expansion of the existing Trenton facility to treat all regional wastewater flows throughout the planning period.

Alternative 2 - Collection and transportation of all wastewater flows in the Trenton Service Area to the regional treatment facility at the Moccasin Bend site.

Alternative 1 was chosen as the optimum control mechanism for the Trenton area.

Chickamauga Supplemental Plan

The Chickamauga Supplement to the Chattanooga 201 plan evaluated two alternatives for the control of municipal point sources. These are described as follows:

Alternative 1 - Collection and transportation of all wastewater flows from the Chickamauga Service Area to a regional treatment facility through a series of interceptor sewers and pump stations.

Alternative 2 - Upgrading and expansion of the existing treatment facility to treat all future flows from the service area.

The point source control option recommended in the Chickamauga Supplement was Alternative 2.

2. Jasper 201 Planning Area

The Jasper 201 Wastewater Facilities Plan has considered several point source control options resulting in the development of an areawide plan. The two basic alternatives evaluated were: (1) construction of a new facility at Jasper for treatment of all wastewater flows from the service area and (2) collection and transportation of wastewater flows to the existing South Pittsburg Wastewater Treatment Plant. The first alternative was chosen as the more cost-effective, and various options regarding the plant location and treatment scheme were formulated. These are outlined below.

Site selection was the first step in the development of the selected alternative, with four locations being considered initially. These were: (1) on Town Creek near Standifer Branch, (2) on the Sequatchie River north of Town Creek, (3) on the Tennessee River in the Browder Switch Industrial Development Area, and (4) on the Tennessee River at South Pittsburg. The Town Creek site was eliminated due to the small flow of the stream which would necessitate an unreasonably high level of treatment. The Tennessee River-Browder Switch site was eventually chosen as the optimum location for the treatment plant since costs for transportation of wastewater to this site would be low.

Upon selection of a site for the treatment facility, various unit processes were evaluated for their use in a treatment scheme. These were the use of aerated lagoons, biological discs, trickling filters, activated sludge processes, land application, and physical/chemical systems. Sludge disposal mechanisms which were considered include aerobic and anaerobic stabilization and drying on beds. The treatment scheme chosen as being optimum for the Jasper area featured the use of an aerated lagoon after preliminary treatment, clarification with use of coagulant aid, and disinfection.

3. Dunlap 201 Planning Area

The Dunlap 201 Wastewater Facilities Plan is currently under preparation, but has not progressed past the alternative development stage. The two major alternatives proposed for treatment of waste flows from the Dunlap Service Area are:

Alternative 1 - The upgrading and expansion of the present treatment facilities located in the city of Dunlap to accommodate future wastewater flows.

Alternative 2 - The building of a new treatment facility to accommodate future wastewater flows.

The point source control options to be evaluated as a part of these alternatives are described below:

- The No-Build Option - This option assumes no changes in existing control practices. If the wastewater treatment plant is not enlarged within the next few years, additional customers will not be able to connect to the overloaded system, requiring the use of septic tank systems. Continued septic tank use will result in increased public health problems, further degradation of surface waters, and severe limitations on growth in many areas of the city of Dunlap.

- The expansion and upgrading of present facilities to meet future waste load allocations through the use of one of the following point source controls:

  - activated biological filter
  - trickling filter
  - biological disc
  - extended aeration process

- The construction of a new plant to provide adequate treatment of future waste flows using one of the following unit processes:

  - oxidation ditch
  - aerated lagoons
  - prefabricated extended aeration system
  - trickling filter
  - biological disc
  - extended aeration

- Land Application Option - This point source control calls for the spreading of treated effluent on agricultural land. An important factor in regard to land application of any type is that secondary treatment is required before application. Since existing stream standards allow secondary discharge into the Sequatchie River, the additional costs of land application would probably not prove to be cost-effective.

No final recommendation concerning implementation of one of these alternatives has been made; however, preliminary estimates show that the expansion of the existing plant with the addition of a trickling filter is the most cost-effective alternative.

4. Whitwell 201 Planning Area

The wastewater facilities planning process has not been initiated in the designated Whitwell 201 Planning Area; however, it is anticipated that some type of treatment facility may be constructed within the next 5 years. For this reason, brief general planning and treatment options have been developed for this area. These alternatives described below, were formulated for planning purposes only and will be subject to change once the planning process is begun by the consultants for Whitwell. It is recommended that facilities planning be initiated as soon as possible.

The point source control options to be considered in the alternative development process are as follows:

- Construction of a treatment facility utilizing one of the following processes:

  - extended aeration
  - trickling filter
  - biological disc
  - aerated lagoons
  - oxidation ditch

- Land application of treated effluent.

A preliminary cost evaluation indicates that an aerated lagoon system would prove to be most cost-effective.

5. South Pittsburg-Kimball 201 Planning Area

Portions of a 201 plan for the South Pittsburg-Kimball area have been submitted to the state of Tennessee for review; however, the plan is incomplete at this time. The consultant preparing this plan has stated that, until the review process is complete, no control options will be evaluated for the 201 area. For this reason, no such controls were developed as a part of the 208 planning process. The South Pittsburg-Kimball area will not be discussed in the following sections, but both the Null Alternative and the Preferred Plan will assume the provisions of the completed 201 plan.

C. MUNICIPAL POINT SOURCE AREAWIDE NULL ALTERNATIVE

The Null Alternative is assumed to have the following wastewater control mechanisms in operation during the planning period:

- Any wastewater treatment plant (WWTP) currently under construction.

- Any WWTP, although only in the proposal stage, which will probably be constructed during the planning period.

- Any program or policy to control point source pollution (including 201 plans) that is currently being implemented or which will be implemented during the planning period.

In addition, this alternative assumes compliance with the National Pollutant Discharge Elimination System (NPDES permits), 303e River Basin Plans, the Construction Grants Program (where it is considered that construction will occur), and any other actions which will be implemented regardless of the 208 program. A description of the Null Alternative for each 201 planning area follows.

1. Chattanooga 201 Planning Area

The Null Alternative for the Chattanooga 201 area assumes the expansion and upgrading of the existing Moccasin Bend facility to provide treatment for regional wastewater flows. Under this point source control, the Brainerd and Red Bank treatment plants would be phased out in the near future, and their flows would be transported through interceptors to the regional facility. Once interceptor sewers reach the existing East Ridge, Soddy-Daisy, Collegedale, and Fort Oglethorpe service areas, their flows will be diverted to the Moccasin Bend plant for treatment. Regionalization will require the construction of 34 interceptors, 44 collection systems, and 20 pump stations, plus improvements to the Moccasin Bend facility, as outlined in Table IV-1. It should be noted that even though the Signal Mountain 201 plan makes no final recommendations, construction activities for regional treatment of wastewater flows from this service area are included in Table IV-1. Other activities assumed for the Chattanooga 201 area under this alternative are described in the following paragraphs.

In addition to the regionalization described above, several other point source controls will be enacted under the Null Alternative. These include the expansion and improvement of the existing Trenton and Chickamauga treatment facilities to treat future waste loads, and construction of a new Ringgold Wastewater Treatment Plant. As previously stated, no final decision has been made concerning the Signal Mountain service area, so the Null Alternative includes either the regionalization of these wastewater flows or expansion and improvement of the existing treatment facility.

2. Jasper 201 Planning Area

Under the Null Alternative for the Jasper 201 area, a new wastewater treatment facility would be constructed. This plant, to be located near the Browder Switch area, will be a 0.78 MGD secondary biological facility discharging to mile 421.8 of the Tennessee River. The unit processes to be included in the treatment scheme are as follows:

- Preliminary treatment including screening, comminution, and flow measurement.
- A two-stage aerated lagoon having a total detention time of 4.6 days at the design flow rate.
- A secondary clarifier with facilities for periodic addition of a coagulant aid and the capability of recirculating sludge to the head of the plant.
- Disinfection.

TABLE IV-1

CONSTRUCTION ACTIVITIES UNDER THE NULL ALTERNATIVE

Required Facilities	Implementation Date
CHATTANOOGA 201 WASTEWATER FACILITIES PLANNING AREA	
Regional System	
Interceptor Sewers and Pumping Stations	
Lake Hills Interceptor	1976
Tyner Interceptor	1976
South Chickamauga Creek Interceptor (Phase I)	1976
Friar Branch Pumping Station	1976
South Chickamauga Creek Pumping Station	1976
South Chickamauga Creek Interceptor (Phase II)	1977
Upper North Chattanooga Parallel Interceptor	1977
Lower North Chattanooga Parallel Interceptor	1977
Collegedale City Interceptor (Part of Collection System)	1978
East Brainerd Interceptor	1978
East Brainerd Pumping Station	1978
19th Street Pumping Station Pumps	1978
Hixson Pumping Station No. 2	1979
Hamill Road Outfall	1979
Hixson Interceptor	1979
Hixson Pumping Station No. 1	1979
Collegedale Interceptor	1979
Apison Pike Pumping Stations and Force Mains	1979
Apison Pike Interceptor	1979
Summit Interceptor	1979
East Brainerd Interceptor	--
North Indian Springs Interceptor	1979
North Catoosa County Interceptor	1979
North Catoosa County Pumping Station	1979
Lakeview Interceptor	1979
Lakeview Pumping Station and Force Main	1979
Middle Valley Interceptor	1980
Valleybrook Pumping Station and Force Main	1980
Tiftonia Pumping Station No. 1 and Force Main (River Crossing)	1980
Tiftonia Pumping Station No. 2	1980

TABLE IV-1

CONSTRUCTION ACTIVITIES UNDER
THE NULL ALTERNATIVE (Continued)

Required Facilities	Implementation Date
Tiftonia Interceptor I	1980
Signal Mountain Interceptor	1980
Daytona Heights Interceptor	1981
Boy Scout Road Pumping Station and Force Main	1981
Daisy Interceptor	1981
Lookout Mountain, Georgia, Interceptor	1981
Tiftonia Interceptor	1981
West Fort Oglethorpe Interceptor	1982
South Catoosa County Interceptor	1982
Upper Amnicola Parallel Interceptor	1982
New Citico Pumping Station	1982
Citico Force Main, River Crossing	1982
Lower Stuart Heights Parallel Interceptor	1982
Stringers Ridge Parallel Tunnel	1982
Stringers Ridge Parallel Interceptor	1982
Soddy-Daisy Pumping Station and Force Main	1983
Upper Soddy-Daisy Interceptor	1983
Lower Soddy-Daisy Interceptor	1983
Upper Middle Valley Interceptor	1983
Middle Valley Pumping Station and Force Main	1983
Waconda Bay Pumping Station and Force Main	1983
Waconda Bay Interceptor	1983
Fort Oglethorpe Connection I	1983
East Ridge Connection I	1983
South Chickamauga Creek Pumping Station Pump	1983
Lower Amnicola Parallel Interceptor	1983
South Indian Springs Interceptor	1985
Lower Chattanooga Valley Interceptor	1985
23rd Street Pumping Station Pumps	1985
Ooltewah Pumping Station and Force Main	1988
Upper Stuart Heights Parallel Interceptor	1991
Middle Stuart Heights Parallel Interceptor	1995
Expanded Citico Pumping Station Pump	1995
<u>Collection Systems</u>	
North Highway 58	1977
Lake Hills	1977
South Highway 58	1978

TABLE IV-1

CONSTRUCTION ACTIVITIES UNDER
THE NULL ALTERNATIVE (Continued)

Required Facilities	Implementation Date
Tunnel Boulevard	1978
Collegedale City (Partial)	1978
Hamillville	1979
Friar Branch	1979
East Brainerd (City)	1979
North Indian Springs	1979
North Catoosa County	1979
Collegedale City (Complete)	1979
North Hills	1980
Valleybrook	1980
South Gold Point	1980
Tiftonia	1980
Red Bank (Complete)	1980
B-18 Completion	1980
B-19 Completion	1980
Ninemile Branch	1981
Dayton Boulevard	1981
Olde Mill	1981
Black Creek	1981
Pan Gap	1981
Sawmill Branch	1981
Fairyland	1981
South Catoosa County	1982
Walker County	1982
Soddy	1983
Daisy	1983
Moses Road	1983
Middle Valley	1983
Sterling Park	1983
Waconda Bay	1983
East Brainerd (County)	1983
Cave Springs	1985
Falling Water	1985
Pitts Branch	1985
South Indian Springs	1985
Chattanooga Valley	1985
Signal Mountain (Completion)	1986
North Rabbit Valley	1988
Ooltewah	1988
Collegedale County	1988
Apison	1988
Moccasin Bend Wastewater Treatment Plant	
Phase I	1979
Phase II	1983
Phase III	1988

TABLE IV-1

CONSTRUCTION ACTIVITIES UNDER THE NULL ALTERNATIVE (Continued)

Required Facilities	Implementation Date
Independent Systems	
Ringgold Wastewater Treatment Plant	1976
Ringgold South Pumping Station	1976
Ringgold North Pumping Station	1976
Force Main	1976
Ringgold Outfall System	1976
Miscellaneous Construction	1976
Trenton Wastewater Treatment Plant Upgrading and Expansion	
Phase I	1978
Phase II	1983
Trenton Collection System	
Phase I	1978
Phase II	1983
Chickamauga Wastewater Treatment Plant Upgrading and Expansion	
Phase I	1977
Phase II	1983
Phase III	1990
Chickamauga Long Hollow Pumping Station and Force Main	1982
Chickamauga Long Hollow Outfall Line	1982
Chickamauga Chandler Hollow Interceptor	1982
Chickamauga Chandler Hollow Pumping Station and Force Main	1982
Chickamauga Chandler Hollow Outfall	--
Chickamauga Shields Crossroads Interceptor	1982
Chickamauga Presently Unsewered Portion of City	1979
Chickamauga Coke Oven Branch Collection System	1983
Chickamauga Long Hollow Collection System	1983
Chickamauga Shields Crossroads Collection System	1987
Chickamauga Chandler Hollow Collection System	1987
Chickamauga South Chickamauga Collection System	1987

TABLE IV-1

CONSTRUCTION ACTIVITIES UNDER THE NULL ALTERNATIVE (Continued)

Required Facilities	Implementation Date
JASPER 201 WASTEWATER FACILITIES PLANNING AREA	
Treatment Facilities	
Main Pumping Station	1979
Browder Switch Force Main	1979
Interceptor to Plant	1979
Jasper Wastewater Treatment Plant	1979
Outfall Line	1979
Engineering, Land, Legal and Administrative Contingencies, Etc.	--
Collection Systems	
Priority 2 System Interceptors	1979
Priority 3 - Browder Switch Collectors	1979
Priority 4 - South Pleasant Grove Area Collection System	1980
Priority 5 - Northeast Pleasant Grove Area Collection System	1980
Priority 6 - Northwest Pleasant Grove Area Collection System	1988
Priority 7 - West Jasper along Route 41	1990
DUNLAP 201 WASTEWATER FACILITIES PLANNING AREA	
Treatment Facilities	
Interceptor Sewer System and Lift Station	1979
Dunlap Wastewater Treatment Plant	1979
Engineering, Land, Legal and Administrative Contingencies, Etc.	--
Collection Systems	
Phase I	1978
Phase II	1983
Phase III	1983

TABLE IV-1

CONSTRUCTION ACTIVITIES UNDER
THE NULL ALTERNATIVE (Continued)

Required Facilities	Implementation Date
WHITWELL 201 WASTEWATER FACILITIES PLANNING AREA	
Treatment Facilities	
Whitwell, Tennessee, 201 Wastewater Treatment Plant	1981
Whitwell Interceptor System	1981
Powell's Crossroads Interceptor	1981
Engineering, Land, Legal and Administrative Contingencies, Etc.	--
Collection Systems	
Whitwell Collection System	1981
Powell's Crossroads	1981

SOURCE: Work Element 401, May 1977, CARCOG/SETDD 208 Study.

A pump station near Town Creek and Standifer Branch will also be constructed in conjunction with the treatment plant. Several other point source controls that will be assumed under the Null Alternative are outlined in the 201 Facilities Plan. These are briefly summarized below.

In order to provide adequate treatment of all wastewater flows in the 201 area, and to avoid environmental degradation from the use of septic tanks, interceptor sewers should be installed in various locations. Such sewers are most needed in the central business district and older areas of Jasper. It is estimated that over 100,000 feet of collection and service lines will be constructed in the immediate future. Increasingly heavy development in the Browder Switch area, along the western side of Jasper, and southern portion of Pleasant Grove Road will necessitate installation of over 18,000 feet (total) of collection lines in these areas. Problems with septic tanks have arisen in the Pleasant Grove and Hancock Road areas in recent years. Since heavy residential development is projected in these areas, construction of sewers seems imminent during the planning period. The Null Alternative assumes that all the above point source controls will be in operation within the next 20 years.

3. Dunlap 201 Planning Area

As stated in the introduction to this section, the Null Alternative assumes the provisions of any completed 201 plans and the construction of any proposed treatment plants. The Dunlap 201 plan has not been completed, but point source control options have been developed and a preliminary cost evaluation has been performed. It appears that the expansion and upgrading of the existing plant, using a trickling filter system, will be the most cost-effective means of providing adequate wastewater treatment. Two other alternatives have similar costs, however, and one may prove to be the optimum treatment system. These alternatives recommend the construction of a new aerated lagoon or trickling filter treatment facility. The Null Alternative for the Dunlap 201 area assumes that one of these three point source control options will be implemented.

4. Whitwell 201 Planning Area

There is no planning process currently underway for the Whitwell 201 area, but it is expected that a wastewater treatment facility will be in operation for this area by 1981. Under the Null Alternative, the city of Whitwell, the surrounding localities, and the Powell's Crossroads area will be sewered for connection to a 0.30 MGD biological treatment plant. The proposed location of this plant is in the southeastern portion of the city near the intersection of Highway 27 and the Sequatchie River. The various treatment options under consideration were described earlier in this chapter. The Null Alternative assumes implementation of one of these treatment schemes.

5. Summary

The municipal point source Null Alternative includes the following actions among its provisions:

- Expansion and upgrading of the Moccasin Bend Wastewater Treatment Plant to provide a regional treatment facility.

- Construction of nineteen interceptor sewers connecting outlying areas to the regional plant.

- The phasing out of six existing treatment plants upon completion of interceptor sewers.

- The construction of twenty pump stations as a part of the regionalization process.

Other point source controls to be carried out under the Null Alternative are the expansion and/or upgrading of five existing facilities and the construction of four new treatment plants. All of these measures will be implemented during the planning period and represent the provisions of all completed 201 plans.

D. PREFERRED MUNICIPAL POINT SOURCE AREAWIDE PLAN

The Preferred Municipal Point Source Areawide Plan, shown in Figure IV-2, for the CARCOG/SETDD 208 area was developed from a screening of the point source control options outlined earlier in this chapter. This evaluative process, performed in Work Task 902.3, was based on aesthetic, public health, socio-economic, resource conservation, and site selection considerations. The screened alternative judged to be the optimum pollution control mechanisms corresponded to those recommended in the completed 201 plans. Since implementation of these plans is assumed under the Null Alternative, the Preferred Municipal Point Source Areawide Plan provides for the same point source controls as the Municipal Point Source Null Alternative. These two strategies will therefore be considered identical. The provisions of the Plan will not be reiterated, but a summary of its proposed actions may be found in Table IV-2. Costs associated with implementation of the Plan are discussed in the following section.

E. REGIONAL PRIORITY DETERMINATION AND PROJECT COSTS

Implementation of the Preferred Municipal Point Source Areawide Plan will result in the completion of several construction activities that are also designated as having regional importance by the state of Tennessee Construction Grants Priority List. These activities include:

- Upgrading of Moccasin Bend treatment plant.

- Construction of Collegedale Collection System and Interceptors.

- Construction of Summit Interceptor.

- Completion of Red Bank Collection System.

- Construction of Signal Mountain Interceptor and completion of connecting collection system.

- Construction of Dunlap Sewage Treatment Plant and Interceptor.
- Construction of Hixson Interceptor and Pump Station.
- Construction of East Ridge Interceptor.
- Construction of Tiftonia Interceptor.
- Construction of East Brainerd Interceptor.
- Construction of S. Pleasant Grove Pump Station and collection system.

These pollution control mechanisms are presented in decreasing order of their priority ranking, ranging from the third highest ranked to number 304 on the state list. Construction of these priority-ranked point source controls will result in an estimated capital expenditure of $113,107,129, while the estimated capital expenditure involved in implementing the Preferred Municipal Point Source Areawide Plan is $375,869,119 (1976 dollars). This cost is broken down by 201 areas as follows:

201 Area	Capital Expenditure ($)
Chattanooga	364,756,609
Jasper	3,849,000
Dunlap	4,338,380
Whitwell	2,925,130

Of the total for the Chattanooga 201 area, $341,534,683 are associated with regionalization and $23,221,926 are earmarked for the development of independent systems.

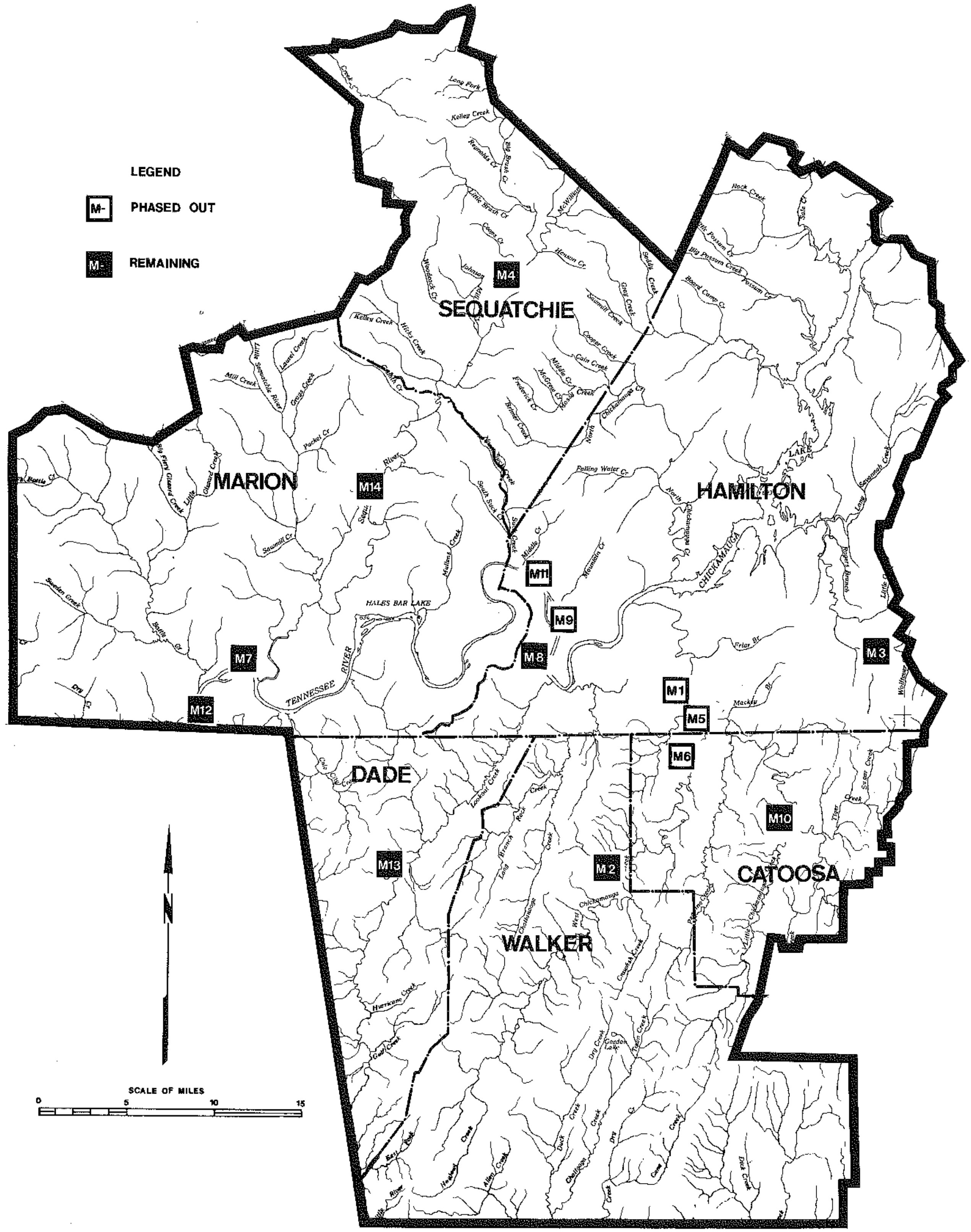


FIGURE IV-2
PREFERRED MUNICIPAL POINT SOURCE
AREAWIDE PLAN

TABLE IV-2

PROPOSED ACTIONS UNDER THE MUNICIPAL POINT SOURCE
PREFERRED AREAWIDE PLAN

Treatment Facility	Control Option			
	Expand	Upgrade	Construct	Phase Out
Moccasin Bend M-8	x	x		
East Ridge M-5				x
Ft. Oglethorpe M-6				x
So. Pittsburg* M-12				
Collegedale M-3	x			x
Brainerd M-1				x
Red Bank M-9				x
Signal Mtn.** M-11	x	x		x
Trenton M-13	x	x		
Chickamauga M-2	x	x		
Ringgold M-10			x	
Jasper M-7			x	
Dunlap M-4	x	x	x	
Whitwell M-14			x	

*The Preferred Plan does not include this existing facility in its provisions.

**Final decision has not been made.

CHAPTER V - INDUSTRIAL POINT SOURCE AREAWIDE PLAN

V
INDUSTRIAL POINT SOURCE AREAWIDE PLAN

The purpose of this chapter is to present the proposed industrial point source areawide plan for the CARCOG/SETDD 208 Study Area. Accompanying the documentation of the proposed plan will be a listing of the projected industrial flows for the years 1983 and 2000, and a description of the null alternative. Background data describing the inventory of existing industrial dischargers and their current state and NPDES permit limitations are presented in Tables III-4 through III-12 in Section D of Chapter III - Receiving Waters.

This discussion will also address the Clean Water Act of 1977, Public Law 95-217, and its impact upon effluent limitations for industrial discharges within the CARCOG/SETDD 208 Study Area. It should be noted that the overall objective of planning for the control and treatment of industrial wastewater within the CARCOG/SETDD 208 Study Area is to provide the most efficient approach for serving the present and future industrial needs of the area's industries.

A. THE NULL ALTERNATIVE

The null alternative for the CARCOG/SETDD 208 Plan was initially developed for the industrial point source component of the plan based upon meeting the applicable requirements of Sections 204, 301, 304, 306, 307, and 316 of the Water Pollution Control Act Amendments of 1972 (Public Law 92-500). Specifically, industrial wastewater treatment must comply with the minimum treatment requirements for Best Practicable Control Technology (BPT) and Best Available Technology Economically Achievable (BAT) by 1977 and 1983, respectively. Direct discharge of industrial wastes to receiving waters must comply, at a minimum, with the provisions of the pertinent Effluent Limitations Guidelines and New Source Performance Standards. Higher treatment levels or internal waste load reductions will be required where BAT requirements do not meet water quality standards. Industries served by municipal systems must comply with pretreatment and cost recovery requirements.

Table V-1 lists the CARCOG/SETDD 208 industries and their projected 1983 and 2000 flows. These flow projections were made from a review of the following:

- NPDES permits
- EPA effluent guideline documents
- Monitoring Reports
- Employment data presented in the CARCOG/SETDD Regional Development Plan - 2000

A growth rate of one percent per year was utilized for projecting the flows for the area's industries. This figure was based upon anticipated economic development for the CARCOG/SETDD 208 Study Area. Treated effluent from each of these upgraded industrial treatment facilities would be discharged directly to their current receiving streams.

TABLE V-1
FLOW PROJECTIONS FOR INDUSTRIAL DISCHARGERS IN THE
CARCOG/SETDD 208 STUDY AREA

Discharger Number	Industry	1975 Aver. Flow (MGD)	1983 Aver. Flow (MGD)	2000 Aver. Flow (MGD)
I-1	Accu-Cast, Inc.	0.0021	0.0023	0.0026
I-2	Accu-Cast, Inc.	0.0001	0.0001	0.0001
I-3	Acheson Foundry & Machine Works	0.02	0.0216	0.025
I-4	ALC, Inc.	0.040	0.0432	0.05
I-5	Alco Chemical Co. Inc.	0.150	0.162	0.1875
I-6	Alloy Fabricators	0.011	0.0119	0.0138
I-7	American Cyanamid	None	--	--
I-8	American Cyanamid	Varies	--	--
I-9	American Electrical Industries	0.250	0.270	0.3125
I-10	American Oil Co. (Chattanooga Barge Terminal)	0.05	0.054	0.0625
I-11	American Oil Co. (Chattanooga Pipeline Terminal)	0.001	0.0011	0.0013
I-12	Atlas Paper Box Co.	0.0058	0.0063	0.0073
I-13	BHY Concrete Finishing Inc.	0.002	0.0022	0.0025
I-14	Central Soya Co., Inc.	0.11	0.1188	0.1375
I-15	C. F. Industries Inc.	0.968	1.045	1.210
I-16	Chattanooga Boiler and Tank Co.	0.0391	0.0422	0.0489
I-17	Chattanooga Gas Co. LPG Storage	0.020	0.0216	0.025
I-18	Chattanooga Gas Co. LPG Storage	0.030	0.0324	0.0375
I-19	Chattanooga Coke & Chemical Co.	Varies	--	--

TABLE V-1
FLOW PROJECTIONS FOR INDUSTRIAL DISCHARGERS IN THE
CARCOG/SETDD 208 STUDY AREA (Continued)

Discharger Number	Industry	1975 Aver. Flow (MGD)	1983 Aver. Flow (MGD)	2000 Aver. Flow (MGD)
I-20	Chattem Drug and Chemical Co.	0.6	0.648	0.75
I-21	TVA Chickamauga Dam Hydro Plant	Varies	--	--
I-22	Cities Service Oil Co.	0.001	0.0011	0.0013
I-23	Clowes Ceramic Division	0.02	0.0216	0.025
I-24	Cobble Muse Hosiery	Varies	--	--
I-25	Colonial Pipeline	Varies	--	--
I-26	Combustion Engineering, Inc.	0.120	0.1296	0.15
I-27	Consolidated Latex Co.	0.001	0.0011	0.0013
I-28	Crane Co. Chatt. Div.	0.260	0.281	0.325
I-29	Cutter Labs, Inc.	0.01	0.0108	0.0125
I-30	Dallas Car Wash	0.0028	0.003	0.0035
I-31	Dept. of Defense Volunteer Army Amunition Plant	3.0	3.24	3.75
I-32	Dixie Sand & Gravel Co.	0.760	0.8208	0.95
I-33	Dixie Yarns, Inc., Lupton City Plant	0.30	0.324	0.375
I-34	E.I. duPont de Nemours & Co.	2.76	2.9808	3.45
I-35	E.I. duPont de Nemours & Co.	9.0	9.72	11.25
I-36	E.I. duPont de Nemours & Co.	0.14	0.1512	0.175
I-37	East Brainerd Wishy-Washy	0.010	0.0108	0.0125
I-38	Ernest Holmes Co., Div. of Dover Corp.	0.0007	0.0008	0.0009
I-39	Exxon Co. (Pipeline Terminal)	Varies	--	--
I-40	Fibron, Inc.	0.048	0.0518	0.06

TABLE V-1
FLOW PROJECTIONS FOR INDUSTRIAL DISCHARGERS IN THE
CARCOG/SETDD 208 STUDY AREA (Continued)

Discharger Number	Industry	1975 Aver. Flow (MGD)	1983 Aver. Flow (MGD)	2000 Aver. Flow (MGD)
I-41	GAF Corporation	0.300	0.324	0.375
I-42	General Crushed Stone	Varies	--	--
I-43	General Oils	0.0004	0.0004	0.0005
I-44	General Portland, Inc. Signal Mtn. Div.	1.600	1.728	2.0
I-45	General Shale	0.0072	0.0078	0.009
I-46	Godsey's Automotive Shop	Varies	--	--
I-47	Hamilton Co. Nursing Home	0.004	0.0043	0.005
I-48	Hamilton Co. Nursing Home	0.064	0.0691	0.08
I-49	Harrison Bay Park	0.0015	0.0016	0.0019
I-50	Stacy Oil Company	0.0025	0.0027	0.0031
I-51	Hixson Coin Laundry	0.0025	0.0027	0.0031
I-52	Independent Enterprises, Inc. Hwy. 58 Shopping Center	0.001	0.0011	0.0013
I-53	Kay's Ice Cream, Inc.	0.0050	0.0054	0.0063
I-54	Koehring Southern Co., Lorain Division	0.0010	0.0011	0.0013
I-55	L & N Railroad Co. Wauhatchie Yards	Varies	--	--
I-56	L & N Railroad Co. Wauhatchie Yards	0.010	0.0011	0.0013
I-57	Lutex Chemical Corp.	Varies	--	--
I-58	McDowell Development Corp. (P.B. & S. Chemicals)	0.01	0.0108	0.0125
I-59	McKee Baking Co.	0.045	0.0486	0.0563
I-60	Missouri Portland Cement Co.	0.04	0.0432	0.05
I-61	Mueller Company	0.001	0.0011	0.0013

TABLE V-1
FLOW PROJECTIONS FOR INDUSTRIAL DISCHARGERS IN THE
CARCOG/SETDD 208 STUDY AREA (Continued)

Discharger Number	Industry	1975 Aver. Flow (MGD)	1983 Aver. Flow (MGD)	2000 Aver. Flow (MGD)
I-62	North River YMCA	0.0004	0.0004	0.0005
I-63	Norton Company	0.0007	0.0008	0.0009
I-64	Polysar Latex, Inc.	0.067	0.0724	0.0838
I-65	Provident Life & Accident Insurance Co.	0.002	0.0022	0.0025
I-66	Thrifty Way Car Wash No. 1	0.0028	0.003	0.0035
I-67	Racket Club Swimming Pool	0.1	0.108	0.125
I-68	Rockwell International Rockwell Std. Div.	Varies	--	--
I-69	Rock-Tenn. Co. Mill Div.	0.137	0.1480	0.1713
I-70	Roper Corp. Chattanooga Div.	0.06	0.0648	0.075
I-71	Roper Corp. Chattanooga Div.	0.02	0.0216	0.025
I-72	Roy's Car Wash	0.0028	0.0030	0.0035
I-73	Sequoyah Nuclear Plant	55.8	60.264	69.75
I-74	Sequoyah Nuclear Plant	Varies	--	--
I-75	Sequoyah Nuclear Plant	--	--	--
I-76	Sha-Rue Co.	0.0028	0.0030	0.0035
I-77	Selox, Inc.	0.0001	0.0001	0.0001
I-78	Shell Oil Company	0.0003	0.0003	0.0004
I-79	Southern Cellulose (Water Plant)	Varies	--	--
I-80	Southern Oil Service	0.001	0.0011	0.0013
I-81	Southern Wood Piedmont Co.	Varies	--	--
I-82	Stainless Metal Products Co.	0.012	0.013	0.015
I-83	Stainless Metal Products Co.	0.0004	0.0004	0.0005

TABLE V-1
FLOW PROJECTIONS FOR INDUSTRIAL DISCHARGERS IN THE
CARCOG/SETDD 208 STUDY AREA (Continued)

Discharger Number	Industry	1975 Aver. Flow (MGD)	1983 Aver. Flow (MGD)	2000 Aver. Flow (MGD)
I-84	Texaco, Inc. Barge Terminal	0.0002	0.0002	0.0003
I-85	U.S. Army Reserve	Varies	--	--
I-86	U.S. Pipe & Foundry Corp., Soil Pipe Div.	0.255	0.2754	0.3188
I-87	U.S. Pipe & Foundry Corp., Pressure Pipe Div.	0.180	0.1944	0.225
I-88	U.S. Pipe & Foundry Corp., Pressure Pipe Div.	0.080	0.0864	0.1
I-89	U.S. Stove	0.027	0.0292	0.0338
I-90	Velsicol Chemical Corp.	Varies	--	--
I-91	Vulcan Materials Co., Chattanooga	12.6	13.608	15.75
I-92	Wauhatchie Washie	0.0064	0.0069	0.008
I-93	Wheland Foundry, Div. of N. American Royalties	Varies	--	--
I-94	Blue Springs Trout Farm	--	--	--
I-95	Economy Cleaners	0.0058	0.0063	0.0073
I-96	Gamble Construction Co.	--	--	--
I-97	General Portland, Inc., S.E. Division	0.216	0.2333	0.27
I-98	Hales Maytag Laundry	0.011	0.0119	0.0138
I-99	Marion Sand & Gravel Co.	1.15	1.242	1.4375
I-100	National Waste Oil Control, Inc.	0.04	0.0432	0.05
I-101	U.S. TVA Nickajack Hydro Plant	--	--	--
I-102	Penn. Dixie Cement Co.	0.040	0.0432	0.05

TABLE V-1
FLOW PROJECTIONS FOR INDUSTRIAL DISCHARGERS IN THE
CARCOG/SETDD 208 STUDY AREA (Continued)

Discharger Number	Industry	1975 Aver. Flow (MGD)	1983 Aver. Flow (MGD)	2000 Aver. Flow (MGD)
I-103	Powells Crossroads Laundry	0.0008	0.0009	0.001
I-104	Tenn. Consolidated Coal Co. (Dogwood Flat)	0.07	0.0756	0.0876
I-105	Tenn. Consolidated (Grundy Mining #21)	Varies	--	--
I-106	Tenn. Consolidated (Va. Mining Co. #18)	Varies	--	--
I-107	Tenn. Consolidated (Marion Coal Co. #29)	Varies	--	--
I-108	Tennessee Alloys Co. (TAC Alloys)	0.012	0.013	0.015
I-109	Tennessee Alloys Co. (TAC Alloys)	Varies	--	--
I-110	Vulcan Materials Co. (Quarry #20)	Varies	--	--
I-111	Earl Patton Coal Co. (Area #31)	Varies	--	--
I-112 to I-117	Tennessee Consolidated Coal Co. (Chestnut #23, Grundy #24, Grundy #28, Grundy #30, Walnut Coal #25, Mary Lee #27)	Varies	--	--
I-118	Texaco Dunlap Terminal	0.0002	0.0002	0.0003
I-119	Acuff Meat Processing Plant	0.0005	0.0005	0.0006
I-120	Alton Box Board	0.0125	0.0135	0.0156
I-121	E.T. Barwick Industries, Inc.	0.900	0.972	1.125
I-122	Cole Steel Drum Co.	0.0010	0.0011	0.0013
I-123	(Candlewick and Turbo Div.)	0.0105	0.0113	0.0131
I-124	(Candlewick and Turbo Div.)	0.0423	0.0457	0.0529
I-125	W.L. Jackson Mfg. Co.	0.03	0.0324	0.0375

TABLE V-1
FLOW PROJECTIONS FOR INDUSTRIAL DISCHARGERS IN THE
CARCOG/SETDD 208 STUDY AREA (Continued)

Discharger Number	Industry	1975 Aver. Flow (MGD)	1983 Aver. Flow (MGD)	2000 Aver. Flow (MGD)
I-126	Quik Thrift Car Wash	0.002	0.0022	0.0025
I-127	Reichhold Polymers, Inc.	0.058	0.0626	0.0725
I-128	Salem Carpet Mills, Inc.	0.015	0.0162	0.0188
I-129	Southern Energy Resources (Mines 2 & 6)	--	--	--
I-130	Southern Metal Products Corp.	0.0001	0.0001	0.0001
I-131	Standard Brands Chemical Ind.	0.15	0.162	0.1875
I-132	Standard Brands Chemical Ind.	0.85	0.918	1.0625
I-133	Sweetwater Carpet Corp.	0.05	0.054	0.0625
I-134	Sweetwater Carpet Corp.	None	--	--
I-135	Sweetwater Carpet Corp.	None	--	--
I-136	Union Oil, Ringgold	0.01	0.0108	0.0125
I-137	Yates Bleachery Company	0.60	0.648	0.75

Additionally, the development of the null alternative included the evaluation of projected industrial waste loads. This effort posed a major problem since the BAT guidelines have not been promulgated by the U.S. EPA for a significant segment of the industries in the CARCOG/SETDD 208 Study Area. Therefore in order to evaluate the impact of BAT guidelines on industrial waste loads to the study area's streams, effluent loading factors for selected industrial sectors were developed and are presented in Table V-2. These loadings were developed from EPA's effluent guidelines for those industrial categories which currently have promulgated BAT guidelines. In addition, proposed BAT guidelines were included in Table V-2 for the Iron and Steel Manufacturing Industry The assumption was made that the BAT effluent limitations would be met by all industrial sectors by 1983. An estimate of the BPT load remaining in the years 1983 and 2000 was calculated based on the projected economic growth information as follows:

$$\text{Percent of BPT Load Remaining in 1983} = \frac{1.06 \times \text{BAT load}}{\text{BPT load}}$$

$$\text{Percent of BPT Load Remaining in 2000} = \frac{1.20 \text{ X BAT load}}{\text{BPT load}}$$

A perusal of Table V-2 indicates that the implementation of BAT guidelines will result in significant reductions in the pollutant discharge rates in virtually every industrial category. The null alternative assumes that these reductions will take place within the planning period. It should be noted that the percent of BPT load remaining is based upon the anticipated industrial growth rate of one percent per year as noted above. This information is provided to show that implementation of the federal guidelines governing industrial point source discharges will result in a significant improvement relative to the pollutional load being discharged to the area's receiving streams.

The information presented above was developed to define the null alternative for industrial point sources. However, this data was developed prior to the passage of the Clean Water Act of 1977 (Public Law 95-217). This Act significantly altered the requirements applicable to industrial point sources. Therefore, the following discussion outlines the Clean Water Act of 1977 and examines its impacts on the industries within the CARCOG/SETDD 208 Study Area.

Under the Clean Water Act of 1977, Public Law 95-217, pollutants discharged by industrial point sources are divided into three broad classifications, conventional pollutants, toxics, and nonconventional pollutants. The Act defines conventional pollutants as biological oxygen demanding substances, suspended solids, fecal coliforms, and pH. All industrial treatment systems will be required to implement best conventional pollutant control technology (BCT) for the conventional pollutants by July 1, 1984. Effluent limitations in excess of BCT are required in situations where BCT controls will not achieve compliance with the applicable water quality standards.

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Iron & Steel Manufacturing	By-Product Coke	40 CFR 20 Subpart A	Ammonia	0.0912 lb/1000 lb	0.0042 lb/1000 lb	4.88	5.53
			Cyanide	0.0219 lb/1000 lb	---	--	--
			Oil & Grease	0.0109 lb/1000 lb	0.0042 lb/1000 lb	40.84	46.24
			Phenol	0.0015 lb/1000 lb	0.0002 lb/1000 lb	14.13	16.00
			TSS	0.0365 lb/1000 lb	0.0104 lb/1000 lb	30.20	34.19
			Sulfide	---	0.0001 lb/1000 lb	--	--
			Cyanide A	---	0.0001 lb/1000 lb	--	--
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Sintering	Subpart C	TSS	0.0104 lb/1000 lb	0.0052 lb/1000 lb	53.00	60.00
			Oil & Grease	0.0021 lb/1000 lb	0.0021 lb/1000 lb	100.60	120.00
			Sulfide	---	0.00006 lb/1000 lb	--	--
			Fluoride	---	0.0042 lb/1000 lb	--	--
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Blast Furnace (Iron)	Subpart D	TSS	0.0260 lb/1000 lb	0.0130 lb/1000 lb	53.00	60.00
			Cyanide	0.0078 lb/1000 lb	---	--	--
			Cyanide A	---	0.00013 lb/1000 lb	--	--
			Phenol	0.0021 lb/1000 lb	0.00026 lb/1000 lb	13.12	14.86
			Ammonia	0.0651 lb/1000 lb	0.0052 lb/1000 lb	8.47	9.59
			Sulfide	---	0.00016 lb/1000 lb	--	--
			Fluoride	---	0.0104 lb/1000 lb	--	--
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Basic Oxygen Furnace	Subpart G	TSS	0.0104 lb/1000 lb	0.0052 lb/1000 lb	53.00	60.00
			Fluoride	---	0.0042 lb/1000 lb	--	--
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Iron & Steel Manufacturing (Continued)	Open Hearth Furnace	Subpart H	TSS	0.0104 lb/1000 lb	0.0052 lb/1000 lb	53.00	60.00
			Fluoride	---	0.0042 lb/1000 lb	--	--
			Nitrate	---	0.0094 lb/1000 lb	--	--
			Zinc	---	0.0010 lb/1000 lb	--	--
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Continuous Casting	Subpart L	TSS	0.0260 lb/1000 lb	0.0052 lb/1000 lb	21.20	24.00
			Oil & Grease	0.0078 lb/1000 lb	0.0052 lb/1000 lb	70.67	80.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Hot Forming-Primary Subcategory	Subpart M*	TSS	0.1250 lb/1000 lb	0.0104 lb/1000 lb	8.82	9.98
			Oil & Grease	0.0375 lb/1000 lb	0.0042 lb/1000 lb	11.87	13.44
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Hot Forming-Section Subcategory	Subpart N*	TSS	0.6251 lb/1000 lb	0.0156 lb/1000 lb	26.45	29.94
			Oil & Grease	0.1875 lb/1000 lb	0.0063 lb/1000 lb	3.56	4.03
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Hot Forming-Flat Subcategory	Subpart O* Operations Producing Plate	TSS	0.8335 lb/1000 lb	0.0156 lb/1000 lb	1.98	2.24
			Oil & Grease	0.2500 lb/1000 lb	0.0063 lb/1000 lb	2.67	2.83
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
		Subpart O* Flat Products	TSS	1.1468 lb/1000 lb	0.0156 lb/1000 lb	1.44	1.53
			Oil & Grease	0.3440 lb/1000 lb	0.0063 lb/1000 lb	1.94	1.53
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Pipe & Tube Subcategory	Subpart P*	TSS	0.2605 lb/1000 lb	0.0156 lb/1000 lb	6.35	7.19
			Oil & Grease	0.0781 lb/1000 lb	0.0063 lb/1000 lb	8.55	9.68
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

*Proposed Guidelines

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Iron & Steel Manufacturing (Continued)	Pickling-Sulfuric Acid Batch	Subpart Q* Spent Pickling Solutions	Iron	0.00015 lb/1000 lb	No discharge	0.00	0.00
			TSS	0.0073 lb/1000 lb	No discharge	0.00	0.00
			pH	6.0 to 9.0	No discharge	0.00	0.00
		Subpart Q* Rinsing Operations	Iron	0.00083 lb/1000 lb	No discharge	0.00	0.00
			Oil & Grease	0.0083 lb/1000 lb	No discharge	0.00	0.00
			TSS	0.0417 lb/1000 lb	No discharge	0.00	0.00
			pH	6.0 to 9.0	No discharge	0.00	0.00
	Pickling-Hydrochloric Acid Batch and Continuous	Subpart R* Spent Pickling Solutions in Concentrated Form	Iron	0.00013 lb/1000 lb	0.00013 lb/1000 lb	106.00	120.00
			TSS	0.0063 lb/1000 lb	0.0031 lb/1000 lb	52.16	55.29
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
		Subpart R* Pickling with HCl regeneration	Iron	0.00083 lb/1000 lb	0.00013 lb/1000 lb	16.60	18.79
			Oil & Grease	0.0083 lb/1000 lb	0.0013 lb/1000 lb	16.60	18.79
			TSS	0.0417 lb/1000 lb	0.0031 lb/1000 lb	7.88	8.92
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
		Subpart R* Pickling Rinsing Operations	Iron	0.00083 lb/1000 lb	0.00021 lb/1000 lb	26.82	30.36
			Oil & Grease	0.0083 lb/1000 lb	0.0021 lb/1000 lb	26.82	30.36
			TSS	0.0417 lb/1000 lb	0.0052 lb/1000 lb	13.22	14.97
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

*Proposed Guidelines

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Iron & Steel Manufacturing (Continued)	Pickling-Hydrochloric Acid Batch and Continuous (Continued)	Subpart R* Pickling with Wet Fume Hood	Iron	0.00021 lb/1000 lb	0.00021 lb/1000 lb	106.00	120.00
			Oil & Grease	0.0021 lb/1000 lb	0.0021 lb/1000 lb	106.00	120.00
			TSS	0.0104 lb/1000 lb	0.0052 lb/1000 lb	53.00	60.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Cold Rolling	Subpart S* Recircula-tion	Oil & Grease	0.00104 lb/1000 lb	0.00104 lb/1000 lb	106.00	120.00
			TSS	0.0026 lb/1000 lb	0.0026 lb/1000 lb	106.00	120.00
			Iron	0.00011 lb/1000 lb	0.000104 lb/1000 lb	100.22	113.46
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
		Subpart S* Operating Mode Combinations	Oil & Grease	0.0167 lb/1000 lb	0.0167 lb/1000 lb	106.00	120.00
			TSS	0.0417 lb/1000 lb	0.0417 lb/1000 lb	106.00	120.00
			Iron	0.00167 lb/1000 lb	0.00167 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
		Subpart S* Direct Application	Oil & Grease	0.0417 lb/1000 lb	0.0417 lb/1000 lb	106.00	120.00
			TSS	0.1042 lb/1000 lb	0.1042 lb/1000 lb	106.00	120.00
			Iron	0.0042 lb/1000 lb	0.0042 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Hot Coatings Galvanizing	Subpart T*	Oil & Grease	0.0375 lb/1000 lb	0.0042 lb/1000 lb	11.87	13.44
			TSS	0.1250 lb/1000 lb	0.0104 lb/1000 lb	8.82	9.98
			Zinc	0.0125 lb/1000 lb	0.00083 lb/1000 lb	7.04	7.97
			Chromium	0.0075 lb/1000 lb	0.000084 lb/1000 lb	1.19	1.35
			Hexa. Chrom.	0.00005 lb/1000 lb	0.000008 lb/1000 lb	16.96	19.20
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

*Proposed Guidelines

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Iron & Steel Manufacturing (Continued)	Hot Coatings Galvanizing (Continued)	Subpart T* Wet Fume Scrubber	Oil & Grease	0.0375 lb/1000 lb	0.0063 lb/1000 lb	17.81	20.16
			TSS	0.1250 lb/1000 lb	0.0156 lb/1000 lb	13.23	14.98
			Zinc	0.0125 lb/1000 lb	0.00125 lb/1000 lb	10.60	12.00
			Chromium	0.0075 lb/1000 lb	0.000126 lb/1000 lb	1.78	2.02
			Hexa. Chrom.	0.00005 lb/1000 lb	0.000013 lb/1000 lb	27.56	31.2
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Hot Coatings Terne	Subpart U*	Oil & Grease	0.0375 lb/1000 lb	0.0042 lb/1000 lb	11.87	13.44
			TSS	0.1250 lb/1000 lb	0.0104 lb/1000 lb	8.32	9.42
			Lead	0.00125 lb/1000 lb	0.000104 lb/1000 lb	8.32	9.42
			Tin	0.0125 lb/1000 lb	0.00083 lb/1000 lb	7.04	7.97
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
		Subpart U* Wet Fume Hood	Oil & Grease	0.0375 lb/1000 lb	0.0063 lb/1000 lb	17.81	20.16
			TSS	0.1250 lb/1000 lb	0.0156 lb/1000 lb	13.23	14.98
			Lead	0.00125 lb/1000 lb	0.000156 lb/1000 lb	13.23	13.23
			Tin	0.0125 lb/1000 lb	0.00125 lb/1000 lb	10.60	12.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Miscellaneous Runoff	Subpart V* Casting of Slagging Operation	TSS	---	No discharge	--	--
			pH	---	No discharge	--	--
		Subpart V* Coal, Limestone & Ore Storage Pile	TSS	---	25 mg/l	--	--
			pH	---	6.0 to 9.0	--	--

*Proposed Guidelines

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Iron & Steel Manufacturing (continued)	Cooling Water Blowdown	Subpart W*	Phosphorus	8 mg/l	8 mg/l	106.00	120.00
			Chromium	3.0 mg/l	0.2 mg/l	7.07	8.00
			Hexa. Chrom.	0.02 mg/l	0.02 mg/l	106.00	120.00
			TSS	50 mg/l	25 mg/l	53.00	60.00
			Zinc	5.0 mg/l	2.0 mg/l	42.40	48.00
	Utility Blowdown	Subpart X*	TSS	50 mg/l	25 mg/l	53.00	60.00
	Maintenance Department	Subpart Y*	Oil & Grease	15 mg/l	10 mg/l	70.67	80.00
			TSS	50 mg/l	25 mg/l	53.00	60.00
	Central Treatment	Subpart Z*	Dissolved Iron	1 mg/l	1 mg/l	106.00	120.00
			Oil & Grease	15 mg/l	10 mg/l	70.67	80.00
			TSS	50 mg/l	25 mg/l	53.00	60.00
			Zinc	5 mg/l	2 mg/l	42.40	48.00
			Hexa. Chrom.	0.02 mg/l	0.02 mg/l	106.00	120.00
			Chromium	0.3 mg/l	0.2 mg/l	70.67	80.00
			Phosphorus	8 mg/l	8 mg/l	106.00	120.00

*Proposed Guidelines

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Petroleum Refining	Topping	40 CFR 419	BOD_5	4.25 lb/1000 bbl	0.75 lb/1000 bbl	18.71	21.17
		Subpart A	TSS	3.6 lb/1000 bbl	0.75 lb/1000 bbl	22.08	25.00
		Point	COD	21.3 lb/1000 bbl	2.8 lb/1000 bbl	13.93	15.77
		Source	Oil & Grease	1.3 lb/1000 bbl	0.14 lb/1000 bbl	11.41	12.92
			Phenolic	0.027 lb/1000 bbl	0.0031 lb/1000 bbl	12.17	13.78
			Ammonia	0.45 lb/1000 bbl	0.18 lb/1000 bbl	42.40	48.00
			Sulfide	0.024 lb/1000 bbl	0.015 lb/1000 bbl	66.25	75.00
			Total Chrom.	0.071 lb/1000 bbl	0.037 lb/1000 bbl	55.24	62.54
			Hexa. Chrom.	0.0044 lb/1000 bbl	0.00062 lb/1000 bbl	14.94	16.91
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Topping	Subpart A	BOD_5	0.21 lb/1000 gal	0.071 lb/1000 gal	35.84	40.57
		Runoff	TSS	0.17 lb/1000	0.071 lb/1000 gal	44.27	50.12
			COD	1.6 lb/1000 gal	0.19 lb/1000 gal	12.59	14.25
			Oil & Grease	0.067 lb/1000 gal	0.014 lb/1000 gal	22.15	25.07
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Topping	Subpart A	BOD_5	0.21 lb/1000 gal	0.071 lb/1000 gal	35.84	40.57
		Ballast	TSS	0.17 lb/1000 gal	0.071 lb/1000 gal	44.27	50.12
			COD	2.0 lb/1000 gal	0.26 lb/1000 gal	13.78	15.60
			Oil & Grease	0.067 lb/1000 gal	0.014 lb/1000 gal	22.15	25.07
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Lube	Subpart D	BOD_5	9.1 lb/1000 bbl	2.2 lb/1000 bbl	25.63	29.01
			TSS	8.0 lb/1000 bbl	2.2 lb/1000 bbl	29.15	33.00
			COD	66 lb/1000 bbl	11.0 lb/1000 bbl	17.67	20.00
			Oil & Grease	3.0 lb/1000 bbl	0.4 lb/1000 bbl	14.13	16.00

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Petroleum Refining (Continued)	Lube (Continued)	Subpart D (Continued)	Phenolic	0.065 lb/1000 bbl	0.0087 lb/1000 bbl	14.19	16.06
			Ammonia	3.8 lb/1000 bbl	1.5 lb/1000 bbl	41.84	47.37
			Sulfide	0.053 lb/1000 bbl	0.035 lb/1000 bbl	70.00	79.25
			Total Chrom.	0.160 lb/1000 bbl	0.11 lb/1000 bbl	72.88	82.5
			Hexa. Chrom.	0.011 lb/1000 bbl	0.0018 lb/1000 bbl	17.35	19.64
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
Cement Manufacturing	Leaching	40 CFR 411 Subpart B	TSS	0.4 lb/100 lb dust	0.005 lb/1000 lb dust	1.33	1.50
			Temperature	3°C rise	3°C rise	Same	Same
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
Nonferrous Metals	Primary Lead	40 CFR 421 Subpart G	TSS	0.021 lb/1000 lb	0.021 lb/1000 lb	106.00	120.00
			Cadmium	0.0004 lb/1000 lb	0.0004 lb/1000 lb	106.00	120.00
			Lead	0.0004 lb/1000 lb	0.0004 lb/1000 lb	106.00	120.00
			Zinc	0.004 lb/1000 lb	0.004 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
Soaps & Detergents	Fatty Acid	40 CFR 417 Subpart B Point Source	BOD_5	1.2 lb/1000 lb	0.25 lb/1000 lb	22.08	25.00
			COD	3.3 lb/1000 lb	0.90 lb/1000 lb	28.90	32.72
			TSS	2.2 lb/1000 lb	0.20 lb/1000 lb	9.63	10.90
			Oil & Grease	0.3 lb/1000 lb	0.15 lb/1000 lb	53.00	60.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Fatty Acid	Subpart B Fatty Acid Hydrogenation	BOD_5	0.15 lb/1000 lb	0.15 lb/1000 lb	106.00	120.00
			COD	0.25 lb/1000 lb	0.25 lb/1000 lb	106.00	120.00
			TSS	0.10 lb/1000 lb	0.10 lb/1000 lb	106.00	120.00
			Oil & Grease	0.10 lb/1000 lb	0.10 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Soaps & Detergents (Continued)	Soap Manufacturing by Fatty Acid Neutral.	Subpart C	BOD_5	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			COD	0.05 lb/1000 lb	0.05 lb/1000 lb	106.00	120.00
			TSS	0.02 lb/1000 lb	0.02 lb/1000 lb	106.00	120.00
			Oil & Grease	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Glycerine Concentration	Subpart D	BOD_5	1.5 lb/1000 lb	0.4 lb/1000 lb	28.27	32.00
			COD	4.5 lb/1000 lb	1.2 lb/1000 lb	28.27	32.00
			TSS	0.2 lb/1000 lb	0.1 lb/1000 lb	53.00	60.00
			Oil & Grease	0.1 lb/1000 lb	0.04 lb/1000 lb	42.40	48.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Glycerine Distillation	Subpart E	BOD_5	0.5 lb/1000 lb	0.3 lb/1000 lb	63.60	72.00
			COD	1.5 lb/1000 lb	0.9 lb/1000 lb	63.60	72.00
			TSS	0.2 lb/1000 lb	0.04 lb/1000 lb	21.20	24.00
			Oil & Grease	0.1 lb/1000 lb	0.02 lb/100 lb	21.20	24.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Soap Flakes & Powders	Subpart F	BOD_5	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			COD	0.05 lb/1000 lb	0.05 lb/1000 lb	106.00	120.00
			TSS	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			Oil & Grease	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Bar Soaps	Subpart G	BOD_5	0.34 lb/1000 lb	0.20 lb/1000 lb	62.35	70.59
			COD	0.85 lb/1000 lb	0.60 lb/1000 lb	74.82	84.71
			TSS	0.58 lb/1000 lb	0.34 lb/1000 lb	62.14	70.35
			Oil & Grease	0.04 lb/1000 lb	0.03 lb/1000 lb	79.50	90.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Soaps & Detergents (Continued)	Liquid Soaps	Subpart H	BOD_5	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			COD	0.05 lb/1000 lb	0.05 lb/1000 lb	106.00	120.00
			TSS	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			Oil & Grease	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Air-SO_3 Sulfation and Sulfonation	Subpart J	BOD_5	0.3 lb/1000 lb	0.19 lb/1000 lb	67.13	76.00
			COD	1.35 lb/1000 lb	0.55 lb/1000 lb	43.19	48.89
			TSS	0.03 lb/1000 lb	0.02 lb/1000 lb	70.67	80.00
			Surfactants	0.30 lb/1000 lb	0.18 lb/1000 lb	63.60	72.00
			Oil & Grease	0.05 lb/1000 lb	0.04 lb/1000 lb	84.80	96.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Neutralization of Sulfuric Acid Esters and Sulfonic Acids	Subpart N	BOD_5	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			COD	0.05 lb/1000 lb	0.05 lb/1000 lb	106.00	120.00
			TSS	0.03 lb/1000 lb	0.03 lb/1000 lb	106.00	120.00
			Surfactants	0.02 lb/1000 lb	0.02 lb/1000 lb	106.00	120.00
			Oil & Grease	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
	Spray Dried Detergents	Subpart O Normal Operations	BOD_5	0.01 lb/1000 lb	0.01 lb/1000 lb	106.00	120.00
			COS	0.05 lb/1000 lb	0.04 lb/1000 lb	84.80	96.00
			TSS	0.02 lb/1000 lb	0.02 lb/1000 lb	106.00	120.00
			Surfactants	0.02 lb/1000 lb	0.02 lb/1000 lb	106.00	120.00
			Oil & Grease	0.005 lb/1000 lb	0.005 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

TABLE V-2: BPT AND BAT EFFLUENT LOADING FACTORS FOR SELECTED INDUSTRIAL SECTORS FOR THE CARCOG/SETDD 208 STUDY AREA (Continued)

Industrial Category	Subcategory	Effluent Guidelines	Parameter	After BPT (30 Day Aver.)	After BAT (30 Day Aver.)	Percent of BPT Load Remaining in 1983	Percent of BPT Load Remaining in 2000
Soaps & Detergents (Continued)	Liquid Detergents	Subpart P	BOD_5	0.2 lb/1000 lb	0.05 lb/1000 lb	26.50	30.00
		Normal	COD	0.6 lb/1000 lb	0.22 lb/1000 lb	38.87	44.00
		Operations	TSS	0.005 lb/100 lb	0.005 lb/1000 lb	106.00	120.00
			Surfactants	0.13 lb/100 lb	0.05 lb/1000 lb	40.77	46.15
			Oil & Grease	0.005 lb/1000 lb	0.0005 lb/1000 lb	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
Grain Mills	Corn Wet Milling	40 CFR 406	BOD_5	50 lb/1000 lb	20 lb/1000 lb	42.40	48.00
		Subpart A	TSS	50 lb/1000 lb	10 lb/1000 lb	21.20	24.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same
Steam Electric Power	Old Unit	40 CFR 423	Zinc	---	1.0 mg/l	--	--
		Subpart C	Chromium	---	0.2 mg/l	--	--
			Phosphorus	---	5.0 mg/l	--	--
			TSS	30 mg/l	30 mg/l	106.00	120.00
			Oil & Grease	15 mg/l	15 mg/l	106.00	120.00
			Copper	1.0 mg/l	1.0 mg/l	106.00	120.00
			Iron	1.0 mg/l	1.0 mg/l	106.00	120.00
			pH	6.0 to 9.0	6.0 to 9.0	Same	Same

Effluent limitations for toxic substances will be determined by the implementation of BAT guidelines. The initial list of toxics covered by the Act is the one referred to in Table 1 of Committee Print Number 95-30 of the Committee on Public Works and Transportation of the House of Representatives. This list is presented in Table V-3. BAT effluent limitations for these toxics shall be achieved by July 1, 1984. The provision is also made that the Administrator of the U.S. Environmental Protection Agency can make additions to this list as needed. Any toxic substance added to the list will require implementation of applicable BAT controls not later than three years after the addition of the substance to the list. Any pollutants which are not considered to be conventional pollutants or which do not appear on the toxic substances list are referred to as nonconventional pollutants and will be required to meet their respective BAT effluent limitations within three years of the time such limitations are promulgated, or by July 1, 1984, whichever is later.

The EPA is currently conducting a review of existing BAT effluent limitations for those industries which previously had limitations established. The review is to determine what changes are necessary to conform to the BCT criteria. The new BCT effluent limitations are to be promulgated by the end of 1978. Table V-4 shows the schedules that EPA has established for the issuance of BAT effluent guidelines for toxic substances for individual industrial categories. Those industries which presently lack BAT guidelines for the conventional pollutants will receive BCT guidelines according to the same schedules. In some cases, BAT guidelines will be published for nonconventional pollutants at the same time that BAT guidelines are published for toxic substances. In other cases, BAT guidelines for these pollutants will be postponed until a later time. However, as was the case when BPT guidelines were published, water quality standards must be met even if effluent limitations more stringent than the appropriate BCT or BAT guidelines are required.

B. PROPOSED INDUSTRIAL POINT SOURCE AREAWIDE PLAN

Under the proposed industrial point source areawide plan for the CARCOG/SETDD 208 Study Area, industries maintaining direct discharges to the area's receiving streams would be required to meet the effluent limitations established by the applicable BCT and BAT guidelines in accordance with the Clean Water Act of 1977. It should also be noted that for those industries with direct discharges, the applicable water quality standards will have to be met even if more stringent effluent limitations than prescribed by the BCT and BAT guidelines are required. The proposed plan is the same as the null alternative that was discussed previously.

Presently, since the exact effluent limitations that will be promulgated pursuant to the Clean Water Act of 1977 are unknown, the development of actual cost data for the proposed plan is virtually impossible. However, it is felt that costs applicable to the

TABLE V-3
TOXIC POLLUTANTS LIST PURSUANT TO THE
CLEAN WATER ACT OF 1977 (PUBLIC LAW 95-217)

1. Acenaphthene.
2. Acrolein.
3. Acrylonitrile.
4. Aldrin/Dieldrin.[1]
5. Antimony and compounds.[2]
6. Arsenic and compounds.
7. Asbestos.
8. Benzene.
9. Benzidine.[1]
10. Beryllium and compounds.
11. Cadmium and compounds.
12. Carbon tetrachloride.
13. Chlordane (technical mixture and metabolities).
14. Chlorinated benzenes (other than dichlorobenzenes).
15. Chlorinated ethanes (including 1,2-dichloroethane, 1,1,1-trichloroethane, and hexachloroethane).
16. Chloroalkyl ethers (chloromethyl, chloroethyl, and mixed ethers).
17. Chlorinated naphthalene.
18. Chlorinated phenols (other than those listed elsewhere; includes trichlorophenols and chlorinated cresols).
19. Chloroform.
20. 2-chlorophenol.
21. Chromium and compounds.
22. Copper and compounds.
23. Cyanides.
24. DDT and metabolites.[1]
25. Dichlorobenzenes (1,2-,1,3-, and 1,4-dichlorobenzenes).
26. Dichlorobenzidine.
27. Dichloroethylenes (1,1-, and 1,2-dichloroethylene).
28. 2,4-dichlorophenol.
29. Dichloropropane and dichloropropene.
30. 2,4-dimethylphenol.
31. Dinitrotoluene.
32. Diphenylhydrazine.
33. Endosulfan and metabolites.
34. Endrin and metabolites.[1]
35. Ethylbenzene.
36. Fluoranthene.
37. Haloethers (other than those listed elsewhere; includes chlorophenylphenyl ethers, bromophenylphenyl ether, bis (dichloroisopropyl) ether, bis-(chloroethoxy) methane and polychlorinated diphenyl ethers).
38. Halomethanes (other than those listed elsewhere; includes methylene chloride methylchloride, methylbromide, bromoform, dichlorobromomethane, trichlorofluoromethane, dichlorodifluromethane).
39. Heptachlor and metabolites.
40. Hexachlorobutadiene.
41. Hexachlorocyclohexane (all isomers).
42. Hexachlorocyclopentadiene.
43. Isophorone.
44. Lead and compounds.
45. Mercury and compounds.
46. Naphthalene.
47. Nickel and compounds.
48. Nitrobenzene.
49. Nitrophenols (including 2,4-dinitrophenol, dinitrocresol).
50. Nitrosamines.
51. Pentachlorophenol
52. Phenol.
53. Phthalate esters.
54. Polychlorinated biphenyls (PCBs).[1]
55. Polynuclear aromatic hydrocarbons (including benzanthracenes, benzopyrenes, benzofluoranthene, chrysenes, dibenzanthracenes, and indenopyrenes).
56. Selenium and compounds.
57. Silver and compounds.
58. 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).
59. Tetrachloroethylene.
60. Thallium and compounds.
61. Toluene.
62. Toxaphene.[1]
63. Trichloroethylene.
64. Vinyl chloride.
65. Zinc and compounds.

[1]Effluent standard promulgated (40 CFR Part 129).
[2]The term "compounds" shall include organic and inorganic compounds.

TABLE V-4
PROPOSED DATES FOR PROMULGATION OF BCT AND BAT
EFFLUENT LIMITATIONS

Group 1 (September 30, 1978 {proposed}, March 31, 1979 {final})

Timber Products
Steam Electric Power Plants
Leather Tanning & Finishing
Iron & Steel Manufacturing
Petroleum Refining

Group 2 (December 31, 1979 {proposed}, June 30, 1979 {final})

Nonferrous Metals Manufacturing
Paving & Roofing Materials (Tars and Asphalt)
Paint & Ink Formulation and Printing
Ore Mining & Dressing
Coal Mining

Group 3 (March 31, 1979 {proposed}, September 30, 1979 {final})

Organic Chemicals Manufacturing
Inorganic Chemicals Manufacturing
Textile Mills
Plastics & Synthetic Materials Manufacturing
Pulp & Paperboard Products
Rubber Processing

Group 4 (June 30, 1979 {proposed}, December 31, 1979 {final})

- Soaps & Detergent Manufacturing
- Auto & Other Laundries (Industrial Laundries)
- Miscellaneous Chemicals
  - Pesticide Manufacturing
  - Photographic Products
  - Gums & Woods (Glue Making)
  - Pharmaceuticals
  - Explosives
  - Adhesives & Sealants
- Machinery & Mechanical Products Manufacturing
  - Battery Manufacturing
  - Plastics Manufacturing
  - Foundries
  - Coil Coatings
  - Porcelain & Enameling
  - Aluminum
  - Copper
  - Electronics
  - Shipbuilding
  - Mechanical Products (Metal Fabrication)
- Electroplating

implementation of the BAT guidelines according to the Water Pollution Control Act Amendments of 1977 provide a reasonable indication of the costs that can be expected under the proposed plan. Therefore, based upon the year 2000 projected industrial process wastewater flows for the industries within the CARCOG/SETDD 208 Study Area, a rough estimate has been determined which reflects the present worth costs associated with the industries within the area achieving their BAT effluent limitations over the 20 year planning period as defined by Public Law 92-500. The industrial cost analysis performed for the CARCOG/SETDD 208 Study Area was based on cost data published in Steel and the Environment - A Cost Impact Analysis - A Report to the American Iron and Steel Institute by A. D. Little, Inc. - 1975 and in Projection Methodologies for Industrial Flows, Loads, and Residues - Martin, E. J. and Guthrie, D. C., of Environmental Quality Systems, Rockville, Maryland - 1977. Information presented in these documents allowed the calculation of a unit cost per MGD for meeting BAT guidelines. A unit cost of $2,500,000 per MGD of industrial process wastewater flow was developed for meeting BAT guidelines assuming all industries had previously achieved BPT effluent limitations. Therefore, the estimated cost for meeting BAT guidelines for the industries within the CARCOG/SETDD 208 Study Area is $82,386,250. Again, this figure must be qualified in light of the Clean Water Act of 1977 and its impact upon effluent limitations applicable to industries. However, it is felt that this cost estimate provides a reasonable indication of what can be expected with implementation of the effluent limitations resulting from the Clean Water Act of 1977.

CHAPTER VI - URBAN RUNOFF AREAWIDE PLAN

VI
URBAN RUNOFF AREAWIDE PLAN

A. INTRODUCTION

During the past decade, a multitude of studies have shown that runoff from storm events in urban areas poses a serious water quality problem. Stormwater runoff from urban areas typically contains substantial quantities of pollutants and in many cases presents a more serious threat to water quality than urban point sources.

Urban stormwater runoff is a major contributing factor in the determination of water quality in the CARCOG/SETDD 208 Study Area. Efforts have been made to determine the most feasible and economical methods in eliminating or curtailing the pollutional effect from urban stormwater runoff. Basically, there are two approaches which have been found to reduce the pollutional impact of urban stormwater. They are:

- Nonstructural or source control options which attempt to reduce the amount of pollutants washed off of the drainage area.

- Structural or discharge control options which attempt to treat the stormwater runoff at the point of discharge into the receiving stream.

In this section of the plan, these two approaches were utilized to establish specific recommendation for urban stormwater runoff control.

This section presents a brief discussion of the primary methodology utilized for generation of urban area data, together with a description of the urban runoff control options, the null alternative, and the urban runoff preferred areawide plan. The final portion of this section presents a priority determination and estimated project costs for implementation of the preferred plan.

B. URBAN AREA DATA

One of the main objectives in 208 areawide waste treatment management planning is to establish the relative impact on water quality of urban nonpoint source pollution in the study area. In the CARCOG/SETDD 208 Study Area, the Storm Water Management Model (SWMM) developed by the U.S. Environmental Protection Agency was utilized as a fundamental tool for modeling and evaluating existing phenomena associated with stormwater runoff and combined sewer overflows from urban areas and, through simulation, to indicate water quality responses to selected means of corrective action developed for urban runoff. Stream flow-stream quality curves were utilized to determine the water quality impact of various urban runoff management alternatives.

In order to properly utilize computer modeling to assist in evaluating urban runoff, it was necessary to develop idealized subcatchments in the designated urban area (see Figure VI-1). The subcatchments delineated in

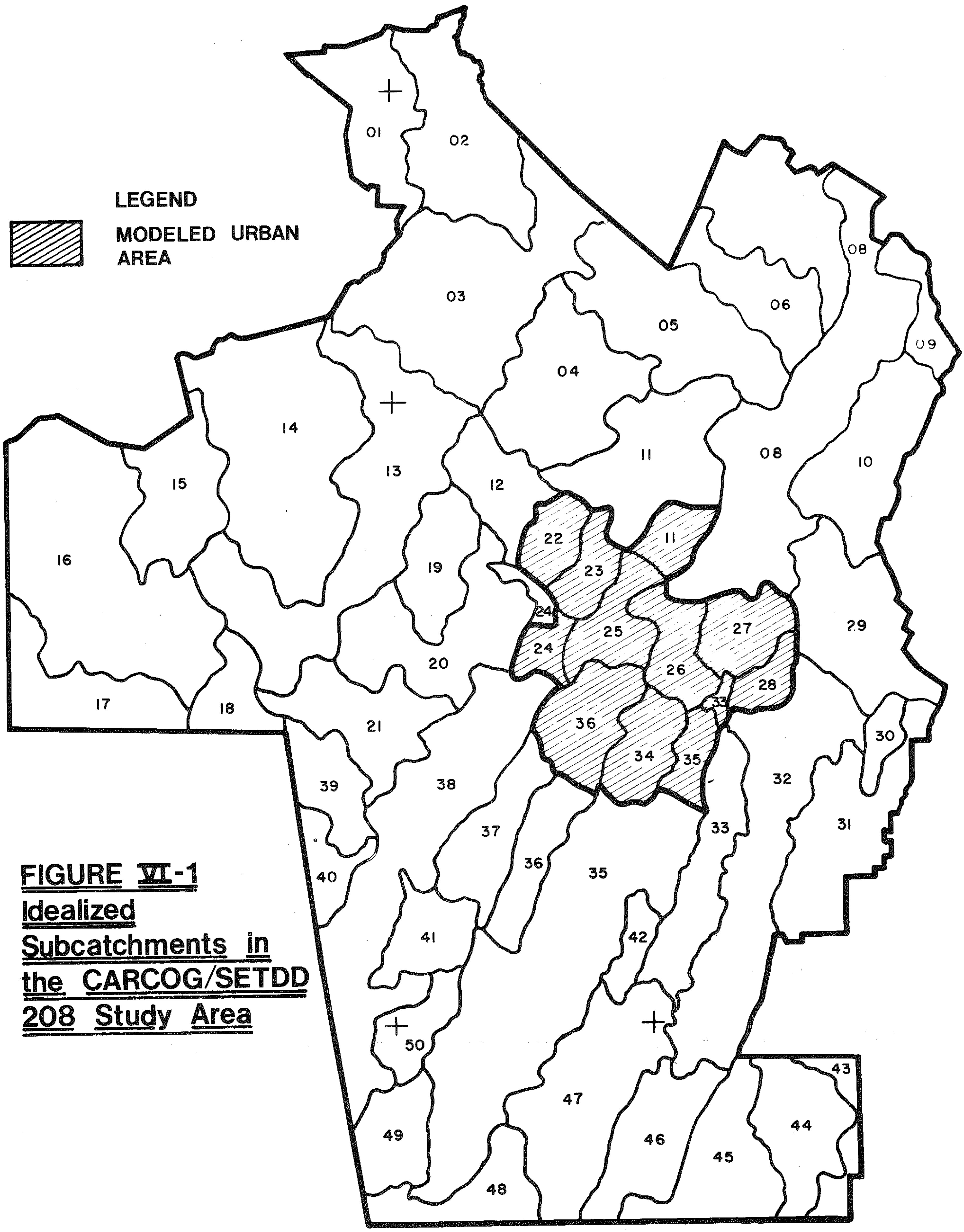


FIGURE VI-1
Idealized Subcatchments in the CARCOG/SETDD 208 Study Area

this area were utilized as the base areas for the aggregation of urban runoff and storm flow data as part of the CARCOG/SETDD 208 urban stormwater modeling effort. Stormwater or "wet weather" modeling was performed on the designated urban area. The RUNOFF Block of SWMM (Stormwater Management Model) was used in the CARCOG/SETDD 208 study to model overland and/or storm flows from the urban area that may directly enter combined or storm sewer systems, or receiving streams.

Initially the urban area was subdivided according to surface drainage patterns into hydrologic subareas. Subcatchment development was based upon various factors including: surface drainage boundaries; sewer service areas; predominant land use; and corporate boundaries. A small portion of the urban area is served by combined sewers and in this area subcatchments were developed primarily on the basis of sewer service areas and land use.

In the urban nonsewered areas, subcatchments were developed based on land use and surface drainage patterns. Natural ravines indicated on the TVA topographic maps were used for nonsewered subcatchments whenever possible.

Predominant land use utilized in subcatchment delineation was based upon the Chattanooga, Tennessee - Georgia Planning Area Wastewater Facilities Plan, May, 1975, EPA Project No. C470387. The land uses were aggregated into five basic land use classifications for modeling purposes. The land use designations used in each subarea were as follows:

- Residential
- Commercial
- Industrial
- Agricultural
- Open Space or Park

The subcatchments developed provided the base areas for the collection and aggregation of essential input data for the RUNOFF and TRANSPORT blocks of SWMM.

The next major step in preparation of the computer model for urban runoff analysis was calibration and verification of the model. Model calibration for the CARCOG/SETDD 208 study entailed fitting the computer model to known and estimated low flow quality and quantity information. The water quality parameters which were modeled include biochemical oxygen demand (BOD), fecal coliforms, ammonia-nitrogen (NH_3-N), and dissolved oxygen. The low flow model consisted of the idealization of the receiving waters plus all known point and nonpoint impacting boundary conditions. Calibration of the model consisted of adjusting the coefficients (i.e., reaeration, decay, roughness, etc.) and adapting the nonpoint source loadings (quantity and quality) until the model simulated the low flow quantity and quality information satisfactorily.

The state of the art of modeling urban runoff quality is such that good calibration and verification are difficult to obtain due to the highly variable nature of such flows. Although extensive data exists and continues to become available, regarding the quality of urban runoff, most is not reported in the form required for the verification of the pollutant default values incorporated in SWMM.

While most of the pollutant default values are based on the American Public Works Association study done in Chicago, various changes have been made by TenEch on the basis of extensive literature reviews and past experience in urban runoff modeling. These changes include the addition of cropland category, the replacement of grease with ammonia-nitrogen, and the replacement of the total coliforms with fecal coliforms. For purposes of the CARCOG/SETDD 208 study, the two residential land use categories in the original SWMM have been combined to form one category by averaging the pollutant accumulation and constituency factors.

These pollutant factors have been shown to produce satisfactory pollutographs of suspended solids and BOD for urban catchments from both the Lexington Urban Study and the Purdue University study done in West Lafayette, Indiana. Modeling of the urban catchments used in these studies served to verify the pollutant accumulation and constituency factors of suspended solids, BOD, and NH_3-N for the residential and commercial land use categories. Unfortunately, appropriate data was not available for the other land use categories.

Detailed descriptions and documentation of model selection, subcatchment delineation, model calibration, and model verification are contained in Work Elements 301, 302, 304 and 306, respectively.

C. URBAN RUNOFF CONTROL OPTIONS

In this section of the plan, all alternative runoff control and reduction options for the urban area of the CARCOG/SETDD 208 planning area are presented. Both source control management options and discharge abatement technology options are included. These options were developed and are discussed in detail in Work Element 308. Initially, options based upon abatement and control technology for urban storm generated pollution are listed in tabular form. This is followed by discussions of abatement and control options for specific combined sewer and storm sewer service areas.

1. Abatement and Control Technology for Urban Storm Generated Pollution

Two basic option development strategies are presented, source control management and discharge abatement technology. Source control management addresses measures currently available for minimizing pollution from urban runoff before it enters a combined or storm sewer system. These measures accomplish this goal by reducing the amount of pollution picked up by runoff or by removing the pollutant prior to the runoff entering the sewer system.

The measures which generally attempt to prevent or reduce the initial pollution of urban stormwater are:

- Street Cleaning
- Solid Waste Management
- Air Pollution Control
- Erosion Control
- Chemical and Material Handling and Storage Controls

The measures which generally attempt to remove pollutants, or portions of them are:

- Sediment Control
- Miscellaneous Pollutant Control

Discharge abatement methods include alternatives which provide pollutant reduction after the stormwater enters the combined or separate storm sewer system. Such alternatives range from increased maintenance and control activities to complex end-of-pipe treatment systems. Table VI-1 lists the various urban runoff abatement, reduction, or control options developed, together with a brief description of the option's features and unit costs for implementation, where available.

2. Abatement and Options for Combined Sewer Service Areas

Abatement and Control Options

The six basic abatement and control methodologies which should be considered as options for combined sewer overflows in the 208 study area are:

- Continuation of the present operation and maintenance practices.

- Improvements in the present operation and maintenance practices.

- Sewer separation with and without treatment of storm sewer discharges.

- Construction of in-line or off-line storage facilities with the stored flows returned to the interceptor system.

- Direct treatment of overflows.

- Source control practices.

These alternatives are disscussed below.

Continuation of the Present Operation and Maintenance Practices: The city of Chattanooga presently has two catch basin cleaning crews operating in the city. Normally, these two cresw spend most their time cleaning

TABLE VI-1: URBAN RUNOFF CONTROL OPTIONS AND STRATEGIES

Reduction Or Control Option	Option Features	Estimated Unit Costs Of Implementation
Source Control Management		
1. Street Cleaning Practice		
Increase frequency	Increase street sweeping frequency or increase number of passes.	--
Increase removal efficiencies	Correct sweeper travel speed, enforcement of auto parking controls, and increased sweeper maintenance.	--
Scheduling of street flushing operations	Correct scheduling of street flushing operations to insure smaller particles are brought to curb.	--
Purchase better equipment	Purchase vacuum type sweepers which have better removal efficiencies than broom type sweepers.	$25,000 to 16,000/sweeper
2. Solid Waste Management Control Practice		
Litter reduction and control	Enforcement of anti-litter laws, sidewalk waste containers, and public education programs.	--
Elimination of dump sites	Closing of unlicensed dump sites, control of roadside dumps, and enforcement of anti-dumping laws.	--
Cleanup campaigns	Promotion of block, town, and city-wide cleanup programs.	--
3. Air Pollution Control Practice		
Control of unpaved roads	Control of dirt and dust from unpaved road reducing speeds, chemical treating and watering.	$0.26 to $1.00/ sq. yd./yr.
Reduction of Particulates	Strict enforcement of air pollution regulations pertaining to industrial sources, mobile sources, constructions sites, etc.	--
4. Chemical and Material Storage and Use Control Practice		
Controlled storage	Includes covering of storage piles, providing drainage ditches and catch basins to collect runoff from storage and cleaning areas, and proper construction and selection of storage areas.	--

TABLE VI-1: URBAN RUNOFF CONTROL OPTIONS AND STRATEGIES (Continued)

Reduction Or Control Option	Option Features	Estimated Unit Costs Of Implementation
Source Control Management		
Controlled use of chemicals	Includes improved methods and proper application of roadside herbicides, pesticides, and fertilizers.	--
5. Construction Site Control Practice		
Disturbed area stabilization (with permanent vegetation)	Establishing permanent vegetative cover such as trees, shrubs, vines, sod, grasses or legumes on disturbed on denuded areas.	$450/acre
Disturbed area stabilization (with temporary seedings)	Establishing temporary vegetative cover with fast growing seedings on disturbed or denuded areas.	$200/acre
Riprap	A revetment of loose rock or similar material installed on a cut or fill slope or a channel side slope to protect the slope from erosion.	$8/cu.yd.
Land clearing	The removal and/or suppression of undesirable trees, brush and other vegetation preparatory to land development.	$1/sq.yd.
Spoilbank spreading	Disposing of excavated materials from a drainage ditch or open channel by spreading the surplus over adjacent land.	$200/acre
Sediment trap, temporary	An impounding area formed by excavation of a basin around a storm drain drop inlet to trap sediment being transported by storm runoff from a disturbed area of very limited size.	$40/trap
Sediment basin	A basin created by the construction of a barrier or dam across a waterway or by excavating a basin or by a combination of both.	$5000/basin
Drain, subsurface	A conduit such as tile, pipe, or tubing installed beneath the ground surface to intercept, collect, and/or convey groundwater.	$0.50 to 3.00/lin.ft.

TABLE VI-1: URBAN RUNOFF CONTROL OPTIONS AND STRATEGIES (Continued)

Reduction Or Control Option	Option Features	Estimated Unit Costs Of Implementation
Source Control Management		
Sediment barrier	Temporary barriers or diversions that are constructed of sandbags, straw or hay bales, brush, logs and poles, gravel or other filtering material.	$400 to 500/acre
Storm water retention structure	A structure providing for temporary storage of storm water and for its controlled release.	--
Drain system structure	An auxiliary structure installed in an existing or new subsurface drainage system.	--
Downdrain-structure (flexible)	A flexible conduit of heavy duty fabric or other material used as a temporary structure to convey concentration of storm water down the face of cut or fill slopes.	$1.00 to 3.00/ lin.ft.
Fences	A protective barrier installed to prohibit undesirable use of a structure.	$5 to 10/ lin.ft.
Drain, vertical	A well, pipe, pit, or bore into porous, underground strata into which drainage water can be discharged.	$1.00 to 3.00/ lin.ft.
Downdrain structure	A structure to safely conduct surface runoff from the top of a slope to the bottom of the slope.	$2/lin.ft.
Construction exit temporary	A stone stabilized pad located at any point where traffic will be leaving a construction site to a public right-of-way, street, alley, sidewalk, or parking area.	$3.00 to 15.00/ lin.ft.
Level spreader	An outlet constructed at zero grade across the slope whereby concentrated runoff may be discharged at non-erosive velocities onto undisturbed areas stabilized by existing vegetation.	$175/acre
Land smoothing	Methods to improve surface drainage, facilitate the installation of a more workable drainage system, and reduce erosion and sedimentation.	$100 to 200/ acre

TABLE VI-1: URBAN RUNOFF CONTROL OPTIONS AND STRATEGIES (Continued)

Reduction Or Control Option	Option Features	Estimated Unit Costs Of Implementation
Source Control Management		
Grade stabilization structure	A structure to stabilize the grade in natural or artificial channels.	$350 to 2500 each
Gabions	Gabions are large, multi-celled, rectangular wire mesh boxes, used in channels revetments, retaining walls, abutments, check dams, etc.	$40/cu.yd.
Filter berm	A filter berm is a temporary ridge of gravel or crushed rock constructed across a graded right-of-way.	$100/acre
Dike, diversion	A ridge of compacted soil with a general life expectancy of one year or less constructed immediately above or below cut or fill slopes.	$1/cu.yd. plus 450/acre for seeding
Channel improvement	Open channels are constructed or stabilized to be nonerosive and provide adequate capacity for flood waters, drainage, other water management practices, or any combination thereof.	$6.00 to 10.00/ lin.ft.
Diversions	An earth channel with or without a supporting ridge on the lower side constructed above, across, or below a slope.	$1/cu.yd. plus 450/acre for
Dike, interceptor	A ridge of compacted soil, to remain for a period usually less than one year, constructed across disturbed rights-of-way and similar sloping areas.	$8/cu.yd.
Waterway or outlet	To dispose of runoff without causing damage either by erosion or by flooding.	$16/lin.ft.
Valley fill	A controlled earth and rock fill across or through the head of a valley or hollow to form a stable, permanent storage space for surface mined materials.	--
Topsoiling	Stripping off the more fertile top soil, storing it, then spreading it over the disturbed area after completion of construction activities.	--
Toe berm	A berm or bench of compacted and vegetated soil constructed at the toe of the slope of a fill.	$10-20/cu.yd.

TABLE VI-1: URBAN RUNOFF CONTROL OPTIONS AND STRATEGIES (Continued)

Reduction Or Control Option	Option Features	Estimated Unit Costs Of Implementation
Source Control Management		
Storm drain outlet protection	Paved and/or riprap channel sections, placed below storm drain outlets.	--
Stream crossing	A temporary structure installed across a flowing stream or watercourse for use by construction equipment.	$500 to 1500 each
Dust control on disturbed areas	Controlling surface and air movement of dust on construction sites, roads, and demolition sites.	--
Disturbed area stabilization (with permanent vegetation)	Establishing permanent vegetative cover such as trees, shrubs, vines, sod, grasses or legumes on disturbed or denuded areas.	$100 to 200/ acre
Retaining walls	A constructed wall to assist in the stabilization of cut or fill slopes.	--
Roof leaders and footing drains	Removal of illegal roof leaders and footings drains from sewer system.	--
Porous surfaces	Includes use of latlice blocks and bricks for parking lots, driveways, and lightly traveled streets. Also use of porous asphalt where hard surfaces are required.	$7/sq.yd.
Buffer Zones and greenbelts	Includes the maintenance of buffer zones along receiving stream and around industrial areas or other areas generating significant runoff quantities.	--
Discharge Abagement Technology		
1. Operation and Maintenance Practices		
Continuation of present O & M programs	Includes continuation of present catch basin cleaning program, TV inspection of sewers, and maintenance crews.	--
Improvement of O & M programs	To include more frequent catch basin cleaning, sewer flushing, and O & M programs.	--

TABLE VI-1: URBAN RUNOFF CONTROL OPTIONS AND STRATEGIES (Continued)

Reduction Or Control Option	Option Features	Estimated Unit Costs Of Implementation
Discharge Abatement Technology		
2. Sewer System Operation and Control Practices		
Catch basin cleaning	Increased maintenance and cleaning of basins, particularily after each significant storm event.	--
Combined sewer flushing	Sewer flushing to improve hydraulic capacity and self-scouring ability. Pollutants from flushing are routed to the dry-weather plant for treatment.	--
3. Separation of the Combined Sewer System		
Construction of new sanitary sewer	Includes construction of new sanitary sewer and use of existing combined sewer as a stormwater sewer.	$16,000 to 20,000/acre
Construction of new storm sewer	Includes construction of storm sewer system and use of existing combined sewer as a sanitary sewer.	$16,000 to 20,000/acre
Construction of forced sanitary sewer	Includes the addition of a forced sanitary sewer within the existing sewer.	$16,000 to 20,000/acre
4. Overflow Storage Practices		
In-line storage	Utilizes existing unused sewer capacity to retain combined sewer overflow during wet weather.	--
Off-line storage	Entails the modification of existing regulator chambers so that flows in excess of dry-weather treatment plant capacity or in excess of the downstream interceptor capacity are diverted to a storage facility.	$750,000 to 2,250,000/MG
5. Direct Treatment of Combined Sewer Overflow		
Biological Treatment	Entails biological treatment methods such as activated sludge, trickling filters, lagoons, and bio-discs.	$30,000 to 80,000 per MGD
Screening	Screens are used to remove gross solids and particulate matter from storm generated discharges.	$8,000 to 63,000/MGD

TABLE VI-1: URBAN RUNOFF CONTROL OPTIONS AND STRATEGIES (Continued)

Reduction Or Control Option	Option Features	Estimated Unit Costs Of Implementation
Discharge Abatement Technology		
Chemical clarification and filtration	Use of chemical aids such as alum, lime, or ferric chloride followed by filtration.	$55,000/MGD
Dissolved air floatation	Use of air bubbles for removal of suspended solids fine floatables, and oil and grease.	$40,000/MGD
Improved regulator chambers	Use of swirl regulator/concentration to improve quality and quantity control of storm runoff overflow.	$6,500/MGD
Disinfection	Involves disinfection of overflows before discharge to the receiving stream.	$1,500 to 13.000/MGD

catch basins which have become clogged and were reported by citizens. When the crews are not working in this "emergency" status, they service catch basins as they come to them, moving from one district to the next.

The city has a sewer TV inspection, cleaning, and repair crew which performs inspection and maintenance work on sewers. This crew generally works on lines which have been reported as being clogged, failed, or in bad need of repair. The combined sewer system regulator chambers are inspected for operability, and cleaned if needed after every major storm if time and work schedule permits.

Improvement in the Present Operation and Management Practices: The street sweeping practices in the city of Chattanooga can be improved in several ways. The city presently does not have regulations which prohibit curb side parking in areas during regularly scheduled street sweeping. Cars parked in the path of the sweepers can result in greatly decreased removal efficiencies. The purchase and use of more efficient vacuum type sweepers can increase removal efficiency. Increased machine maintenance regarding broom adjustments can also increase removal efficiencies.

Catch basin cleaning could be performed much more frequently. The maximum removal efficiencies would be achieved if every catch basin were cleaned after each storm event.

Sewer flushing activities could be improved by increasing the present manpower levels. Trouble spots in the sewer system could be located by inspection activities and these areas could be flushed more often. In some cases, automatic in-line sewer flushing systems could be installed.

By improving the present operation and maintenance activities, the probability that a sizeable sediment or organic load will be present during the time of a storm event is reduced. The specific costs and expected benefits of improved maintenance activities are highly dependent on the efficiency of the existing system.

Sewer Separation: Sewer separation entails the removal of storm sewer inlets and roof and surface drains from the combined sewer system. The removal of storm water inflow from the combined sewer system would provide the additional capacity required to reduce or eliminate combined sewage overflow. The major expense in this option would be the construction of a new storm sewer system to handle the storm water inflow removed from the combined sewer system. Additional expense is required to plug and reconnect existing inlets now connected to the combined sewer system, conduct ground and utility surveys, prepare final design documents, and provide construction supervision. It should be noted that considerable disruption and time will be required to complete a separation program.

The effect upon the receiving water of removing storm water inflow from the combined sewer system is difficult to evaluate. While the removal of storm water inflow would reduce or eliminate the amount of combined sewer overflow discharges, it should be mentioned that urban storm water runoff itself is a significant source of stream pollution.

Sewer separation alone would not alleviate this source of waste loading unless treatment of storm water flows is provided or source control practices are applied.

Storage Systems: The function of storage systems is to provide the required storage capacity necessary for reducing peak flows in the trunk sewers. The stored flows may be released to the existing system for treatment during periods of low flow or treated directly in the storage facility before discharging into the receiving waters.

Storage can be accomplished by in-line or off-line facilities. Because most of the combined sewers are relatively small, in-line storage is not considered feasible and will not be discussed further.

Limitations to off-line storage are the large amounts of land required for the facilities and the possibility of public disapproval in locating these facilities in densely populated areas. One solution for the latter objection may be to locate the facilities below ground. In this way, the area located above the subsurface storage reservoir may be landscaped and possibly used for recreational activities. While this would provide a more aesthetically pleasing situation, it also greatly increases the cost of the facility. Both situations have been considered in determining their feasibility with respect to the subsystems of the combined sewer system.

Direct Treatment: Combined sewer overflows may be treated either at individual overflow locations or at a centralized facility. Although centralization of facilities provides for lower treatment plant costs, this is generally offset by the greater expense required for a collection system.

The direct treatment technologies are biological processes, screening systems, chemical clarification, filtration, dissolved air flotation, swirl concentrator regulator chambers, and disinfection. Most biolological processes function most efficiently within a narrow range of hydraulic and organic loading, and must operate continuously to sustain biomass. Because combined sewer overflows occur on an intermittent and highly variable basis, biological treatment processes which depend on continuous, constant flow would have to be located adjacent to dry-weather facilities. Lagoon systems, which do not rely on continuous organic loading, require considerable land which generally is not available in the urban area. For these reasons, biological treatment processes will not be considered as viable options.

The physical/chemical treatment process involving chemical addition, clarification, and filtration can readily be adapted to treat combined sewer overflows with high removal efficiencies. However, due to the land requirements and high unit cost for such systems, this option was not considered for the Chattanooga area.

The viable alternatives which were considered are:

- Dissolved air flotation
- Microscreening
- Disinfection
- Swirl concentrator regulator chambers.

Source Control Options: Runoff-induced pollution can be assuaged through the adoption and implementation of a variety of the source control options. Some of these source control options were discussed earlier. Additional source controls that deserve consideration in developing detailed pollution abatement and control measures are discussed below.

If more than 25 percent of a given existing site is covered with impermeable surface, specific site adjustment plans should be made to control the runoff in such a way that the maximum feasible amount of the runoff generated can be partially assimilated or reduced in volume by greenbelts, buffer zones, or other porous surfaces.

Dutch drains (an excavated pit filled with coarse rocks) can be used to store and enhance infiltration of runoff from impermeable surfaces. The rough cost of a Dutch drain installation is $40 per cubic yard of water storage capacity.

The use of porous materials for paving should be encouraged wherever possible, such as in driveways, parking lots, and low traffic streets. Various materials are available which allow high levels of infiltration at costs comparable to conventional paving. The costs may be higher or lower depending on the type of porous materials used and the need for curb and gutter with a conventional pavement.

Detention devices may be used on roofs to delay runoff. Gravel barriers on flat roof or findams on sloping roofs are effective in detaining runoff. Findams are a series of fin or weir structures which slow the rate of runoff from roofs and which also retain some water for evaporation.

Natural depressions and recharge areas will return runoff following preliminary concentration (i.e., from drainage areas of 2 to 10 acres). Supplementary grading or excavation may be required to enhance the effectiveness of such a system. The cost of such excavation may be on the order of $10 per cubic yard of excavated material.

When looking at future urban areas, consideration should be given to maintaining undisturbed land areas which have slopes greater than 14 percent. Lesser slopes with large contiguous areas should be managed so that a maximum amount of infiltration can be realized and so that any unavoidable runoff is collected and discharged to a natural seepage area or to a suitable storm sewer system. For areas which have highly erodible soils, development should not occur if the average slopes are greater than 10 percent. It may also be beneficial to establish a setback distance of at least 100 feet from all surface waters for all development. In areas where there is evidence of significant streambank erosion, increases in setback distances may be required to prevent any aggravation of the erosion.

Development plans should minimize changes in the existing topography, i.e., fit buildings, streets, drainage systems, etc., to the existing landscape rather than completely disregarding it to accommodate a preconceived development scheme.

Chemical and material storage and use controls, additional air pollution controls, and control of nonsettleable pollutants also represent a potentially significant means of preventing pollution of storm water runoff in the urban areas.

The establishment and enforcement of ordinances regarding erosion and sediment control should be of primary consideration for the 208 study area. The state of Georgia has recently passed such legislation; however, this bill regulates only developers. Other activities such as highway construction and agriculture, with high erosion and sedimentation potential, have been specifically excluded. Although the regulation of development activities will significantly benefit water quality during storm events, more forceful and universally applicable regulations are needed in the CARCOG/SETDD 208 Study Area.

Limitations to be Considered in the Selection of an Option

Six abatement and control options for combined sewer overflows have been discussed. The final selection of an option for the control of the combined sewer overflows for a specific service area involves a benefit-cost analysis. The expected benefits from the implementation or construction of a certain option are evaluated in terms of percent reduction in pollutant concentrations. A certain degree of efficiency may be required to maintain a desired level of water quality. The costs or limitations associated with the implementation of a specific option also must be considered.

The cost of a particular options is affected by several factors. First, there is the cost of equipment, which will be relatively constant regardless of site location. The cost of land, the construction cost, and the actual feasibility for a particular option may vary considerably from one site to another depending on various limiting factors. Site related and other limitations for various options are as follows.

There are presently no curb side parking restrictions during scheduled street sweeping activities. The cost of implementing such restrictions would be the cost of scheduling street sweeping activities and posting signs and taking other measures to properly educate the public as to when parking is prohibited on particular streets.

The feasibility of implementing such a program in a specific area is determined by how much of a problem exists and how much public resentment would be generated. For example, parking restrictions in high density residential areas produce significant results; however, public resentment would be great. Restrictions in commercial areas such as Market Street or Broad Street would be infeasible during the day. Such restrictions at night would also meet with disapproval if they deterimentally affect commercial establishments such as night clubs, or cultural activities such as at the Tivoli Theatre or the City Auditorium. Other improvements in the present operation and maintenance practices will basically involve increases in budgeting to cover the costs of buying more efficient street sweepers and other equipment and providing more manpower for the program. Site related costs or limitations would not be significant.

Sewer separation is a tremendously costly undertaking for the primary benefit of reducing organic pollution. Other limitations to sewer separation are related to the construction of the new system. First of all, such an undertaking would require years to complete. During this period, traffic disruption would be considerable. In residential areas or on main thoroughfares, traffic disruption would result in significant hardship on merchants and the general public.

The costs of storage facilities can vary significantly depending on site specific characteristics. Surface storage impoundments require large amounts of land which are often unavailable in the urban area. Also surface impoundments may be aesthetically displeasing and are often unacceptable by the public. Underground storage facilities may require less land; however, underground facilities are much more expensive to construct and operate than surface facilities.

Direct treatment options to be considered in the CARCOG/SETDD 208 Study Area are dissolved air flotation, microscreening, disinfection, and improved regulator devices. The costs and limitations for these options vary according to equipment costs, the amount of land required, and the degree of pollutant reduction needed. Dissolved air flotation facilities are the most costly and disinfection facilities are the least costly of the systems considered. Dissolved air flotation and microscreening facilities require flow equilization resulting in increased land requirements. Swirl concentrators have relatively low cost, significantly reduce solids loadings, and require little more land than the existing regulator chambers.

Some source control methodologies such as the use of greenbelts, buffer zones, and porous pavements are more readily implemented in developing areas. Constructing greenbelts and buffer zones in highly developed areas is impractical. Other alternatives such as the installation of rooftop and parking lot detention systems are more effective in highly developed areas.

The following section describes the applicability of the various control options for specific combined sewer service areas.

Options for the Combined Sewer System

The combined sewer system has been divided into four distinct drainage basins or service areas. The regulator chamber overflows for each service area discharge into the same receiving stream. The options for each service area are discussed below.

North Chattanooga Service Area: The North Chattanooga Service Area is that portion of the combined sewer system north of the Tennessee River consisting of subarea C-10 which has an area of 310 acres. The population of this area is approximately 1,800 and the land use is primarily residential except for the commercial-industrial area in the vicinity of Frazier Avenue where the regulator chamber is located. The overflow from the regulator chamber discharges into the Tennessee River upstream from the Walnut Street Bridge and the dry-weather flow is conveyed to Moccasin Bend Treatment Plant by the sanitary interceptor which runs along the north shore of the river. The options for this service area are presented in Table VI-2.

TABLE VI-2: OPTIONS FOR THE NORTH CHATTANOOGA SERVICE AREA

Description of Option	Estimated Costs (Capital/yearly O & M) $000	Waste Load Reduction % (BOD/SS/NH_3/Fec. Col.)
1. Continuation of the Present Operation and Maintenance Practices	0	0/0/0/0
2. Improvement in the Present Operation and Maintenance Practices	20%	5/10/0/0
3. Sewer Separation Without Treatment of Storm Flows	5183/0	0
4. Off-line Storage with Flows Returned to the Interceptor		
a. Surface impoundment	750/20 per MG Storage	80/80/0/90
b. Subsurface impoundment	2250/25 per MG Storage	80/80/0/90
5. Direct Treatment of Combined Sewer Overflows		
a. Dissolved Air Flotation	40 per mgd/.07 per MG Treated	40/60/10/0
b. Microscreening	13 per mgd/.007 per MG Treated	30/70/0/0
c. Disinfection (high-rate chlorination)	2.0/.1 per mgd	5/0/0/99
d. Swirl Concentrator	6.5/0 per mgd	20/50/0/0

The present system is used as the base for comparison; therefore, the cost and pollutant reductions for this option are shown as zero. It is believed that implementation of curb side parking regulations and other improvements in the maintenance activities, as discussed earlier, could be accomplished for a 20 percent increase in the present budget. This would result in pollutant reductions as shown in Table VI-2.

Sewer separation is estimated to cost $16,720 per acre. This results in an estimated cost for the option which appears to be unreasonably high for the pollutant reductions expected. As discussed earlier, control measures for the separate storm flows would be necessary.

As mentioned earlier, the land use in the vicinity of the regulator chamber is commercial-industrial. There is virtually no land available in this subarea for surface or underground storage facilities as indicated by their high estimated cost per million gallons of capacity in Table VI-2. The only land which may be available would be visible from Market Street Bridge. A surface storage facility at this location would have to be designed with aesthetics receiving prime consideration.

As discussed earlier, dissolved air flotation and microscreening facilities will require more land for flow equilization facilities than will the other two direct treatment options. Disinfection will require more land than will a swirl concentrator due to the contact period requirement.

Since the North Chattanooga Service Area is an older, highly developed, generally residential area of Chattanooga, source control practices such as buffer zones, greenbelts, and roof top storage would be infeasible.

Citico Creek Service Area: The Citico Creek Service Area consists of the combined sewer subareas C-9, C-15, C-16, C-17, and C-18. This service area, consisting of approximately 617 acres; has residential, commercial, institutional, industrial, and public land uses; and serves a population of approximately 5,050. There are five regulator chambers in this service area through which combined sewage overflows to the Tennessee River during storm events. The dry-weather flow is conveyed by an interceptor sewer running along the river to the Citico Creek Pumping Station. The options for this service area are presented in Table VI-3.

As for the North Chattanooga Service Area, the present system is used as the base for comparison; therefore, costs and pollutant reduction for this option are also shown as zero. As discussed in the previous section, it is believed that implementation of curbside parking regulations and improvements in the existing maintenance activities would result in a 20 percent increase in budget and the pollutant reduction shown in Table VI-3.

Just as for the North Chattanooga Service Area, sewer separation also appears to be infeasible for the Citico Creek Service Area.

Land for storage and/or direct treatment facilities is available between the Citico Creek Pump Station and the UTC Tennis Center. Due to the availability of land, the unit costs for these options are lower for this service area than for the North Chattanooga Service Area or the Tennessee River Service Area. Aesthetic considerations are of some concern due to the visibility from Amnicola Highway.

TABLE VI-3: OPTIONS FOR THE CITICO CREEK SERVICE AREA

Description of Option	Estimated Costs (Capital/yearly O & M) $000	Waste Load Reduction % (BOD/SS/NH_3/Fec. Col.)
1. Continuation of the Present Operation and Maintenance Practices	0	0/0/0/0
2. Improvement in the Present Operation and Maintenance Practices	20%	5/10/0/0
3. Sewer Separation Without Treatment of Storm Flows	10,316/0	40/0/0/99
4. Off-line Storage with Flows Returned to the Interceptor		
a. Surface impoundment	500/20 per MG Storage	80/80/0/90
b. Subsurface impoundment	1500/25 per MG Storage	80/80/0/90
5. Direct Treatment of Combined Sewer Overflows		
a. Dissolved Air Flotation	35 per mgd/.07 per MG Treated (1)	40/60/10/0
b. Microscreening	11 per mgd/.007 per MG Treated (1)	30/70/0/0
c. Disinfection (high-rate chlorination)	1.5/.1 per MGD (1)	5/0/0/99
d. Swirl Concentrator	6.5/0 per mgd	20/50/0/0

(1) Depending on the overflow rates, it may be more cost effective to convey the individual overflows via a relief sewer to a central treatment facility in the service area.
The costs of relief sewers are not included.

Since the Citico Creek Service Area is composed of a variety of land uses amenable to source controls, these options should receive serious consideration in implementing specific abatement plans. The type of source controls selected will depend to a large degree upon the water quality data and engineering feasibility. Therefore, the cost-effectiveness of specific control options are not listed in the table but should be developed when more information becomes available.

Erosion and sediment controls should be implemented for construction activities.

Chattanooga Creek Service Area: The Chattanooga Creek Service Area is that portion of the combined sewer system consisting of subareas C-1, C-2, C-3, and C-4. The population of this area is approximately 4,370, with land uses consisting of industrial, commercial, residential, and public. The service area has four regulator chambers. The overflows from these regulator chambers discharge into Chattanooga Creek which is a tributary of the Tennessee River. The dry-weather flows are diverted into the interceptor system. The options for this service area are presented in Table VI-4.

For the Chattanooga Creek Service Area, the present system is also used as the base for comparison and costs, and pollutant reductions are therefore shown as zero in Table VI-4. Improvement in the present system and implementation of curbside parking regulations would also require a budget increase of 20 percent and have the same pollutant reductions as the other service areas as shown in Table VI-4.

As for the other service areas, sewer separation appears to be infeasible for the Chattanooga Creek Service Area.

Adequate land is available for storage and/or direct treatment facilities south of I-24 near Howard High School. Due to the availability of land, the unit costs for these options are the same as for the Citico Creek Service Area. However, aesthetic considerations will be of greater concern here due to the visibility of this area from the interstate.

The service area is also composed of a variety of land uses amenable to source controls similar to the Citico Creek Service Area. The selection of specific controls will also be subject to the same conditions as Citico Creek and therefore the cost-effectiveness of specific options is not presented but will also be developed when additional information is available.

Tennessee River Service Area: The Tennessee River Service Area consists of the combined sewer subareas C-5, C-6, C-7, C-11, C-12, C-13, and C-14. This service area, consisting of approximately 875 acres, has predominantly industrial and commercial with some residential land uses, and serves a population of approximately 4,410. There are seven regulator chambers in this service area through which combined sewage overflows

TABLE VI-4: OPTIONS FOR THE CHATTANOOGA CREEK SERVICE AREA

Description of Option	Estimated Costs (Capital/yearly O & M) $000	Waste Load Reduction % (BOD/SS/NH_3/Fec. Col.)
1. Continuation of the Present Operation and Maintenance Practices	0	0/0/0/0
2. Improvement in the Present Operation and Maintenance Practices	20%	5/10/0/0
3. Sewer Separation Without Treatment of Storm Flows	15,132/0	40/0/0/99
4. Off-line Storage with Flows Returned to the Interceptor		
a. Surface impoundment	500/20 per MG Storage	80/80/0/90
b. Subsurface impoundment	1500/25 per MG Storage	80/80/0/90
5. Direct Treatment of Combined Sewer Overflows		
a. Dissolved Air Flotation	35 per mgd/.07 per MG Treated (1)	40/60/10/0
b. Microscreening	11 per mgd/.007 per MG Treated (1)	30/70/0/0
c. Disinfection (high-rate chlorination)	1.5/.1 per MGD (1)	5/0/0/99
d. Swirl Concentrator	6.5/0 per mgd	20/50/0/0

(1) Depending on the overflow rates, it may be more cost effective to convey the individual overflows via a relief sewer to a central treatment facility in the service area.
The costs of relief sewers are not included.

directly to the Tennessee River. The dry-weather flows from subareas C-11, C-12, C-13, and C-14 are conveyed by the interceptor sewer running south along the river to the inverted syphon at 9th Street. The dry weather flows from subareas C-5, C-6, and C-7 are conveyed by the interceptor sewer running north along the river to the 9th Street inverted syphon. The options for this service area are presented in Table VI-5.

As for the other service areas, the present system is used as the base for comparisons and the costs and pollutant reducts are shown as zero. Improvements in the present system and implementation of curb-side parking regulations will also require the 20 percent budget increase and provide the pollutant reductions shown in Table VI-5.

Sewer separation also appears to be infeasible for the Tennessee River Service Area.

Land for storage and/or direct treatment facilities is available in the Combustion Engineering storage yard. Costs of land and operation will be higher for this area than for Citico Creek or Chattanooga Creek service areas, since the land is currently in use for other purposes. Aesthetics will be of very little concern in this area since visibility is low and the adjacent land uses do not conflict.

Source controls may also provide a desirable method for pollution abatement and should be given serious consideration in developing specific plans. As for the other service areas, the selection is a function of the factors discussed for the North Chattanooga Service Area and a cost-benefit analysis is not shown in Table VI-5.

3. Abatement and Control for Storm Sewer Service Areas

Abatement and Control Options

The five basic abatement and control methodologies which should be considered as options for the storm sewer discharges in the 208 study area are:

- Continuation of the present operation and maintenance practices.
- Improvements in the present operation and maintenance practices.
- Construction of off-line storage facilities with the settled flows returned gradually to the sewer system or receiving stream.
- Direct treatment of storm sewer discharges.
- Source control practices.

These options are discussed on the next page.

TABLE VI-5: OPTIONS FOR THE TENNESSEE RIVER SERVICE AREA

Description of Option	Estimated Costs (Capital/yearly O & M) $000	Waste Load Reduction % ($BOD/SS/NH_3$/Fec. Col.)
1. Continuation of the Present Operation and Maintenance Practices	0	0/0/0/0
2. Improvement in the Present Operation and Maintenance Practices	20%	5/10/0/0
3. Sewer Separation Without Treatment of Storm Flows	14,630/0	40/0/0/99
4. Off-line Storage with Flows Returned to the Interceptor		
a. Surface impoundment	600/20 per MG Storage	80/80/0/90
b. Subsurface impoundment	1800/25 per MG Storage	80/80/0/90
5. Direct Treatment of Combined Sewer Overflows		
a. Dissolved Air Flotation	37 per mgd/.07 per MG Treated (1)	40/60/10/0
b. Microscreening	12 per mgd/.007 per MG Treated (1)	30/70/0/0
c. Disinfection (high-rate chlorination)	1.6/.1 per MGD (1)	5/0/0/99
d. Swirl Concentrator	6.5/0 per mgd	20/50/0/0

(1) Depending on the overflow rates, it may be more cost effective to convey the individual overflows via a relief sewer to a central treatment facility in the service area.
The costs of relief sewers are not included.

Continuation of the Present Operation and Maintenance Practices: The city of Chattanooga presently cleans and repairs the open ditch sewer systems when accumulated material or vegetative growth has caused significant reductions in hydraulic capacity.

As discussed previously, street sweeping is performed in the areas served by storm sewers approximately once a week.

The sewer cleaning and street sweeping activities performed in the areas served by storm sewers approximately once a week.

The sewer cleaning and street sweeping activities performed in the storm sewer service areas result in a pollutant reduction in storm water runoff because the material is removed prior to contact with the runoff. The determination of actual reduction efficiencies and the cost-effectiveness of these practices is highly complex. However, these are good management practices which should be continued.

Improvement in the Present Operation and Maintenance Practices: By improving the present operation and maintenance activities, the probability that a sizable sediment or organic load will be present during the time of a storm event is reduced. Improving the present activities will entail buying new equipment and providing more manpower to the existing programs. It is estimated that an increase of 20 percent in the present operation and maintenance activities will result in slight pollutant reductions.

Construction of Off-Line Storage Systems: Control of storm water can be accomplished through the collection and storage of peak flows. The stored water is released gradually back to the sewer system or to the receiving stream. The storage facility also serves as a settling basin, retaining much of the undesirable material in the runoff. These solids must be removed by drag line or other means when the effective volume is significantly reduced.

Direct Treatment of Storm Sewer Discharges: The direct treatment options which were considered for storm sewer discharges in the 208 study area are:

- Dissolved air flotation
- Microscreening
- Disinfection
- Swirl Concentrators

Detailed discussions of these options were discussed earlier.

Source Control Practices: The source control options available for the abatement and control of the storm sewer discharges are the same as for combined sewer service areas; therefore, for a description of these options refer to the previous section. Just as for the combined sewer service areas, selection of source control options for incorporation into specific abatement plans for each storm sewer service area were a function of the computer modeling, water quality data, and engineering feasibility.

Options For The Storm Sewer System

The storm sewer service areas include:

- North St. Elmo
- South St. Elmo
- South East Lake
- Highland Park-East Lake
- South Brainerd
- North Brainerd
- Eastdale
- East Chattanooga-Avondale-Bushtown-Orchard Knob

The Highland Park-East Lake, North St. Elmo, South St. Elmo, and South East Lake service areas all discharge directly to Chattanooga Creek. The East Chattanooga-Avondale-Bushtown-Orchard Knob service area discharges to Citico Creek. The Eastdale and North Brainerd service areas discharge directly into South Chickamauga Creek. The South Brainerd Service Area discharges to Spring Creek which is tributary to West Chickamauga Creek and South Chickamauga Creek.

The options available for abating and controlling the discharges from the storm sewer service areas are outlined in Table VI-6.

D. URBAN RUNOFF AREAWIDE NULL ALTERNATIVE

In this section, documentation of the existing wet weather water quality conditions (null alternative), as determined by computer modeling, are presented. A detailed discussion of the water quality modeling parameters and assumptions, together with the critical wet weather conditions utilized, are presented in Work Element 307.

The four major watercourses in the study area are briefly described and existing wet weather water quality conditions are delineated. These watercourses are North Chickamauga Creek, South Chickamauga Creek, Chattanooga Creek, and Nickajack Reservoir.

1. North Chickamauga Creek

North Chickamauga Creek and its tributaries empty into the backwater of Nickajack Reservoir at Tennessee River Mile 470.9. The water quality of this stream is generally good, as is evidenced by the water quality information presented earlier. However, there is one reach (river mile 7.0-8.7) designated by the state of Tennessee as being an effluent limited segment in violation of stream standards. This classification applies to streams which, while in violation of stream standards, are expected to meet these standards upon application of best available treatment (BAT) processes for industrial dischargers. Another reach of North Chickamauga Creek (river mile 0.0-6.0) has been designated as being a water quality limited segment not presently in violation of stream standards. This classification is used whenever a stream segment is expected to violate stream standards even after application of the best available treatment

TABLE VI-6: GENERAL OPTIONS FOR THE STORM SEWER SERVICE AREAS

Description of Option	Estimated Costs (Capital/yearly O & M) $000	Waste Load Reduction % ($BOD/SS/NH_3$/Fec. Col.)
1. Continuation of the Present Operation and Maintenance Practices	0	0/0/0/0
2. Improvement in the Present Operation and Maintenance Practices	20%	5/10/0/0
3. Sewer Separation Without Treatment of Storm Flows		
4. Off-line Storage with Flows Returned to the Interceptor		
a. Surface impoundment	1000/30 per MG Storage	30/70/0/0
b. Subsurface impoundment	3000/35 per MG Storage	30/70/0/0
5. Direct Treatment of Combined Sewer Overflows		
a. Dissolved Air Flotation	35 per mgd/.07 per MG Treated (1)	40/60/10/0
b. Microscreening	11 per mgd/.007 per MG Treated (1)	30/70/0/0
c. Disinfection	1.5/.1 per MGD (1)	5/0/0/99
d. Swirl Concentrator	6.5/0 per mgd	20/50/0/0

methods for industries. The stream standards applicable to these reaches are based upon the stream classification of intended use made by the state. The state of Tennessee has designated North Chickamauga Creek as having the following uses:

- Fish and aquatic life
- Recreation
- Irrigation
- Livestock watering and wildlife

The stream standards set for these uses are as follows:

- Dissolved oxygen 5.0 mg/l
- Ammonia-nitrogen 1.5 mg/l
- Fecal Coliforms 200 MPN/100 ml

These standards were used as the criteria for determining water quality violations in evaluating the wet weather model output.

There is one industrial, one commercial, and one municipal discharger located on the modeled portion of North Chickamauga Creek. These dischargers, their locations, flows, and effluent characteristics used for modeling purposes are listed in Table VI-7. It should be noted that the Chickamauga Power Service Center and Northgate Mall are both located on a water quality limited segment of the stream. The other discharger, Hixson High School, is located on an effluent limited segment.

Wet weather modeling for North Chickamauga Creek was accomplished by simulating a 10 year, 24 hour storm during low flow Q_{20-3} conditions. The portion of the stream modeled reaches from the junction with Tennessee River to a point 8.7 miles upstream near the Hixson High School discharge. The selected storm event is detailed by its hyetograph presented in Table VI-8. It should be noted that the maximum rainfall occurred during the third hour (hour 2) of the storm. The effect of this rainfall event on stream flow is depicted in the hydrographs for two points along the stream presented in Table VI-9. For both locations, the maximum flow occurs during hour 2, corresponding to the maximum rainfall. There are three peaks evident in each hydrograph. The first (hour 2) is a result of the heavy rain falling during the first two hours of the storm. The second and third peaks (hour 9 and hour 12, respectively) are due to increases in rainfall intensity in the hours preceeding them (hours 7 and 11).

The effect of the imposed storm event on the stream's water quality is demonstrated in Figures VI-2, and VI-3, and Table VI-10. Figures VI-2, and VI-3 present values for various water quality parameters plotted against the time since the beginning of the storm. Two locations are graphed, river mile 0.0 (Figure VI-2), the junction of North Chickamauga Creek and Nickajack Reservoir, and river mile 2.7 (Figure VI-3), the point at which the minimum dissolved oxygen value for the stream was observed. Table VI-10 presents maximum, minimum, and average wet weather values for five water quality parameters at various locations along the creek. Analysis of these data is presented below.

TABLE VI-7

POINT SOURCE DISCHARGERS LOCATED ON NORTH CHICKAMAUGA CREEK

Stream and River Mile	Discharger	Flow (cfs)	BOD_5 (mg/l)	NH_3-N (mg/l)	D.O. (mg/l)	Fecal Coliforms (#/100 ml)
North Chickamauga 0.7	Chattanooga Power Service Center	0.009	30.9	16.5	4.0	130
Unnamed tributary 1.0/ North Chickamauga 4.4	Northgate Mall	0.39	2.0	2.0	4.0	1
North Chickamauga 8.7	Hixson High School	0.0015	2.5	16.0	3.0	200

TABLE VI-8

STORM EVENT HYETOGRAPH FOR WET WEATHER MODELING

Time (Hours)	Rainfall (in./hr.)
0	0.36
1	0.36
2	1.64
3	0.20
4	0
5	0.20
6	0.12
7	0.48
8	0.24
9	0.12
10	0.24
11	0.32
12	0.12
13	0.28
14	0.16
15	0.12
16	0.12
17	0.12
18	0
19	0.08
20	0.08
21	0
22	0
23	0
24	0

TABLE VI-9

WET WEATHER HYDROGRAPHS FOR NORTH CHICKAMAUGA CREEK

Time (hours)	Flow (cfs) River Mile 0.7	Flow (cfs) River Mile 6.0
1	37.03	9.52
2	999.6	298.5
3	631.0	179.7
4	125.4	40.82
5	66.01	20.27
6	57.16	19.19
7	140.4	44.01
8	117.8	42.93
9	143.0	48.03
10	92.95	34.78
11	84.43	28.81
12	127.5	42.34
13	83.79	31.53
14	89.92	30.08
15	79.02	28.23
16	56.48	20.49
17	46.76	16.46
18	29.14	11.25
19	15.38	6.08
20	15.12	4.98
21	14.56	5.09
22	9.53	3.67
23	5.84	2.36
24	3.74	1.52
25	2.54	1.02
26	1.80	0.72

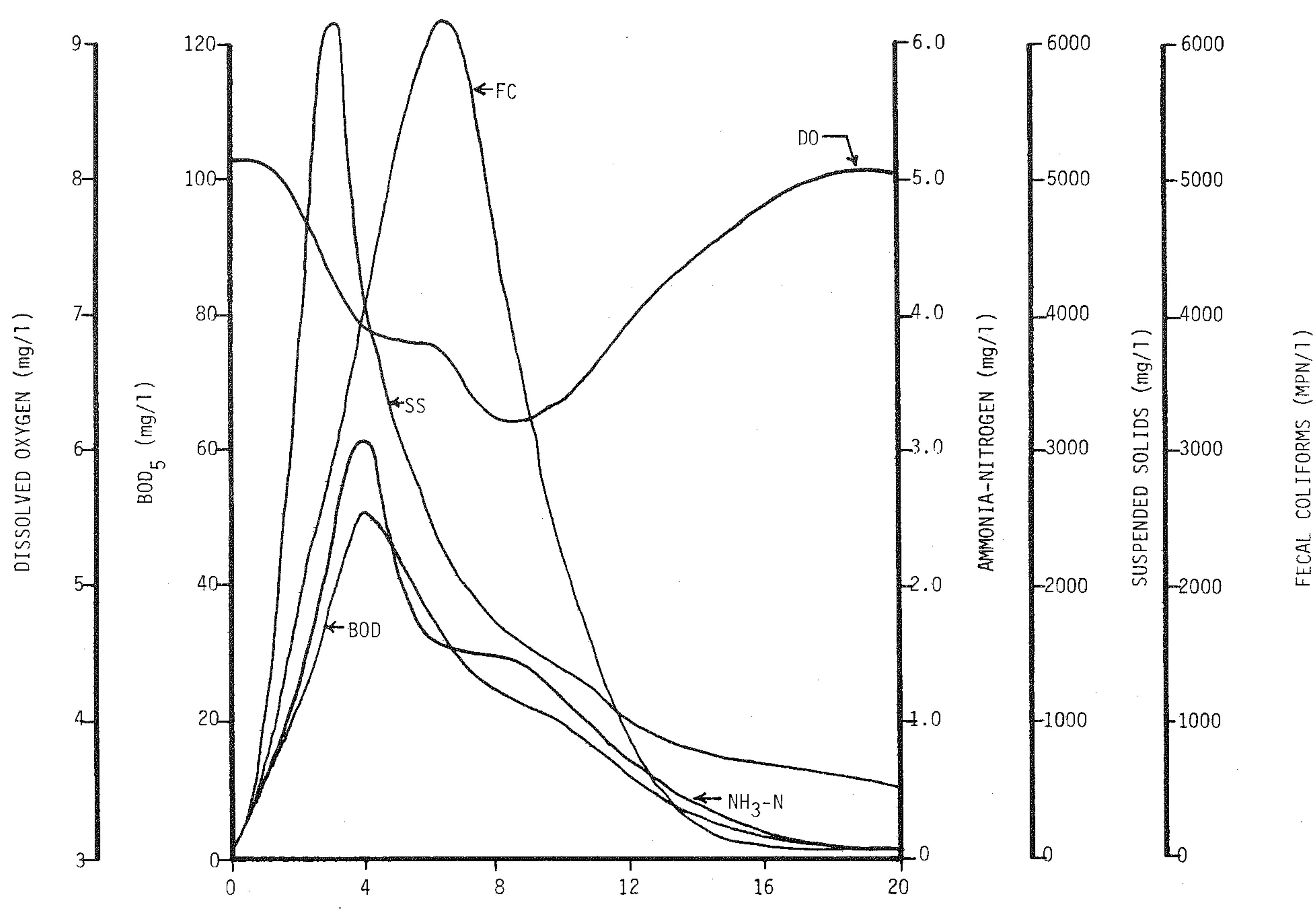


FIGURE VI-2: Existing Water Quality in North Chickamauga Creek (River Mile 0.0) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

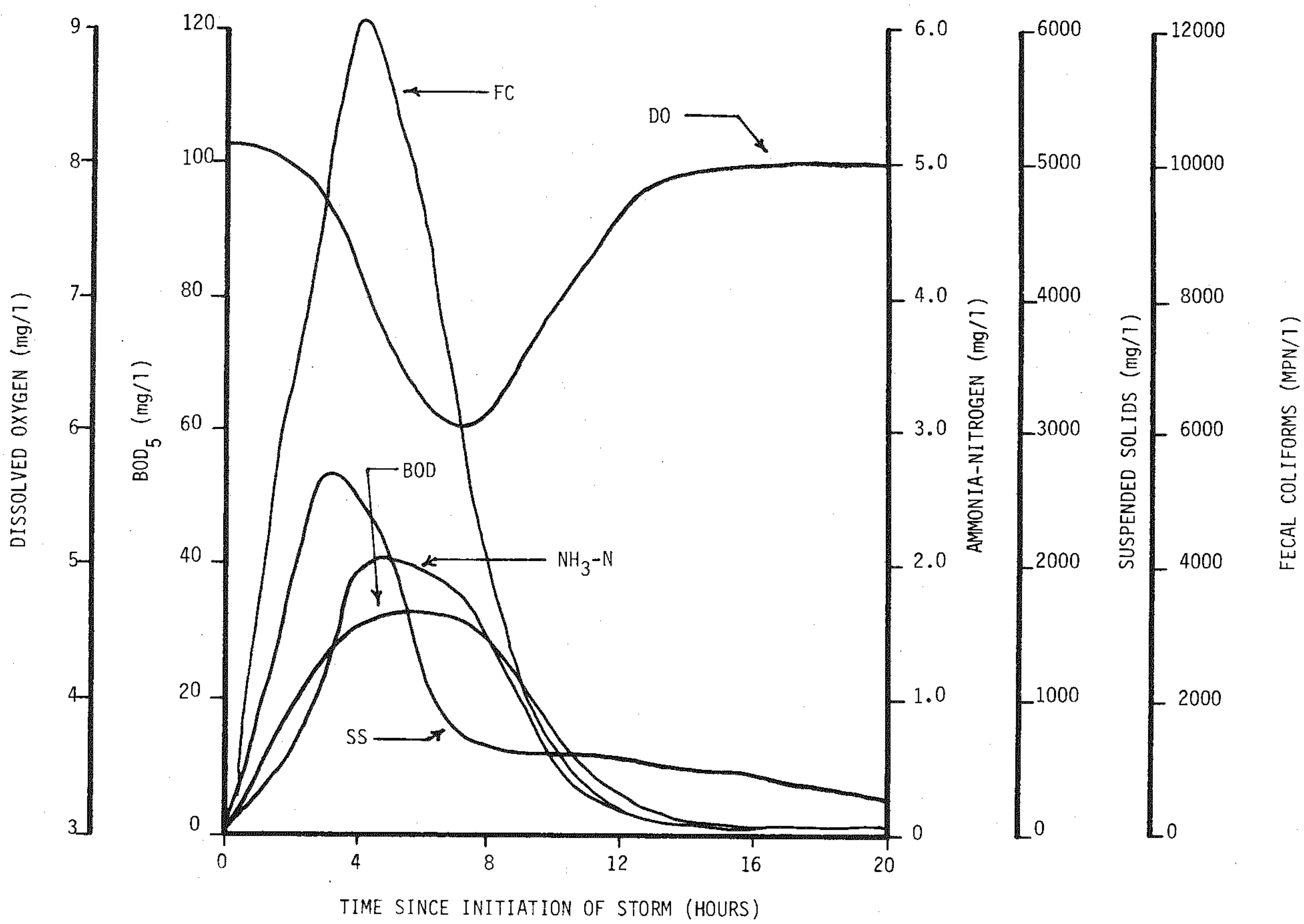


FIGURE VI-3: Existing Water Quality in North Chickamauga Creek (River Mile 2.7) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

TABLE VI-10

WATER QUALITY PARAMETER VALUES FOR NORTH CHICKAMAUGA CREEK
DURING WET WEATHER CONDITIONS

River Mile	BOD_5 (mg/l)			TSS (mg/l)			Fecal Coliforms (#/100 ml)			NH_3-N (mg/l)			D.O. (mg/l)		
	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.
8.7	7.3	59.7	0.65	647	3430	11	54	250	<1	0.61	4.2	0.10	8.0	8.2	7.1
8.0	6.1	33.3	0.48	779	5820	11	385	7630	<1	0.42	2.8	0.04	8.0	8.2	7.1
6.0	6.6	29.5	0.48	729	3500	11	316	3650	<1	0.55	2.3	0.04	7.9	8.2	6.7
4.4	6.6	24.1	0.50	855	2930	9.0	227	2170	<1	0.57	2.1	0.05	7.8	8.2	6.4
2.7	7.0	23.0	0.24	875	2750	3.4	182	1370	<1	0.60	2.0	0.05	7.6	8.1	6.1
0.7	8.4	35.7	0.40	1270	6150	20	128	724	<1	0.74	3.1	0.06	7.6	8.1	6.5
0	8.3	35.3	0.17	1260	6150	9.5	106	619	<1	0.73	3.0	0.06	7.4	8.1	6.2

Figures VI-2, and VI-3 exhibit similar trends in the data they display. Maximum values for ammonia-nitrogen, suspended solids, and BOD_5 occur at approximately the same time, around hour 4 of the storm. These values are a reflection of the maximum rainfall and the resulting runoff which takes place during hour 2 of the storm. The values at river mile 0.0 are higher for all three parameters than at river mile 2.7. The fecal coliform peak occurs a little later in the storm event, around hour 6. Values at river mile 0.0 are lower than at river mile 2.7. The dissolved oxygen sag reaches its minimum near hour 8. The profile for river mile 2.7 shows a lower minimum value, earlier sag, and slower recovery than that experienced at river mile 0.0. This is not surprising since the increased stream depth in the backwater areas of the Tennessee River provide dilution of the storm water flows and thus a lessening of the peak effects of the storm.

Table VI-10 displays several patterns in the water quality parameter values as they are viewed according to location. Ammonia-nitrogen and BOD_5 follow roughly the same trend with high initial values, a dramatic decrease, and a gradual increase. The high values at river mile 8.7 are due to the first flush effect of the modeled storm. These values drop at river mile 8.0 due to the dilution effects of the tributary located there. The following increase is a result of the runoff from the storm event. Significant increases in both parameter values, noted at river mile 0.7, are most likely due to the discharger located on the tributary which has its confluence at this point. Fecal coliform values exhibit a large increase at river mile 8.0 due to the presence of an upstream discharger and as a result of the runoff from the storm event. The average values steadily decrease downstream as dilution from runoff occurs. Suspended solids increase with downstream distance due to the increasing amounts of runoff experienced at these locations. The dissolved oxygen values exhibit a gradual decrease, attributable to the increased oxygen demanding material contained in storm runoff.

Tennessee water quality statutes for ammonia-nitrogen and fecal coliform (1.5 mg/l and 200 MPN/100 ml) are violated at all locations during the storm event. These violations are however, short-lived and can be directly attributed to the runoff occurring during wet weather conditions. No locations exhibit violations of the dissolved oxygen standard. The values for suspended solids and BOD_5 indicate few, if any, serious water quality problems. In general, it can be stated that no major adverse effects result during wet weather conditions on North Chickamauga Creek.

2. South Chickamauga Creek

South Chickamauga Creek and its tributaries empty into the Tennessee River at river mile 468.2. The water quality of these streams is highly variable, as the information presented earlier demonstrates. Many industrial and municipal dischargers are located in this river basin, causing water quality problems. In some locations, pH varies from below 5.0 to above 10.0, dissolved oxygen approaches zero, and high concentrations of nitrates, ammonia, and toxic metals are present. Consequently, the state of Tennessee has designated South Chickamauga Creek and its tributaries from river mile 0.0 to 17.3 as being water quality limited segments in violation of stream standards. Several locations on both South and West Chickamauga Creeks are classified by the state of Georgia as being effluent limited. The stream standards applicable to these reaches are based upon the classification of intended use made by the state. South Chickamauga Creek and its tributaries have been designated by the state of Tennessee as having the following uses:

- Industrial water supply
- Fish and aquatic life
- Irrigation
- Livestock watering and wildlife

These uses require that the following standards be met:

- Dissolved oxygen 5.0 mg/l
- Ammonia-nitrogen 1.5 mg/l
- Fecal coliforms 1000 MPN/100 ml

These criteria were used in determining stream violations when wet weather model outputs were evaluated.

There are several municipal and industrial dischargers located on the modeled portions of South Chickamauga Creek and its tributaries. The major dischargers, their locations and effluent characteristics are listed in Table VI-11. All of these dischargers are located in water quality limited segments of their respective receiving streams.

The storm used in the modeling process has been previously described by its hyetograph (Table VI-8). Hydrographs for two locations on South Chickamauga Creek are presented in Table VI-12. The three peak flows occur at hours 2, 9 and 12 for similar reasons presented in the discussion of North Chickamauga Creek. The stream reaches modeled include South Chickamauga Creek from its junction with the Tennessee River to a point 16.7 miles upstream at the junction with Peavine Creek; Friars Branch from South Chickamauga Creek to a point 6.9 miles upstream, including two small tributaries; West Chickamauga Creek From South Chickamauga Creek to a location 6.9 miles upstream; and Spring Creek from West Chickamauga Creek to a point 4.6 miles upstream.

The effect of the imposed storm event on the water quality of the stream is demonstrated in Figures VI-4 and VI-5, and Table VI-13. Water quality parameter values plotted against time are presented for two locations in Figures VI-4 and VI-5. River mile 0.0 (Figure VI-4) is the junction of South Chickamauga Creek and the Tennessee River. The second location for which data is plotted is river mile 9.7 (Figure VI-5), the site of the minimum dissolved oxygen value during the modeled storm. Table VI-11 presents the maximum, minimum, and average wet weather values for five water quality parameters at several locations along the stream. An analysis of these data is presented below.

Figures VI-4 and VI-5 show several trends taking place during the storm event. The BOD maximum values at both locations occur during hour 7 after a rather quick rise and are followed by a gradual decline. The peak values for ammonia-nitrogen immediately follow the periods of heavy rain and appear simultaneously with peak flows (hours 3-4, 7, 9). Ammonia-nitrogen values at river mile 9.7 are higher due to the municipal outfalls

TABLE VI-11

MAJOR POINT SOURCE DISCHARGERS ON SOUTH CHICKAMAUGA CREEK AND ITS TRIBUTARIES

Stream and River Mile	Discharger	Flow (cfs)	BOD_5 (mg/l)	NH_3-N (mg/l)	D.O. (mg/l)	Fecal Coliforms (#/100 ml)
South Chickamauga 8.8	Vulcan Materials Co.	9.75	10.0	0	3.0	0
South Chickamauga 9.7	Brainerd STP	6.81	16.0	2.0	4.0	200
South Chickamauga 13.8	East Ridge STP	3.56	30.0	15.0	4.0	200
South Chickamauga 1.1	Alco Chemical Co.	0.77	70.0	0.6	3.0	0
Unnamed tributary 1.1/ Friars Branch 2.8	C.F. Industries, Inc.	1.70	10.0	40.0	3.0	0
West Chickamauga 4.8	Ft. Ogelthorpe STP	3.09	26.0	15.0	4.0	200

TABLE VI-12

WET WEATHER HYDROGRAPHS FOR SOUTH CHICKAMAUGA CREEK

Time (hours)	Flow (cfs) River Mile 1.6	Flow (cfs) River Mile 9.7
1	36.26	93.78
2	888.94	2203.57
3	598.43	956.75
4	111.44	186.32
5	61.09	128.58
6	48.85	128.96
7	120.61	351.06
8	102.82	282.82
9	126.02	348.85
10	82.02	217.33
11	76.53	200.70
12	110.37	313.57
13	73.61	197.00
14	81.19	216.29
15	68.75	188.67
16	50.61	132.43
17	42.04	109.71
18	25.66	67.26
19	14.20	32.98
20	14.62	33.29
21	12.71	34.86
22	8.30	21.68
23	5.30	12.59
24	3.51	7.70
25	2.42	5.02
26	1.74	3.45

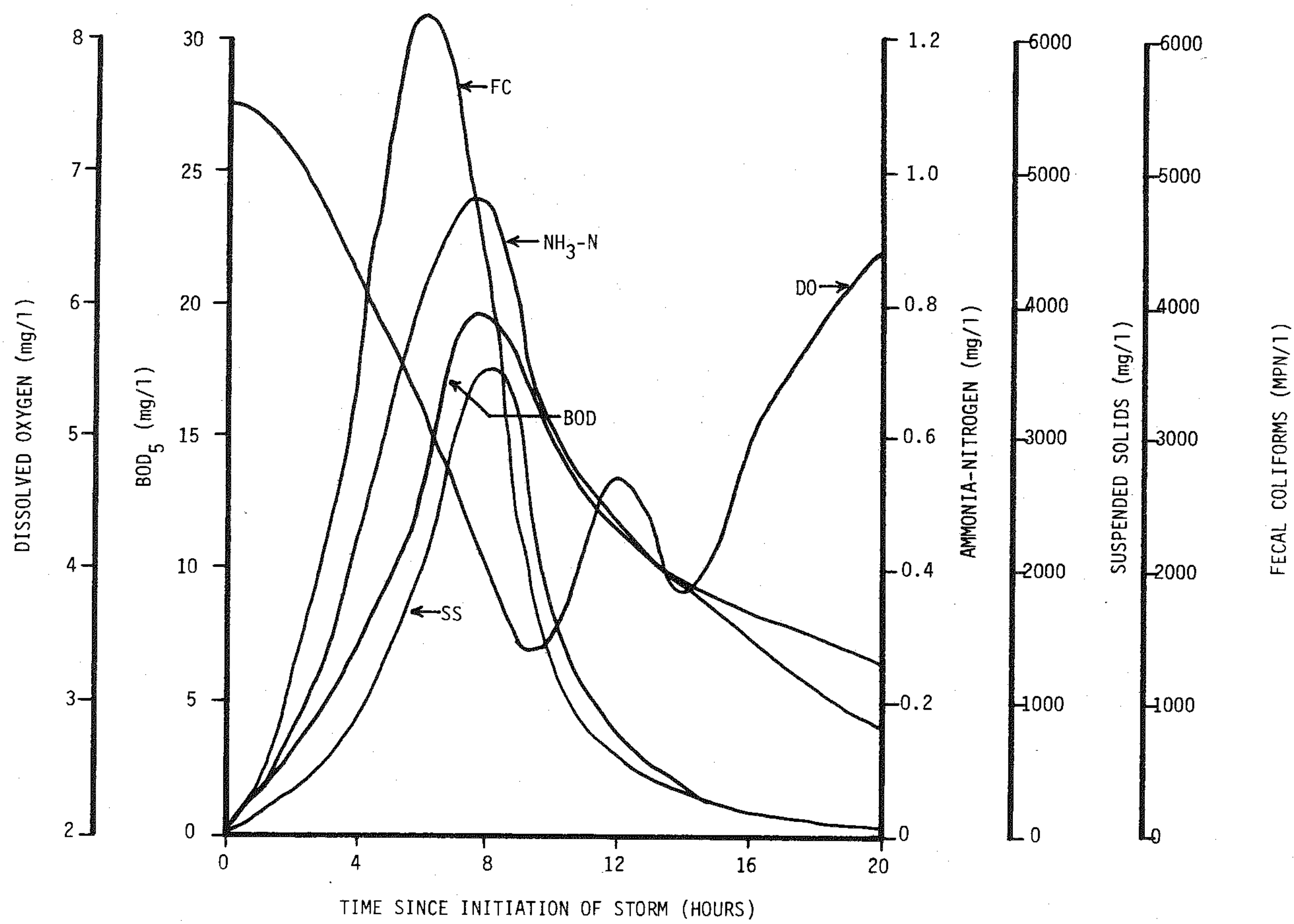


FIGURE VI-4: Existing Water Quality in South Chickamauga Creek (River Mile 0.0) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

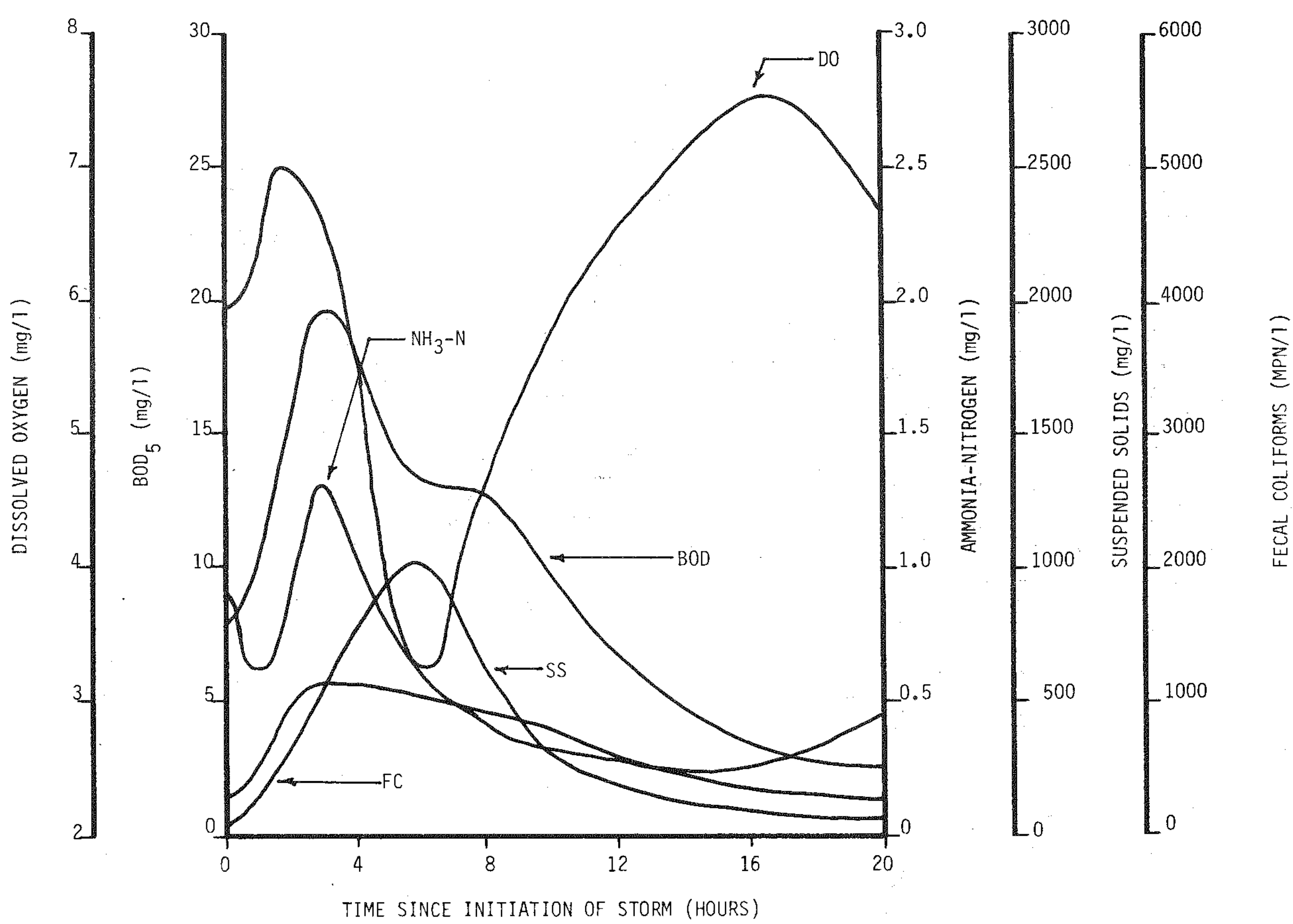


FIGURE VI-5: Existing Water Quality in South Chickamauga Creek (River Mile 9.7) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

TABLE VI-13

WATER QUALITY PARAMETER VALUES FOR SOUTH CHICKAMAUGA CREEK
DURING WET WEATHER CONDITIONS

River Mile	BOD5 (mg/l) Avg.	BOD5 (mg/l) Max.	BOD5 (mg/l) Min.	TSS (mg/l) Avg.	TSS (mg/l) Max.	TSS (mg/l) Min.	Fecal Coliforms (#/100 ml) Avg.	Fecal Coliforms (#/100 ml) Max.	Fecal Coliforms (#/100 ml) Min.	NH_3-N (mg/l) Avg.	NH_3-N (mg/l) Max.	NH_3-N (mg/l) Min.	D.O. (mg/l) Avg.	D.O. (mg/l) Max.	D.O. (mg/l) Min.
13.8	7.1	18.1	3.5	627	1940	13.4	93	650	0	0.84	1.56	0.42	6.2	7.8	3.6
12.5	6.3	18.8	2.2	515	1370	12.0	53	381	7	0.50	1.24	0.20	6.4	7.7	3.7
10.8	6.1	18.2	2.1	499	1360	10.8	44	324	6	0.47	1.15	0.18	6.1	7.6	3.3
9.7	6.5	26.6	1.9	530	1520	10.7	46	255	5	0.61	2.48	0.22	6.2	7.6	3.2
8.8	5.1	15.7	1.2	491	1180	12.7	35	252	5	0.42	1.21	0.11	6.5	7.8	3.9
7.4	6.0	18.9	1.1	852	6130	12.6	216	4340	4	0.47	1.60	0.10	6.5	7.8	3.9
5.6	5.7	15.4	1.3	755	4160	12.4	99	1660	4	0.45	1.32	0.11	6.2	7.7	3.7
3.6	5.5	15.0	1.5	751	4140	10.5	80	1350	2	0.42	1.23	0.13	5.9	7.5	3.3
1.6	5.4	13.9	1.5	784	3290	8.2	66	914	5	0.40	1.11	0.14	6.0	7.4	3.8
1.1	5.4	13.3	1.3	768	3220	7.2	56	762	4	0.39	1.03	0.13	5.9	7.3	3.7
0.0	5.3	13.0	0.9	761	3220	6.0	46	651	1	0.36	0.96	0.05	5.7	7.6	3.3

located at, and upstream of, river mile 9.7. Fecal coliform colonies reach their maximum during hour 6 for both locations. River mile 9.7 shows a high initial value due to the wastewater treatment plant located in this vicinity. Suspended solids reach their highest concentration during hour 3 (at river mile 9.7), immediately following the heaviest rainfall. The runoff characteristics and land use in the region cause this peak to be delayed a few hours at the downstream location. The dissolved oxygen reaches its minimum during hour 7 at river mile 9.7, and a little later, during hour 9, at river mile 0.0. The stream recovery is much more pronounced at the upstream point than at the downstream location. This is due to the reduced reaeration capacity at the downstream point.

Table VI-13 shows very effectively the impact of the tributary stream at river mile 7.4 on the water quality of South Chickamauga Creek. The concentrations of BOD, suspended solids, and fecal coliforms all decrease from the upstream location to this point whereupon the confluence with the tributary stream produces a marked increase in all values. The concentrations then gradually decrease as stream flow increases. Ammonia-nitrogen values show an initial maximum due to the effluent from the wastewater treatment plant located at river mile 13.8. Concentrations gradually decrease with increased stream length, downstream. Dissolved oxygen values remain more or less constant until the last two downstream points, where they begin to significantly drop. This occurs due to the reduced reaeration capacity of the backwater areas of the Tennessee River.

The Tennessee water quality statutes reviewed earlier are violated for dissolved oxygen at all stream locations during the storm. This is a result of the rather poor water quality of the stream stemming from the various municipal and industrial dischargers located along the modeled reach. The fecal coliform standard is violated at several locations on South Chickamauga (river miles 7.4, 5.6, 3.6) immediately downstream from its confluence with a tributary stream. This phenomenon is primarily the result of heavy runoff occuring along the tributary stream. Ammonia-nitrogen values exceed the prescribed standard levels at two locations, river mile 13.8 and 9.7. Both are sites of municipal treatment plants and also have high BOD_5 values. It appears that wet weather conditions do not markedly affect the water quality of the stream other than to increase solids content overall and provide some high fecal coliform values. Imposition of 1983 controls on point source dischargers to South Chickamauga Creek will significantly increase water quality in that creek. Water quality under wet weather conditions will also be significantly improved although to a lesser extent than the improvement in dry weather conditions.

3. Chattanooga Creek

The southern part of the city of Chattanooga is drained by Chattanooga Creek which then flows into the Tennessee River at Tennessee river mile 460.6. The water quality of this stream and its tributaries may be categorized as generally poor, with low dissolved oxygen and high fecal coliform values. The numerous discharges into these reaches contribute large amounts of pollutants and cause excessive amounts of solids, oils, and phenols to be present. The state of Tennessee has designated Chattanooga Creek and all tributaries from river mile 0.8 to 9.3 as being water quality limited in violation of stream standards. The standards which are used as criteria in making these classifications are based upon state designations of intended uses. These streams have been evaluated by the state of Tennessee to be suitable for the following:

- Industrial water supply
- Fish and aquatic life
- Irrigation
- Livestock watering and wildlife

The state of Georgia has designated Chattanooga Creek as being suitable for fishing and the propagation of fish, game, and other aquatic life. The stream standards that must be met for these uses are as follows:

- Dissolved oxygen 5.0 mg/l
- Ammonia-nitrogen 1.5 mg/l
- Fecal Coliforms 1000 MPN/100 ml

These standards were used in determining water quality violations in evaluating wet weather computer modeling output.

There are 13 commercial and industrial dischargers located on the modeled portion of Chattanooga Creek. Table VI-14 lists the major dischargers and characterizes the effluent from each. Of those listed in the table, all but one, Yates Bleachery, are located on the water quality limited segment of the stream. Eleven of the total 13 are situated along this stream reach and contribute significantly to the pollution problems experienced there. Their effect on the water quality at specific locations will be assessed below.

The imposition of a 10 year, 24 hour storm on low flow (Q_{20-3}) conditions was utilized to achieve wet weather modeling for Chattanooga Creek. This storm has been previously detailed by its hyetograph (Table VI-8). The maximum rainfall occurs during hour 2, with other peaks at hours 7 and 11. The modeled portion of the stream reaches from the junction with the Tennessee River to a point 11.4 miles upstream. A tributary stream, Dry Creek, was also modeled from its junction with Chattanooga Creek to a point 4.3 miles upstream. The results of this modeling effort are given in the following paragraphs.

Figures VI-6 and VI-7 and Table VI-15 demonstrate the impact of wet weather conditions as simulated by the modeling process. Figures VI-6 and VI-7 present values for various water quality parameters plotted against the time since the beginning of the storm. Two locations are graphed, river mile 0.0, the junction of Chattanooga Creek and the Tennessee River; and river mile 0.8, the point at which the minimum dissolved oxygen value for the stream was observed during the storm. Table VI-15 presents maximum, minimum, and average wet weather values for 5 water quality parameters at various locations on Chattanooga Creek. Analysis of these data is presented below.

TABLE VI-14

MAJOR POINT SOURCE DISCHARGERS ON CHATTANOOGA CREEK

River Mile	Discharger	Flow (cfs)	BOD_5 (mg/l)	NH_3-N (mg/l)	TSS (mg/l)	Fecal Coliforms (#/100 ml)
0.8	Wheland Foundry	0.546	9.8	1.56	59.3	0
	Chattem Drugs	1.86	299.5	1.60	39.9	0
2.1	Crane Co.	0.40	20.0	0	151.7	0
4.7	D. M. Steward Manuf. Co.	0.015	7.2	1.20	2.4	0
	Velsicol Chemical Corp.	0.019	648.4	2.00	29.9	0
11.4	Yates Bleachery Co.	0.93	11.0	15.0	103.7	200

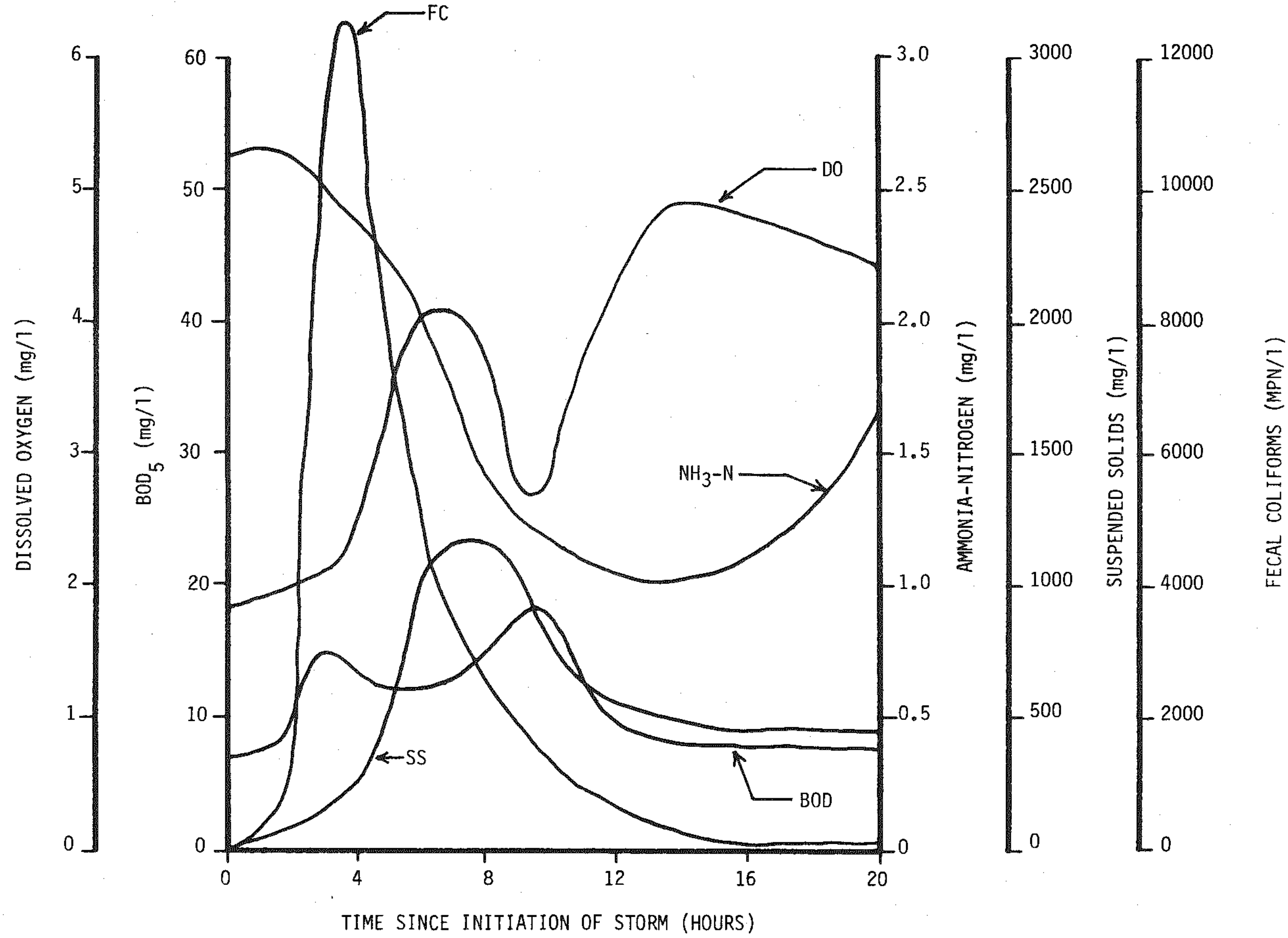


FIGURE VI-6: Existing Water Quality in Chattanooga Creek (River Mile 0.0) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

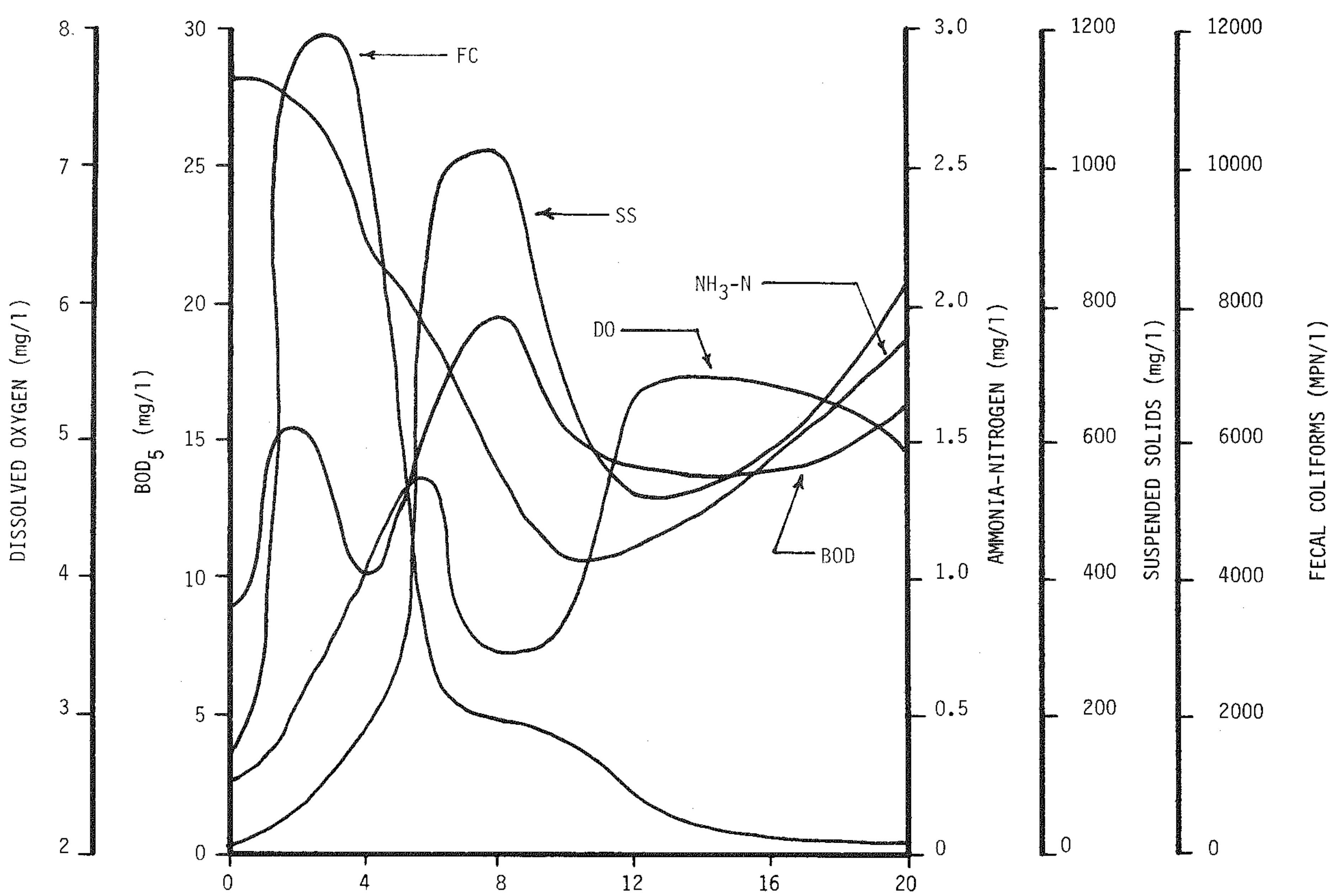


FIGURE VI-7: Existing Water Quality in Chattanooga Creek (River Mile 0.8) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

TABLE VI-15

WATER QUALITY PARAMETER VALUES FOR CHATTANOOGA CREEK
DURING WET WEATHER CONDITIONS

River Mile	BOD_5 (mg/l) Avg.	Max.	Min.	TSS (mg/l) Avg.	Max.	Min.	Fecal Coliforms (#/100 ml) Avg.	Max.	Min.	NH_3-N (mg/l) Avg.	Max.	Min.	D.O. (mg/l) Avg.	Max.	Min.
11.4	4.9	34.3	0	3400	13000	0	704	1810	0	0.40	2.42	0	7.8	8.2	4.9
9.5	5.2	33.1	0	330	278	0	36	296	0	0.32	2.70	0	7.9	8.2	6.0
8.0	4.2	52.3	0	4320	28000	0	290	6160	0	0.32	4.13	0.02	7.9	8.2	5.5
6.3	6.5	32.5	1.6	1890	8250	0	267	2310	0	0.42	2.60	0.07	7.6	8.1	5.5
5.5	3.7	18.3	0.6	1200	4620	<1	1340	23000	0	0.31	1.47	0.05	7.8	8.2	6.0
4.7	4.3	16.3	1.3	1050	4060	<1	683	12000	0	2.10	3.83	1.25	7.3	7.8	5.4
2.6	4.1	14.0	1.3	1020	3460	0.1	530	9160	0	1.84	3.43	1.18	6.6	7.4	4.6
2.1	8.3	13.5	5.4	647	1230	0.9	2260	20000	0	1.74	3.06	1.10	5.3	6.2	3.8
0.8	8.1	13.1	5.5	601	1170	2.7	1920	16000	0	1.66	2.85	1.05	4.6	5.5	2.7
0.0	7.7	12.7	5.4	565	1170	2.7	1630	14000	0	1.60	2.72	1.01	3.9	5.0	1.9

The data graphed in Figures VI-6 and VI-7 display two major influences on water quality. The first is that produced by the storm event. This effect is evident in the values for BOD, suspended solids, and fecal coliforms. The maximum concentrations of all 3 parameters occur between hours 8 and 9, or during hour 2, following the period of maximum runoff due to the rainfall in hours 2 and 7. The second influence on water quality is that produced by the point source dischargers lying directly upstream from the graphed locations. The ammonia-nitrogen and dissolved oxygen profiles show the significant effect of these dischargers on the creek's water quality. The critical values for these parameters occur at hour 1, before the storm event begins. The runoff from the storm serves to dilute the discharger effluents so ammonia-nitrogen levels decrease as stream flow increases and dissolved oxygen values increase with time of storm.

Table VI-15 further demonstrates the effect of dischargers on the creek's water quality. The BOD and fecal coliform values follow roughly the same pattern, showing increases at river mile 2.1, directly downstream from several dischargers. The ammonia-nitrogen profile shows a great increase at river mile 4.7, corresponding to a discharger location. The effect of the tributaries entiring at river mile 6.3 is seen in the short-lived changes produced in ammonia-nitrogen, suspended solids, and BOD values at this location. Dissolved oxygen levels begin to drop dramatically at river mile 2.6 and do not recover prior to entering the Tennessee River. This is caused by the combined effects of a drop in reaeration capacity in the backwater areas of the Tennessee River and the combined sewer overflows located in this section of Chattanooga Creek. It should be pointed out however, that dissolved oxygen levels at these locations during the storm are consistently higher than the levels experienced during the pre-storm condition.

The applicable Tennessee water quality standards are violated at many locations on Chattanooga Creek. Fecal coliform and ammonia-nitrogen values exceed the recommended levels at all locations but one. Dissolved oxygen concentrations fall below stream requirements at half the modeled locations. Suspended solids and BOD_5 concentrations reach very high levels at several locations. Most of these are the result of the dischargers located along the stream reach. Wet weather conditions serve to eliminate some of the problems by virtue of diluting pollutant concentrations. No major adverse effects can be attributed to the occurrence of the modeled storm event, with the exception of high coliform levels below the combined sewer overflows.

4. Nickajack Reservoir

Nickajack Reservoir formed by the dam at Tennessee river mile (TRM) 424.7 extends 46.3 miles upstream to Chickamauga Dam. The reservoir is approximately 55 feet deep at the dam and has a mean depth of 23.3 feet for a volume of 252,390 acre-feet. Nickajack Reservoir is the smallest impoundment of the main stem of the Tennessee River and provides only 32,000 acre-feet of controlled storage for flood control. Consequently, it often resembles a slowly flowing river more than a lake.

The Chattanooga area of Nickajack Reservoir is considered by the Tennessee Department of Public Health to be the most severely degraded waterway in the Lower Tennessee River Basin. Nickajack Reservoir begins in the extreme northwest corner of Chattanooga and flows through the heart of the city. This portion of the Tennessee River directly receives waste flow from numerous industries (especially cooling water discharges), several major domestic treatment plants (Mocassin Bend, Red Bank, and Signal Mountain), and from pavement runoff and sewer bypass, resulting in dissolved oxygen and coliform standard violations.

During the calendar year of 1973, the Tennessee Valley Authority conducted an extensive, 12-month bacteriological, sanitary-chemical, and mineral water quality survey of Nickajack Reservoir.

The results of the bacteriological survey indicated that most areas of the 46-mile-long reservoir were suitable for water contact recreation. The monthly samples showed that the Nickajack waters were relatively low in organic content; BOD values of approximately 1 mg/l were found at all main stream stations throughout the year. Dissolved oxygen and temperature profiles indicated that the reservoir was well mixed and did not undergo thermal stratification. Dissolved oxygen concentrations were ample and were found to drop below the state standard very rarely. Phenols were observed in very high concentrations throughout the reservoir ranging up to 75 μg/l with the average being more than 4 μg/l.

The mineral quality of water in Nickajack Reservoir was determined to be suitable for domestic and industrial uses after appropriate treatment The concentration of nitrate-plus-nitrite nitrogen average 0.43 mg/l and ammonia-nitrogen averaged about 0.07 mg/l at the main stem sample locations. Total phosphate phosphorus concentrations average 0.05 mg/l in the main stem of Nickajack Reservoir. Suspended solids ranged from less than 1 mg/l to 200 mg/l at stations in the reservoir and at most stations averaged less than 20 mg/l. The higher values were observed after heavy rainfalls as expected.

The state of Tennessee has designated the portion of Nickajack Reservoir from Tennessee river miles 448 to 471 as being a water quality limited segment in violation of stream standards. This classification is given to stream reaches that are expected to violate water quality standards after application of best available treatment (BAT) practices for industries and secondary treatment for municipalities. The standards used in evaluating stream reaches for this designation are based upon the specified uses assigned to the stream by the state. The lower portion of Nickajack Reservoir (TRM 448-460) is classified by the state of Tennessee as having the following uses:

- Industrial water supply
- Fish and aquatic life
- Livestock watering and wildlife
- Navigation

In addition to these uses, the upstream portion of Nickajack Reservoir (TRM 460-499) is designated as having the following uses:

- Domestic raw water supply
- Recreation
- Irrigation

The state standards which must be met for these uses are given as follows:

- Dissolved oxygen 5.0 mg/l
- Ammonia-nitrogen 1.5 mg/l
- Fecal Coliforms 200 MPN/100 ml

These criteria were used in identifying water quality violations as determined by the modeling process.

In order to fully evaluate the effect of wet weather on the water quality of a stream, it is necessary to identify the locations of point source dischargers, tributary streams, and combined sewer overflows. Table VI-16 lists the location of tributary streams and point source dischargers, as well as their water quality and effluent characteristics. Combined sewer overflows are located at Tennessee river miles 451.0, 457.8, 458.7, and 459.8.

Wet weather modeling for Nickajack Reservoir was accomplished using the 10 year, 24 hour storm previously described (Table VI-8) imposed upon low flow conditions (Q_{20-3}) to give a "worst possible" storm event. The results of this modeling are displayed in Figures VI-8, VI-9, and VI-10 which present water quality parameter values at three locations graphed against time since the beginning of the storm. The points chosen (TRM 469.9, 457.8, and 443.0) are the sites of the beginning of the D.O. sag curve, a point far downstream from combined sewer overflows, and a site at the location of combined sewer overflows. An analysis of these data are presented below.

Figure VI-8 for TRM 469.9 illustrates the effect of the storm event on the water quality at this location. The critical values for dissolved oxygen, ammonia-nitrogen, and BOD all occur during hour 6 of the storm. This is shortly after the heaviest rainfall of the storm and can be attributed to stormwater runoff. The maximum concentration of suspended solids occurs slightly earlier during hour 5. Fecal coliform values, while nearly constant, are somewhat lower during this period due to the dilution from runoff. The background levels of pollutants at this location show that only ammonia-nitrogen and suspended solids increase significantly during the modeled storm event. The highest concentrations for these constituents do not indicate any serious water quality problems.

The data presented in Figure VI-9 for TRM 457.8 display a different trend than that for the upstream location due, in a large part, to the combined sewer overflows located in the vicinity of this point. Once again, the maximum suspended solids value occurs during hour 5, following the period of the heaviest rainfall. The dissolved oxygen minimum does not take place until much later in the storm (hour 14) as would be expected for this downstream location. The BOD and ammonia-nitrogen maximums occur during hour 11 of the storm event when the combined sewer overflows reach the stream. Fecal coliform values decline steadily from their initial maximum as runoff from the storm increases. The only water quality parameter to significantly increase above background levels is suspended

TABLE VI-16

EFFLUENT CHARACTERISTICS OF DISCHARGERS AND WATER QUALITY PROFILES OF TRIBUTARIES TO NICKAJACK RESERVOIR

River Mile	Discharger	Flow (cfs)	BOD_5 (mg/l)	NH_3-N (mg/l)	D.O. (mg/l)
453.8	Signal Mountain STP	0.183	17.8	13.9	8.1
454.5	General Portland Cement Co.	2.48	10.0	0	3.0
455.4	Red Bank STP	1.24	14.6	17.2	3.2
457.8	Moccasin Bend STP	47.12	46.3	8.3	5.1
458.7	Valley View Elementary School	0.003	30.9	18.5	4.0
461.8	Combustion Engineering Co.	0.19	9.7	0	3.0
	Ross-Meehan Foundries	0.06	10.2	0	3.0
	U.S. Pipe & Foundry #1	0.28	9.9	0	3.0
	U.S. Pipe & Foundry #2	0.31	7.0	29.9	3.0
462.8	Dixie Sand & Gravel Co.	1.18	9.9	0	3.0
	Gilman Paint & Varnish Co.	0.05	10.0	0	3.0
463.3	American Electrical Industries	0.50	1.0	0	3.0
463.9	Roper Corporation	0.07	10.0	0	3.0
465.3	Tennessee-American Water Co.	1.55	29.9	0	3.0
467.9	Central Soya Co., Inc.	0.15	201.2	15.2	4.0
468.2	Moccasin Bronze Co.	0.008	30.1	13.9	4.0
	DeSota, Inc.	0.05	10.4	0	3.0

TABLE VI-16 (Continued)

River Mile	Discharger	Flow (cfs)	BOD_5 (mg/l)	NH_3-N (mg/l)	D.O. (mg/l)
469.9	E.I. Dupont DeNemours & Co., Inc.	6.50	34.9	3.0	4.0
470.4	Chattanooga State Area V-T School	0.02	30.6	14.8	4.0
	Tributaries				
470.8	North Chickamauga Creek	5.0	<1	0.03	7.0
468.2	South Chickamauga Creek	181.0	2.0	0.40	5.0
465.3	Citico Creek	2.0	19.9	1.48	0.0
460.6	Chattanooga Creek	60.0	20.0	5.05	0.0
459.8	Lookout Creek	12.0	2.3	0.04	7.5

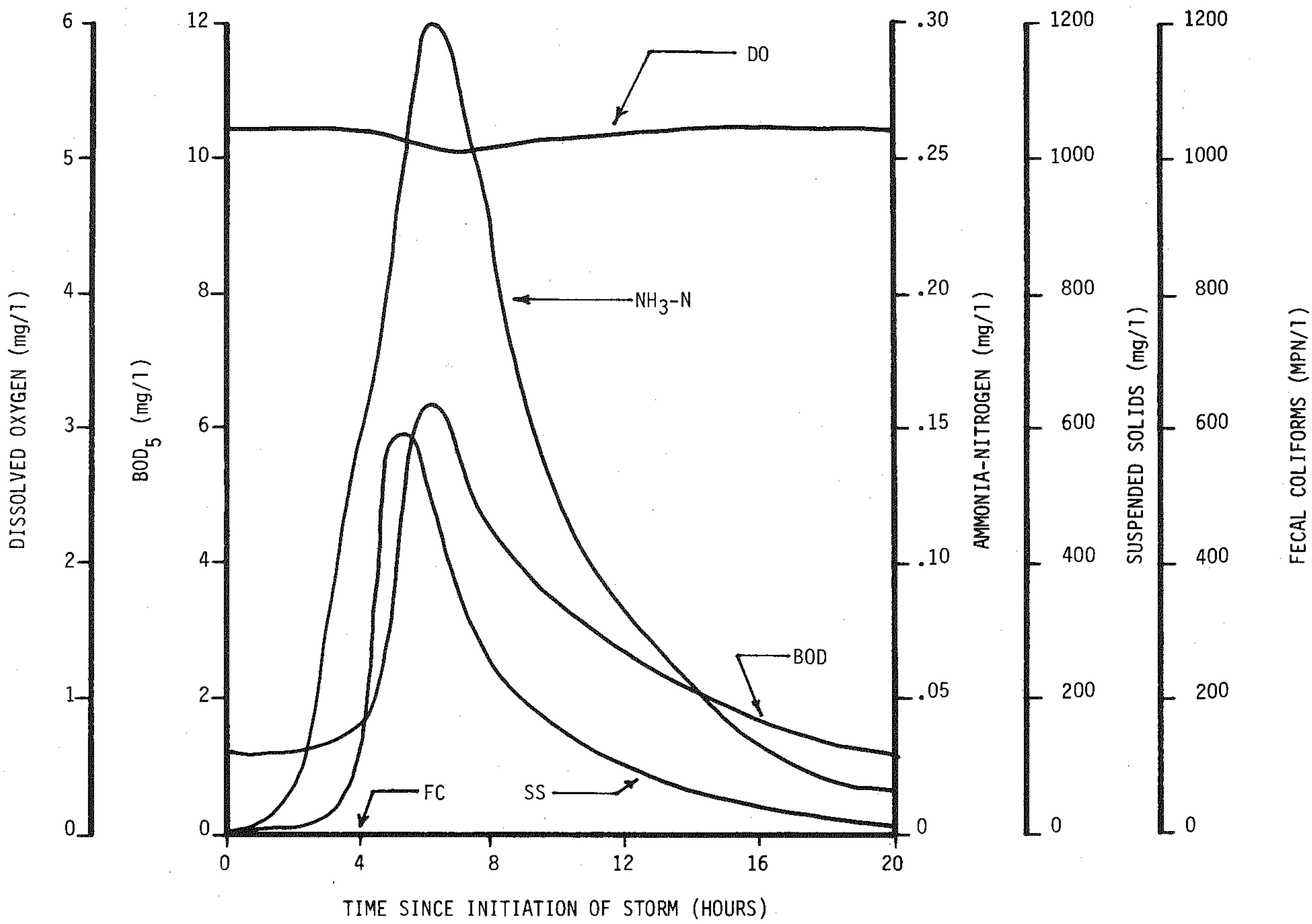


FIGURE VI-8: Existing Water Quality in Nickajack Reservoir (TRM 469.9) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

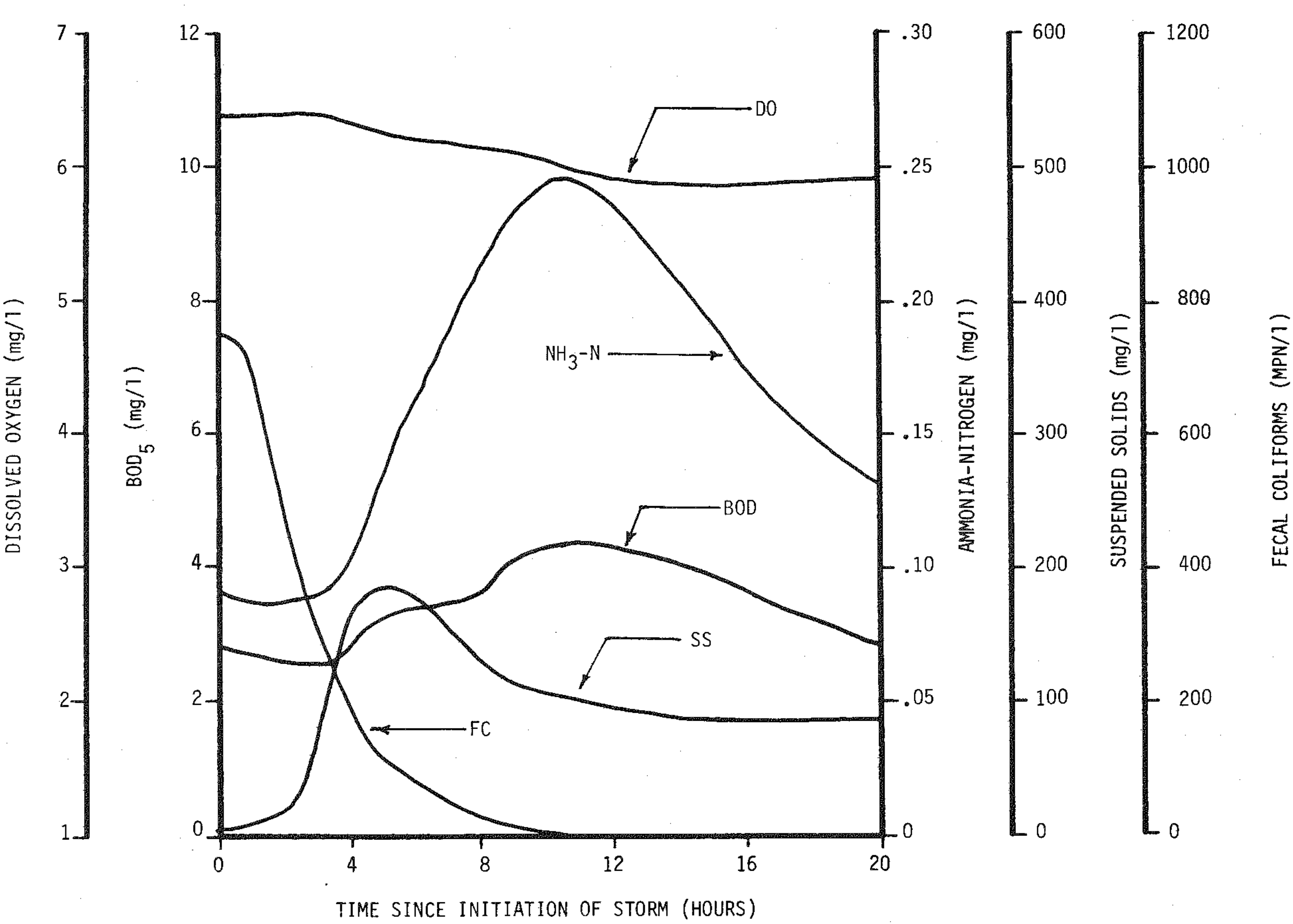


FIGURE VI-9: Existing Water Quality in Nickajack Reservoir (TRM 457.8) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions)

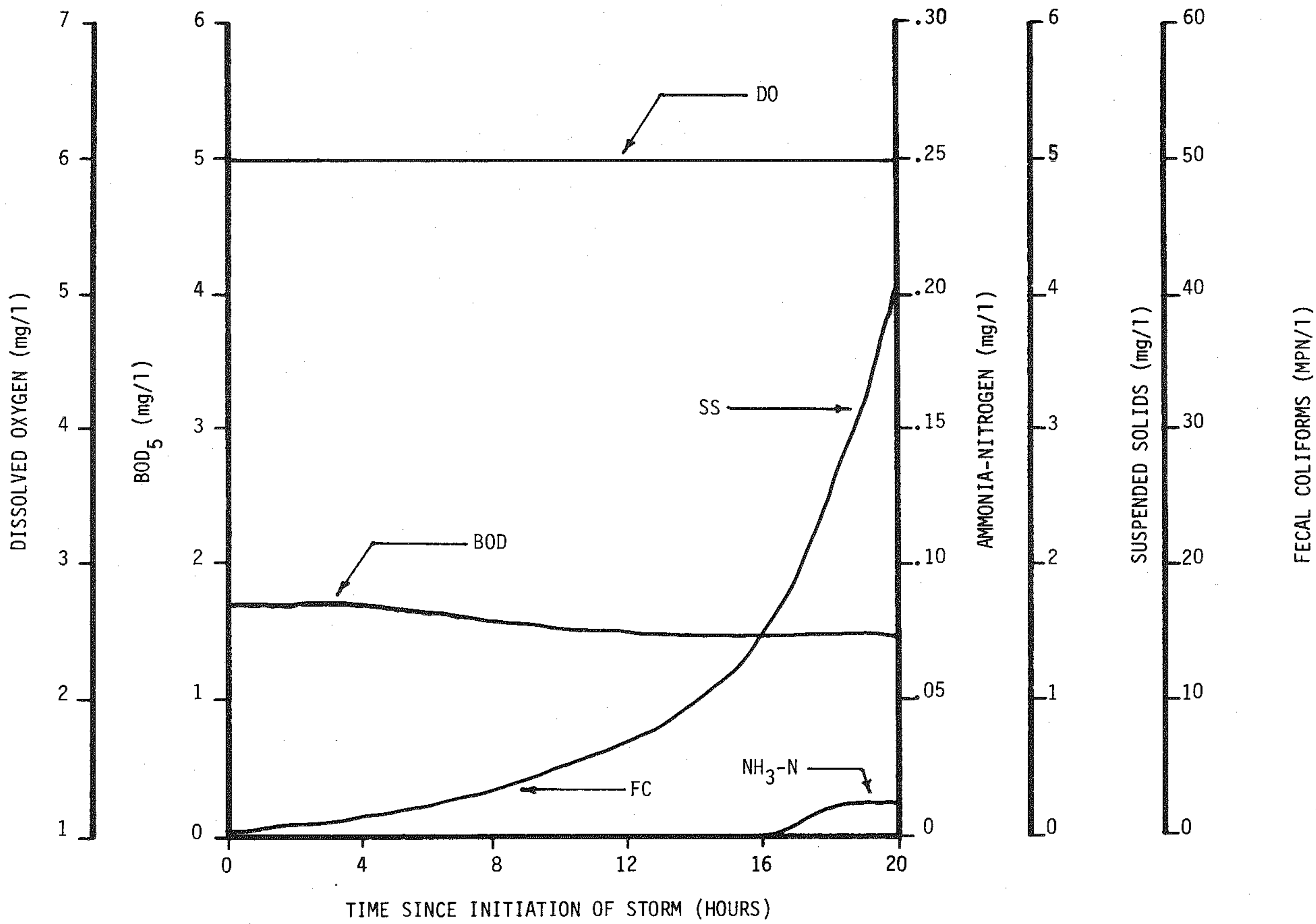


FIGURE VI-10: Existing Water Quality in Nickajack Reservoir (TRM 443) under Q_{10-7} Low Stream Flow (Critical Dry Weather Conditions) solids. Once again, this is due to stormwater runoff and is not at an extremely high level. Fecal coliform concentrations dramatically decrease from their high background levels, due to the location of the Mocassin Bend STP directly upstream from the plotted location, to negligible levels during the storm event.

The data presented in Figure VI-10 for Tennessee river mile 443.0 indicates no trends comparable to those found at the other two upstream points. Here we find a steadily decreasing BOD value along with a concurrent increase in solids concentration. Both of these phenomena may be attributed to increasing amounts of stormwater runoff. The values for dissolved oxygen, ammonia-nitrogen, and fecal coliforms are constant throughout the storm, indicating that tributary and dischargers effects are not noticeable at this downstream location. The values for these parameters are essentially at background levels throughout the storm event.

The applicable state of Tennessee water quality standards are violated for fecal coliforms at several locations. No violations for ammonia-nitrogen or dissolved oxygen were found during the modeled storm event. Fecal coliform violations are present at several points, all of which are downstream from the Signal Mountain and/or Moccasin Bend treatment plants. The magnitude of these violations decreases during the storm event, indicating that they are not due to runoff, but rather to the effluent from these treatment plants. Overall, the modeled storm event appears to have only a small deterimental impact on the water quality of Nickajack Reservoir.

E. URBAN RUNOFF PREFERRED AREAWIDE PLAN

Urban stormwater runoff is a major contributing factor in the determination of water quality in the CARCOG/SETDD 208 Study Area. Efforts have been made to determine the most feasible and economical methods in eliminating or curtailing the pollutional effect from urban stormwater runoff. Basically, there are two approaches which have been found to reduce the pollutional impact of urban stormwater. They are:

- Nonstructural or source control options which attempt to reduce the amount of pollutants washed off of the drainage area.

- Structural or discharge control options which attempt to treat the stormwater runoff at the point of discharge into the receiving stream.

In this section of the plan, these two approaches were utilized to establish specific recommendations for urban stormwater runoff control. The recommendations presented in this report are based solely upon knowledge of the existing physical systems, discussions with various state, federal, and local officials and employees of several city departments, past experience in the development of urban stormwater runoff control systems, storm water management modeling, and best engineering judgement.

1. Nonstructural Control Options

There are basically two alternatives for reducing the pollutional impact associated with urban stormwater runoff. One is the treatment of storm sewer discharges with the use of discharge controls. The other is the reduction in the pollutional load carried by the urban stormwater runoff through the use of source or nonstructural control techniques. Nonstructural or source control options or techniques include all measures for reducing stormwater pollution prior to the urban runoff entering a combined sewer, storm sewer, or receiving stream.

Realistically, existing urban areas have a more limited range of source control options than future urban areas. The urbanized land within the CARCOG/SETDD 208 Study Area is expected to increase significantly by the year 2000. With this thought in mind, the evaluation of source control options has considered both existing and future urban areas, when appropriate.

A number of control strategies which reduce the pollutional effects of urban stormwater runoff have been identified. Generally, these control strategies may be broadly categorized into either quality or quantity control measures. Quality control measures deal with the reduction of material which may be transported or "picked-up" during a rainfall event. Quantity control measures, on the other hand, deal with techniques for retention or detention of stormwater runoff allowing for flow volume reduction by evaporation or groundwater recharge, or flow rate reduction of stormwater runoff by using detention structures.

Options for quality control are included in the following areas of study:

- Street cleaning practices
- Solid waste management - litter reduction
- Chemical application controls
- Erosion control practices
- Air pollution controls
- Site control practices
- Buffer zones and greenbelts
- Chemical and material storage controls
- Catch basins

Options for quantity control are included in the following areas of study:

- On-site detention and retention
- Porous surfaces
- Site control practices
- Control of roof leaders and footing drain discharges

Each of the above options are presented in detail in Work Element No. 308, "Develop Urban Runoff Controls." Since these options are applicable to all the urban areas in the 208 study area as indicated in Figure VI-11, they will not be specifically designated for use in one area or another. However, it is desirable and strongly advised that local agencies incorporate these practices into their agency's planning and/or regulatory efforts.

The selection of one control option or strategy over another was based on several criteria. Included in these criteria were such factors as effectiveness of the option to reduce or control runoff, the estimated costs associated with an option, the environmental effect of implementation of the options, and the flexibility, reliability, and operability of the control option. The completion of evaluation of the nonstructural control options on this bases indicated several options which are applicable to the CARCOG/SETDD 208 planning area. A brief description of each of these control options is presented in the following sections.

Options for Quality Control

Street Cleaning: Street surface contaminants, which represent a major portion of urban land contaminants, can be partially removed by street sweeping operations prior to being exposed to runoff. A primary method of abating urban runoff pollution is to improve existing street cleaning practices. Currently, the city of Chattanooga has a good street cleaning program. However, there are also areas where the overall efficiency of this program may be improved. Municipal street cleaning practices may be improved by:

- Strict enforcement of parking regulations with regard to street cleaning schedules. This would serve to allow the sweepers to clean the curb area where the vast majority of the pollutional accumulation takes place.

- Increasing the removal efficiencies of street cleaning methods. This would include daily brush adjustments, proper operator training, and proper equipment maintenance.

- Increased use and proper scheduling of flushing trucks. The purchase of additional trucks may be necessary to effectively perform the necessary flushing operations.

Solid Waste Management - Litter Reduction: Although intentional disposal of waste materials on city streets and sidewalks is generally prohibited, it continues to occur frequently. Spent containers from food and drink, cigarettes, newspapers, floor sweepings, and a multitude of other materials carelessly discarded become street litter. Unless removed by street cleaning equipment, these materials often are deposited into stormwater inlets. Enforcement of anti-litter laws, convenient location of sidewalk waste disposal containers, and public education programs are all control measures that may provide significant water pollution benefits.

Chemical Application Controls: Chemicals of a wide variety are used in the urban environment for various purposes. These include chemicals used

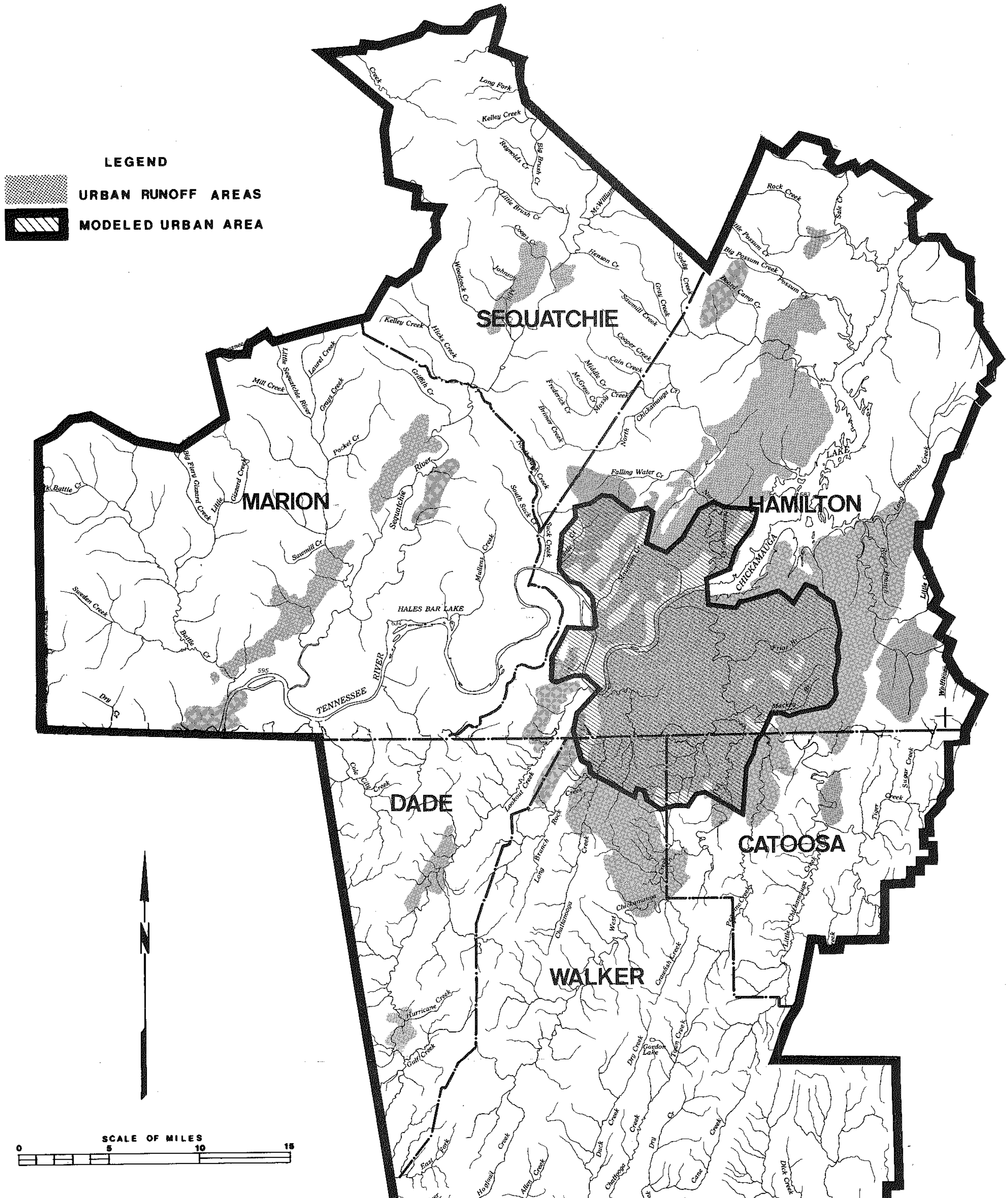


FIGURE VI-11
URBAN AREAS IN THE CARCOG/SETDD
208 STUDY AREA

to melt snow and ice from roads and sidewalk surfaces, those used to control vegetation, as well as materials used for resurfacing roads. Presently, significant problems associated with road de-icing do not appear to exist in the Chattanooga area. However, it is important to note that management should be aware of new chemicals and techniques as they become available, together with conservation programs. These efforts will help eliminate the possible pollutional effect of these chemicals upon water quality.

Erosion Controls: There are numerous methods for reducing sediment yields from urban areas. Some of these methods are delineated previously in this section and in Work Element 308. Three general methods for reducing and controlling erosion and sedimentation which are recommended for the urban area are:

- The maintenance and enhancement of native vegetation (and certain introduced species) is one of the most cost-effective methods of reducing erosion because it intercepts rainfall and reduces its impact on the ground surface, it reproduces itself and often requires very little maintenance, enhances infiltration of surface water because of root penetration of the soil, and usually enhances the visual attractiveness of the area affected.

- The lining of drainage channels with grass may also be used effectively for reducing erosion. The principal benefits of using grass-covered drainage channels are that they delay runoff, allow infiltration, enhance sedimentation of solid particles because of the rough flow surface, assimilate certain pollutants (particularly nutrients), and provide a visually attractive channel.

- It is common in urban areas to find stream bank failures caused by changes in the channel, direct uses of the stream banks which destroy protective plant cover, or by excavation and/or other disruptive activities too close to the stream bank. In such cases, one or a combination of the following options is appropriate depending on the steepness of the bank and the total contiguous area subject to erosion:

  - Grass or other plantings
  - Gabion mattresses
  - Fabriform mats inflated with pumped mortar

It should be noted that although these techniques are recommended, they are not the only ones to be considered. Since erosion and sedimentation problems are almost completely site specific, each problem area and options for controlling that problem must be considered on a site by site basis.

Air Pollution Control: Atmospheric dustfall may be a noticeable source of particulate contaminants that are deposited and ultimately washed off surfaces during rainfall events. Some of this particulate matter occurs naturally and is difficult if not impossible to control. Other particulate material results from man-made processes. Some of the man-made sources (stationary sources) include:

- Emissions from burning materials
- Emissions from chemical reactions
- Control equipment maintenance and breakdown
- Grain elevators

Recent advances in stationary source controls for particulate matter resulted in removal efficiencies commonly greater than 99 percent. Emmissions from stationary sources are controlled by a large variety of local, state, and federal agencies. The regulations and policies established by the local air pollution control board are designed to prohibit the accumulation of harmful air-pollutant concentrations and to prohibit nuisance conditions. Although particulate matter has been described as a serious problem in the Chattanooga area, it appears that this problem is being properly addressed and no further recommendations are currently required.

Site Control Practices: The range of options open to any given urban landowner to control the quality of surface runoff may vary greatly depending on the size, topography, type of existing surface cover, soil type, etc., of the owner's land. An areawide effort to minimize total runoff from urban land surfaces may contribute significantly to the improvement of surface water quality. Surface recommendations are as follows:

- Direct discharge from roof downspouts, paved driveways, and parking lots, to porous surfaces (lawns and other planted areas, graveled depressions, porous pavements, etc.).

- Use of detention devices on roof to delay runoff.

- Use of Dutch drains (an excavated pit filled with coarse rocks) to store and enhance infiltration of runoff from impermeable surfaces.

- Installation of terraces, diversion structures, runoff spreaders, etc., to control the runoff from impermeable surfaces.

- Control of urban patterns and the densities of developments.

In addition to the recommendations discussed for existing urban areas, the following options should be considered in site planning for future development:

- Minimize the amount of impermeable land surface on new sites (roofs, parking lots, driveways, etc.).

- Use porous materials for paving wherever possible, such as in driveways, parking lots, and low-traffic streets.

- Minimize changes in the existing topography, i.e., fit buildings, streets, drainage systems, etc., to the existing landscape rather than completely disregarding it to accommodate a preconceived development scheme.

- Use natural depressions and aquifer recharge areas for runoff infiltration following preliminary concentration (i.e., from drainage areas of 2 to 10 acres).

Again it is necessary to indicate that it is impossible to recommend specific site control options for the entire CARCOG/SETDD 208 Study Area because each problem area and its control is site specific.

Buffer Zones and Greenbelts: The potential for using buffer zones and greenbelts to improve the quality of runoff in already urbanized areas may be minimal. Major tributaries could be protected from urban runoff by a buffer strip of undisturbed or minimally disturbed vegetation, measured from the average annual high water line on the stream or river bank. Where previous use has stripped or diminished the plant cover, supplemental plantings and seedlings may be required. If the water body is close to a land area with particularly high runoff pollution loads (for example, large parking lots, industrial areas), a wider buffer zone may be needed. The specific use of buffer zones in the urban area will depend almost entirely on the existing availability of the areas and the protection of the zones by local planning and zoning ordinances.

Chemical and Material Storage Controls: Urban areas typically have open storage sites for chemicals such as salts, ferrous products, and extraction products or materials such as coal, gravel, and sand. The runoff from open storage sites may present minor surface water quality degradation in some cases. It should be noted that certain specific activities regarding chemical and material storage are subject to EPA rules and regulations which require some form of pretreatment of the runoff from those areas affected.

To reduce the runoff of pollutants from a storage site, one must consider whether the pollutants will be dissolved or suspended in the runoff water. If dissolved pollutants are to be controlled, the site should be covered to keep the precipitation off the stockpiles. For the control of suspended pollutants, it is not necessary to cover stockpiles with domes; however, it may be beneficial to install small sedimentation pits for the removal of the suspended pollutants contained in the stockpile runoff.

It is felt that in the case of many industrial areas and storage sites, that these areas fall under the category of point sources of pollution. It is recommended that more consideration and close inspection of these areas be performed by the appropriate state and/or federal agencies to determine the status of these sources of pollution.

Catch Basins: Catch basins traditionally have been built as inlets to combined sewers and storm drains for the purpose of removing heavy grit and debris which might otherwise settle out in the piping system. Catch basins provide a trapped pocket of liquid and solids in which the organic components undergo decomposition between rains.

Catch basins in certain circumstances are unnecessary as far as their primary source of preventing sewer clogging is concerned. The obsolescence of this former function is due to two factors:

- The greatly reduced quantities of solids entering the sewer system via the street inlets.

- Technological advances in sewer design and cleaning, as well as the effects of street cleaning.

In lieu of elimination of catch basins, either the basic design of such structures may be improved to minimize the volume of liquid retained for purposes of inducing greater stilling effects or greater attention to maintenance may be employed.

It is recommended that the existing systems of catch basins be carefully evaluated for need and proper design. Also, proper scheduling of catch basin cleaning should be established to best improve the efficiency of these facilities, if it is not presently being done.

Options for Quantity Control

On-Site Detention and Retention: In almost any system for abating storm sewer discharges and combined sewer overflow pollution, the cost involved is very sensitive to both the quantity and the rate of the flows involved. Techniques or devices to slow the flow of significant amounts of stormwater to the stormwater inlets would increase the period in which the runoff volume would be treated. Hence, a smaller and less expensive treatment facility could achieve the same degree of pollution abatement as a larger more expensive facility.

By temporarily detaining (on-site) runoff from rainfall directly falling on an impervious area, it is possible to reduce the rate of flow into the sewer system. This results in less flow to store and treat. If this is coupled with retaining (on-site) runoff from rainfall areas for percolation into the ground, then the total volume of water entering the sewer system is reduced.

Alternatives for on-site detention and retention include:

- Building detention basins in large parking lots with "undersized" outlets which serve to collect the runoff and release it over an extended time period.

- Construct detention basins in natural drainageways to slow runoff after preliminary concentration. The basin can be drained slowly with "undersized" outlets.

- Retention systems can be used in natural drainageways in cases where the collected runoff can be used effectively.

Porous Surfaces: Although having a rather limited role in already urbanized areas, this option involves the use of porous materials wherever feasible in the design and construction of urban areas. Vegetated soil is one of the most effective surfaces, but where this surface is not suitable for the required land use, a growing number of materials are available which offer resistant, yet porous surfaces, which include:

- Pre-cast concrete lattice blocks and bricks can be used in parking lots, driveways, and lightly traveled streets to give a driveable surface yet one which allows a high level of infiltration.

- In cases where a continuous hard surface is required, porous asphalt pavement may be used which allows substantial infiltration.

- Aeration of lawns, parks, golf courses, etc.

Site Control Practices: The site control practices previously discussed as quality control measures also apply here.

Roof Leaders and Footing Drains: In urban areas, roofs of structures represent a large part of the impervious surfaces which increase runoff. In many combined sewer communities, and other areas of cities, the drainage from such roof areas, as well as groundwater around the structures is discharged into public sewers. The obvious benefit resultant from the disconnection of foundation drains and roof leaders would be a reduction in the flow of stormwater which enters the sanitary sewer system.

Additionally, it should be noted that roofs, as streets, collect dust and dirt as well as other debris. Redirection of roof leaders would allow the runoff from roofs to flow onto vegetative areas where some of the pollutants may be removed.

It is recommended, that illegally connected roof leaders and footing drains be removed from the sewer system. This can be accomplished by simple inspection of the older urban areas.

2. Structural Control Options

Structural control options for reducing urban runoff pollution involve the construction of discharge treatment facilities or alterations or improvements to the present sewer system. Structural options available for abating and controlling urban runoff were discussed earlier and in Work Element 308, "Develop Urban Runoff Controls." The options which were evaluated can be grouped into the following basic categories:

- Improved Operation and Maintenance Activities
- Separation of the Combined Sewer System
- Storage
- Direct Treatment of Discharges

Reference is made to Work Element 308 for detailed discussion concerning the scope, applicability, cost, and expected pollutant reductions for the specific structural options. The following sections briefly summarize the material developed in Work Element 308, and provide the rational for the selection of an option for implementation in the CARCOG/SETDD 208 Study Area.

Structural Options Considered for the Combined Sewer System

Improvements in the Present Operation and Maintenance Activities: As discussed in Work Element 308, improvements in the present system basically involve increased budgeting in the following three activities:

- Street Sweeping
- Catch Basin Cleaning
- Sewer Maintenance

Improvements in the existing street sweeping and catch basin cleaning practices are nonstructural options and were discussed earlier in this report. The city of Chattanooga presently has a TV inspection, cleaning, and repair crew which performs inspection and maintenance work on sewers. This crew generally works on lines which have been reported as being clogged, failed, or in bad need of repair. When the crew is not working on lines known to be in need of repair, it inspects, cleans, and repairs sewer lines as they come to them. Additionally, the city has a maintenance crew which inspects, cleans, and repairs the combined sewer regulator chambers after major storm events to insure proper operation of the bypass system.

Sewer maintenance activities such as those discussed above result in significant pollutant reduction when the sewer system has characteristics which promote solids deposition during dry weather conditions. Characteristics which would tend to cause solids deposition include low flow velocities caused by large pipe sizes and/or low slopes, and pooling caused by flow restrictions or irregularities in the sewer invert.

By the mid 1960's the combined sewer system of Chattanooga, originally constructed of brick, had deteriorated to the point where solids deposition were occurring in numerous locations due to obstructions in the sewers or depressions in the sewer inverts. Concerned over the deterioration of the system, the city undertook a sewer rehabilitation program consisting of cleaning and guniting the old brick sewers. This rehabilitation resulted in the removal of flow restrictions and provided smooth inverts. Most of the sewers in Chattanooga are relatively small, egg shaped sewers. Due to the egg shape, ample slope and improved hydraulic characteristics as a result of the rehabilitation, it is believed that solids deposition is not a significant problem in the sewer system and would not be a major cause of pollution in the CARCOG/SETDD 208 Study Area. Therefore, there appears to be no justification in significantly increasing expenditures for improved maintenance activities. The present structural operation and maintenance activities are believed to be adequate and it appears that major improvements in the system would not result in significant pollutant reduction.

Separation of the Combined Sewer System: Separation of the combined sewer system would involve construction of a separate storm sewer system and the removal of storm water inflow from the combined or sanitary system. Separation of the combined system is estimated to cost $16,720 per acre. Separation would eliminate the discharge of untreated sanitary and industrial wastewater to the Tennessee River or Chattanooga Creek during storm events. However, separation would result in discharge of all storm runoff, a portion of which is presently being treated at the dry weather facilities. Therefore, because stormwater runoff from urban areas is a highly polluted waste itself, overall pollutant loadings would not be reduced significantly. Another major limitation to sewer separation is the impacts incurred during the time consuming construction operation. Such limitations are related to traffic disruption and include public inconvenience and interference with commercial activities. Due to these limitations coupled with the low cost-effectiveness, sewer separation appears to be infeasible and its implementation in the CARCOG/SETDD 208 Study Area should be excluded from further consideration.

Storage: Storage options consisting of in-line and off-line facilities were evaluated for applicability in the CARCOG/SETDD 208 Study Area. During preliminary screening, in-line systems were determined to be infeasible due to the small line size and resulting storage capacity in most of Chattanooga's sewer system and due to the complex monitoring and control systems required for proper operation.

Surface and subsurface systems were considered for off-line storage facilities in the CARCOG/SETDD 208 Study Area. Surface facilities could take the form of lagoons, ponds, or basins similar to primary clarifiers. Limitations to surface facilities are the large amount of land required which is often not available in an urban area, and the possibility of public disapproval in locating these facilities in densely populated areas. Aesthetic limitations may be overcome by constructing underground facilities such as silos, basins, or void space storage. The area above the subsurface facility may be landscaped and possibly used for recreation or other purposes. Although underground facilities are more aesthetically pleasing, the cost for such systems are much more than for surface facilities.

The function of storage systems in the CARCOG/SETDD 208 Study Area would be to provide the required storage capacity necessary for reducing peak flows in trunk sewers. The stored flows would be released to the interceptor system during dry weather, low flow conditions for treatment at Moccasin Bend Treatment Plant. Therefore, the majority of the combined sewer overflow would receive secondary treatment which would result in a very significant reduction of pollutants discharged into the receiving stream.

Based upon the preliminary evaluation of water quality data collected in the study area during storm events, it appears that the minor extent of degradation does not justify implementation of costly options which would result in superflous reduction of pollutants. Therefore, based on site limitations, high cost, and unjustified pollutant reduction efficiencies, the implementation of storage systems should no longer be considered a viable option for the reduction of pollution caused by combined sewer overflows in the CARCOG/SETDD 208 Study Area.

Direct Treatment of Discharges: Direct treatment technologies discussed are biological processes, screening systems, chemical clarification, filtration, dissolved air flotation, swirl concentrator/regulator chambers, and disinfection. Preliminary screening eliminated biological systems from further consideration due to the high cost, dependency on dry weather loading, or large land requirements. Likewise, physical/chemical treatment processes involving chemical addition, clarification, and filtration were eliminated because of high capital and operating costs and land requirements.

The direct treatment options evaluated are dissolved air flotation, high rate microscreening, disinfection, and swirl concentrator/regulator chambers. Dissolved air flotation and microscreening facilities require additional land due to flow equalization needs. Although these two options provide slightly greater pollutant reduction than would swirl concentration, they are considerably more costly to construct and operate. Disinfection is the least costly direct treatment option evaluated. However, disinfection only results in destruction of fecal coliforms with insignificant reduction in the other pollutants. Based upon preliminary evaluation of water quality data, it appears that the major problem constituents are biochemical oxygen demand (BOD), solids, and fecal coliforms. The data indicate, however, that fecal coliform pollution is universal and does not appear to be caused by combined sewer overflow. Therefore, disinfection of these discharges is not expected to result in significant water quality improvement. On this basis, disinfection does not appear to be a beneficial option and should not be considered for implementation.

The water quality data indicate that the degradation caused by urban stormwater runoff in the study area is generally isolated along the left bank of the Tennessee River as it flows around the heart of the city or the combined sewer service area. The water quality degradation appears to be of rather brief duration lasting only up to 3-4 hours depending on flow conditions in the reservoir. Based on this information it would appear that some form of direct treatment of combined sewer overflows is needed; however, since the water quality data indicate that degradation is neither severe nor of significant duration, it appears that the pollutant reduction advantage of dissolved air flotation or microscreening facilities over swirl concentrator/regulator chambers will not justify the increased cost. Therefore, based on engineering judgement, estimated cost, pollutant reduction, and water quality information, construction of swirl concentrator/regulator chambers appears to be the only justifiable structural option for the abatement and control of combined sewer overflows in the CARCOG/SETDD 208 Study Area.

Structural Options Considered for the Storm Sewer System

Improvement in the Present Operation and Maintenance Activities: As discussed in Work Element 308, improvements in the present system basically would involve increased budgeting in the following two activities:

- Street Sweeping
- Sewer Maintenance

Improvements in the present street sweeping practices were discussed earlier in this report as a nonstructural option. The city of Chattanooga presently cleans and repairs the open ditch storm sewer systems when accumulated material or vegetative growth has caused significant reductions in hydraulic capacity. As with the combined sewer system, significant water quality degradation would occur if solids deposition during minor storm events were occurring. It is believed that a sewer reconditioning program initiated by the city in 1975 has effectively corrected many of the problem conditions which would promote solids deposition and subsequent water quality degradation from a "first flush." Therefore, as with the combined sewer system, the present structural maintenance activities appear to be adequate and greatly increased expenditures would not result in significant water quality improvements.

Construction of Off-line Storage Systems: The off-line systems considered for abating pollution caused by storm sewer discharges consist of surface or subsurface settling basins with the settled flows gradually released to the receiving stream. Such systems require considerable land and are costly to construct and operate. Water quality data collected in the tributaries to the Tennessee River indicate that degradation, as determined by increases in conventional indicators such as BOD, suspended solids, and fecal coliforms, increases at a uniform rate as the stream traverses the urban environment. It appears that nonpoint sources and not the discharge of a specific storm sewer is causing significant water quality deterioration. Based on this preliminary evaluation, nonstructural controls appear to be the most cost-effective means of correcting urban runoff generated pollution in the study area. Therefore, storage systems can be eliminated from consideration at this time.

As mentioned earlier, localized degradation, manifested by observed pH extremes and increases in such parameters as phenols and oil and grease, appears to be caused by runoff from industrial sites. The correction of such conditions should be the responsibility of the polluting industry and should be regulated as a point source.

Direct Treatment of Discharges: The direct treatment options considered for storm sewer systems in the CARCOG/SETDD 208 Study Area are dissolved air flotation, microscreening, disinfection, and swirl concentration. The operation, cost, and pollutant reduction of these systems have been discussed in detail in Work Element 308 and earlier in this report. As discussed above, significant improvement should be realized by the implementation of less costly nonstructural controls and direct treatment systems should not be necessary.

The Selected Structural Control Option

The structural option selected for controlling pollution caused by stormwater runoff from the urban CARCOG/SETDD 208 Study Area consists of replacing the existing float-type regulator chambers in the combined sewer system with swirl concentrator/regulator chambers. The swirl concentrator/regulator chamber has been selected for use due to its adaptability to large flows, its limited land requirements, its relatively high treatment efficiencies, and low cost. The swirl concentrator/regulator is similar to other advanced regulator systems in that it takes advantage of physical secondary fluid motions and natural liquids/solids separation in bends and other forms of rotational flow to split storm flow into a low volume concentrate and a high volume, relatively clear stream.

The swirl concentrator/regulator shown in Figure VI-12 is of simple annular-shaped construction and requires no moving parts. It provides a dual function, regulating flow by a control circular weir-spillway while simultaneously treating combined sewer discharges by swirl action which imparts liquid/solids separation. Dry weather flows are diverted through a cunnette-like channel in the floor of the chamber into a bottom orifice located near the central stanpipe discharging to the interceptor sewer for subsequent treatment at the municipal plant. During higher flow conditions, the low-volume concentrate is diverted via the same bottom orifice leading to the interceptor and the excess, relatively clear, high-volume supernatant overflows the center circular weir into a downshaft for discharge to the receiving stream. This device is capable of functioning efficiently over a wide range of discharge rates and has the ability to separate settleable, light-weight organic matter and floatable solids at a small fraction of the detention time required for primary separation.

Work Element 308 subdivided the combined sewer system into four major service areas for the evaluation of four central discharge treatment facilities consisting of either dissolved air flotation or microscreening. Because swirl concentrator/regulator chambers were selected over these other options, the four service area designation is no longer relevant. The control option now will be discussed as to its implementation in the 17 combined sewer subareas each overflowing through a single bypass regulator chamber.

3. Evaluation of Urban Runoff Preferred Areawide Plan

An evaluation of the urban runoff preferred areawide plan was accomplished utilizing SWMM to model the preferred control options under wet weather conditions. As during the evaluation of the null alternative, the four major watercourse in the study area were examined.

The nonstructural control options modeled include reductions in air pollution, increased litter control, erosion control on farmland and construction sites, and improved efficiency of street sweeping in downtown Chattanooga.

An examination of available literature indicates that as much as 60 percent of the dust and dirt accumulation in city streets is caused by dust fall. Additional dust and dirt accumulations can be expected from litter, construction sites, and road construction. Based upon the nonstructural control options to be assessed, the existing conditions in the study area, and available information from the literature, a reduction in dust and dirt accumulation rates of 25 percent was selected to model the nonstructural runoff control options.

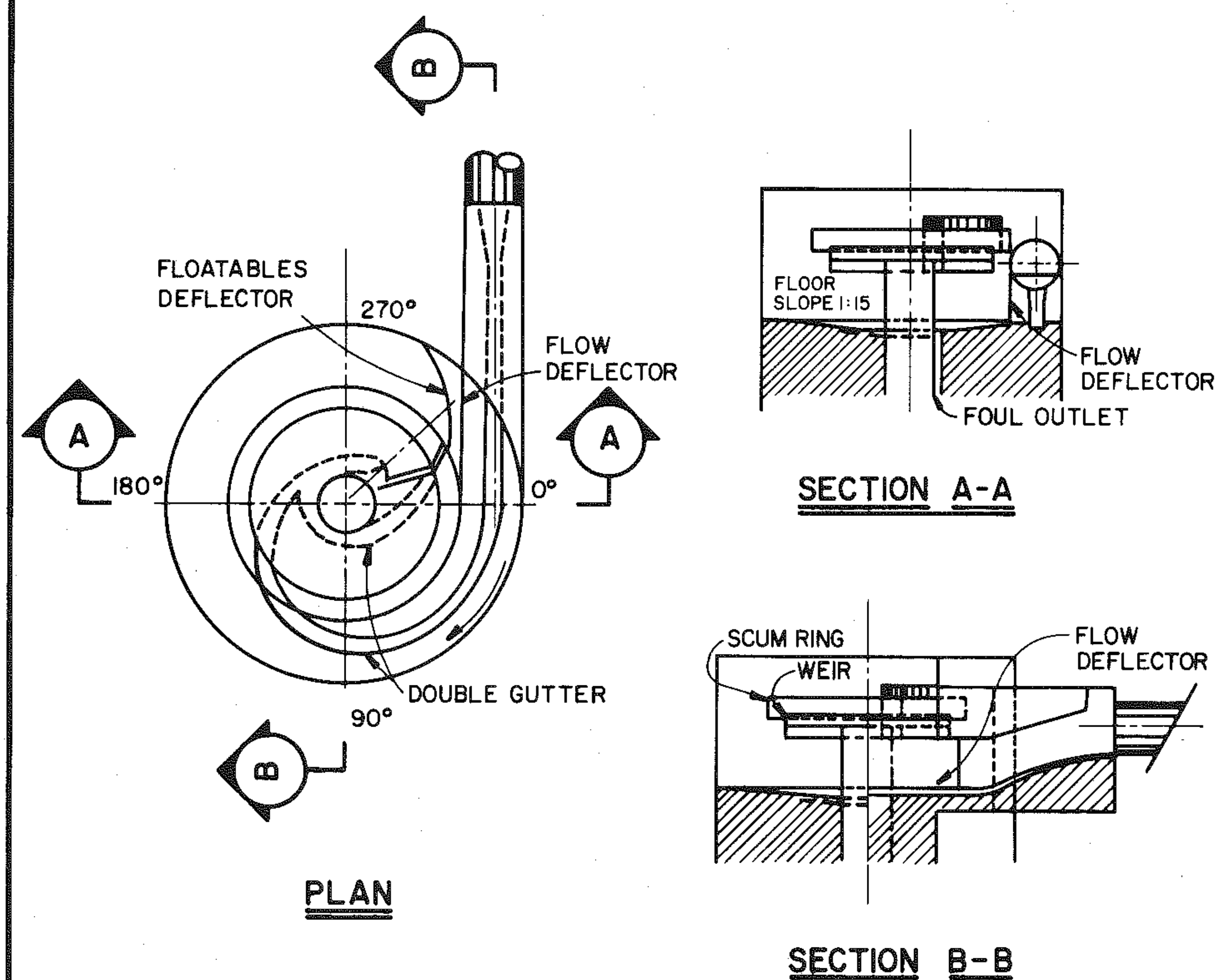


Figure VI-12: Recommended Configuration for Swirl Concentrator

The structural nonpoint control options selected for modeling were swirl concentrators at the point of combined sewer overflows. In addition, the effects of chlorination on combined sewer overflows was also addressed.

North Chickamauga Creek

The options to be evaluated for the modeled portion of North Chickamauga Creek include nonstructural improvements utilizing a minimum of capital expenditure. These options encompass such control measures as stricter enforcement of air pollution laws and improved land management practices in the drainage basin. Implementation of these options will result in reducing the pollutant loadings to streams by approximately 25 percent. The existing conditions and storm event used for this modeling have been detailed previously and will not be reiterated here. The effect of enacting the above options on the water quality of North Chickamauga Creek is detailed below.

Figures VI-13 and VI-14 and Tables VI-17 and VI-18 demonstrate the result of the imposed options on water quality during the chosen storm event. The figures present values for various water quality parameters plotted against the time since the beginning of the storm. Data for two locations are graphed: river mile 0.0, the junction of North Chickamauga Creek and the Tennessee River; and river mile 2.7, the point at which the minimum dissolved oxygen value for the stream was calculated. Table VI-17 presents the maximum, minimum, and average wet weather values of five water quality parameters under nonstructural runoff control options. These data are given for several locations along the modeled stream reach. Table VI-18 lists the percent reduction in stream loadings of various pollutants achieved through the implementation of the options. Analysis of these data are presented below.

Tables VI-17 and VI-18 show several similar trends. Ammonia-nitrogen and BOD_5 both exhibit peak values near the fifth hour of the storm. These values are a reflection of the maximum rainfall and the resulting runoff which takes place during the second hour. Both of these parameters seem to reach a plateau at river mile 2.7 starting at hour four of the storm and lasting for several hours. This phenomenon may be attributed to the nature of the storm event which includes small equal amounts of rain in hours three and five, and no rain in hour four. The maximum values for these parameters are higher at river mile 0.0 than at 2.7. The suspended solids concentrations reach their highest level in North Chickamauga Creek during hour three, immediately following the heaviest rain of the storm with its corresponding maximum erosion. The fecal coliform peaks occur later in the storm, at hours eight and five for river miles 0.0 and 2.7, respectively. Values for fecal coliforms are lower at river mile 0.0 than at river mile 2.7 due to the increased depth of the stream in the backwater areas of the Tennessee River. This provides dilution of the stormwater loadings and tends to mask the peak effects of the storm. Dissolved oxygen minimums occur near hour eight. The dissolved oxygen profile at river mile 2.7 exhibits a lower value, slower recovery, and earlier sag than that at river mile 0.0.

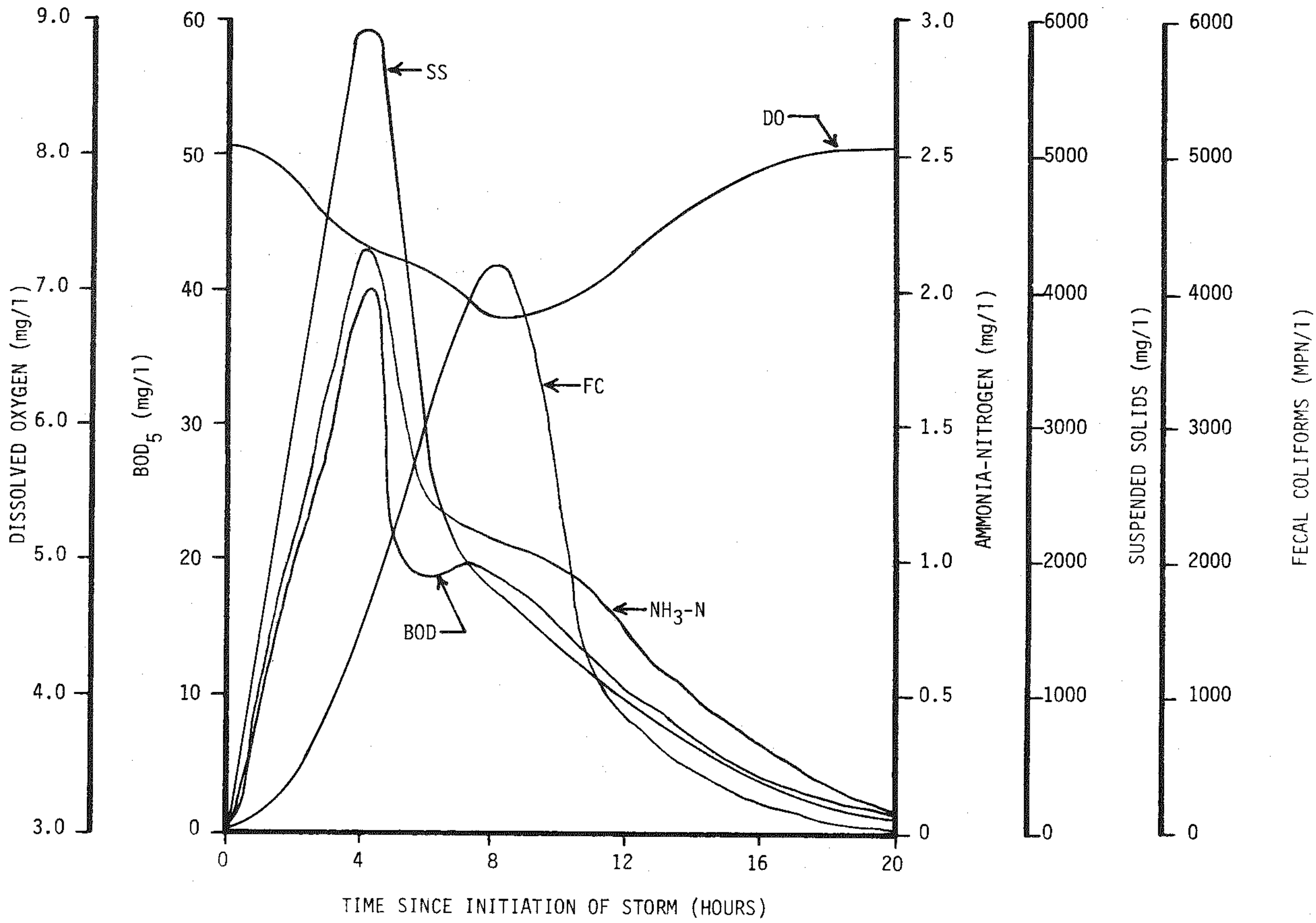


FIGURE VI-13: Water Quality in North Chickamauga Creek (River Mile 0.0) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

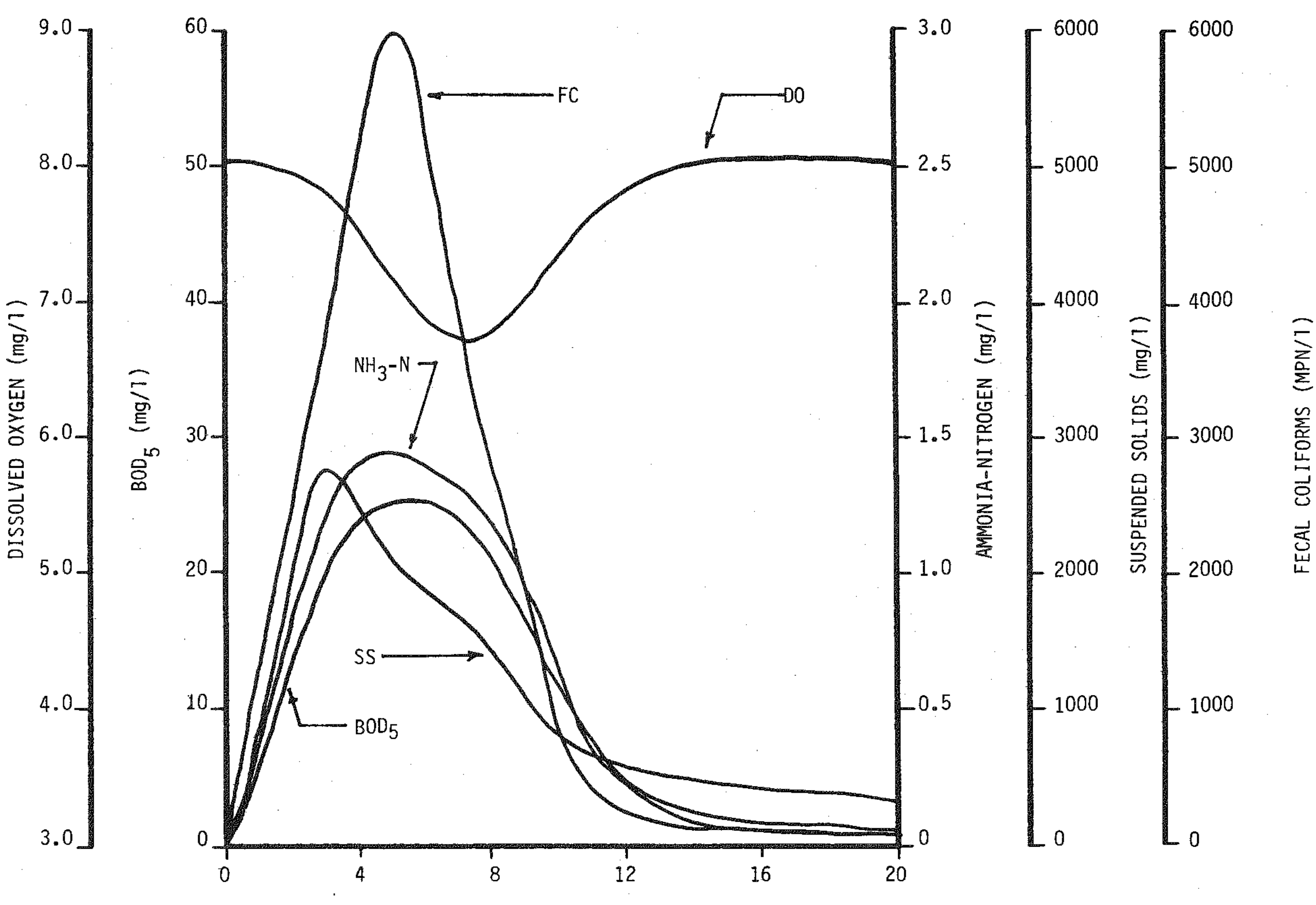


FIGURE VI-14: Water Quality in North Chickamauga Creek (River Mile 2.7) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

TABLE VI-17

WATER QUALITY PARAMETER VALUES FOR NORTH CHICKAMAUGA CREEK
DURING WET WEATHER UNDER NONSTRUCTURAL CONTROLS

	BOD_5 (mg/l)			TSS (mg/l)			Fecal Coliform (#/100 ml)			NH_3-N (mg/l)			D.O. (mg/l)		
River Mile	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.
8.7	5.5	44.9	0.6	632	3370	11	41	187	<1	0.47	3.17	0.10	8.0	8.2	7.4
8.0	3.9	24.9	0.4	766	5770	11	289	5720	<1	0.32	2.08	0.04	8.1	8.2	7.3
6.0	4.9	22.1	0.4	712	3440	11	237	2740	<1	0.42	1.71	0.04	7.9	8.2	7.1
4.4	5.0	18.1	0.4	837	2900	9.0	171	1630	<1	0.43	1.57	0.04	7.9	8.2	6.9
2.7	5.3	17.3	0.2	856	2720	3.4	137	1030	<1	0.46	1.47	0.04	7.8	8.2	6.6
0.7	6.3	26.8	0.4	1250	6060	20	96	543	<1	0.56	2.30	0.04	7.7	8.1	6.9
0.0	6.2	26.5	0.2	1230	6060	9.5	80	464	<1	0.55	2.28	0.05	7.6	8.1	6.7

TABLE VI-18

MASS LOADINGS AND % REDUCTION ACHIEVED UNDER NONSTRUCTURAL RUNOFF OPTIONS FOR NORTH CHICKAMAUGA CREEK

Hour	BOD (lbs/hr)	TSS (lbs/hr)	Fecal Coliform (MPN/min)	NH_3-N (lbs/hr)	BOD (% reduced)	TSS (% reduced)	Fecal Coliform (% reduced)	NH_3-N (% reduced)
1	4.6	172	2.04×10^4	1.4	0	0	0	0
2	256	1.03×10^4	3.66×10^7	57.9	8.6	1.0	25.1	0
3	4541	1.01×10^6	8.61×10^7	285	24.9	1.0	25.1	24.6
4	747	7.54×10^4	7.50×10^5	42.8	25.0	2.3	24.9	25.0
5	281	3.13×10^4	3.24×10^6	16.1	24.7	1.6	24.7	23.7
6	234	1.65×10^4	4.03×10^6	14.4	25.0	4.1	24.9	24.2
7	803	6.78×10^4	5.71×10^7	46.1	25.0	3.0	25.0	24.9
8	503	4.46×10^4	3.27×10^7	28.3	24.9	2.6	25.0	24.9
9	621	5.94×10^4	3.05×10^7	35.0	25.0	2.5	25.1	25.2
10	270	2.55×10^4	9.44×10^6	15.4	25.0	2.7	25.1	24.9
11	239	2.45×10^4	6.06×10^6	13.9	25.1	2.8	25.0	24.5
12	290	3.03×10^4	5.39×10^6	17.0	25.1	2.6	25.0	24.4
13	101	1.32×10^4	1.42×10^6	5.87	24.6	1.5	24.9	26.1
14	96	1.77×10^4	1.03×10^6	5.71	25.0	1.7	23.2	24.2
15	50	1.18×10^4	$4.16.10^5$	3.02	25.0	1.0	25.0	25.1
16	25	8134	1.65×10^5	1.54	24.5	1.0	25.0	23.4
17	16.8	6727	9.36×10^4	1.04	24.7	0.7	25.1	23.0
18	6.4	2988	3.17×10^4	0.40	24.3	0.6	24.9	24.5
19	2.8	1467	1.29×10^4	0.17	23.9	0.5	25.0	22.7
20	4.0	2289	1.82×10^4	0.24	25.2	0.5	25.1	25.0
21	2.7	1593	1.20×10^4	0.17	23.5	0.5	25.0	26.1
22	1.3	807	5842	0.08	24.0	0.5	24.9	27.3
23	0.69	452	3167	0.04	25.0	0.7	24.9	33.3
24	0.42	278	1884	0.03	23.6	0.7	24.9	25.0

Table VI-17 displays several trends in the water quality parameter values viewed according to location. Ammonia-nitrogen and BOD_5 follow roughly the same trend with high initial values, a dramatic decrease followed by an increase. The high values at river mile 8.7 are due to the first flush effect of the modeled storm. These values drop at river mile 8.0 due to the dilution effects of the tributary which has its confluence there. The following increase results from the runoff due to the storm event. Significant increases in concentration for both parameters, noted at river mile 0.7, are most likely due to the discharger located on the tributary entering there. The fecal coliform increase at river mile 8.0 is attributable to the presence of an upstream discharger and the runoff from the storm event. The average fecal coliform values steadily decrease downstream as dilution from runoff, as well as instream die off occurs. Suspended solids show an increase with downstream distance. The dissolved oxygen values exhibit an initial increase and then decrease along the stream reach. This is a typical picture of the dissolved oxygen sag curve.

Table VI-18, displaying the percent reduction due to implementation of nonstructural control options, exhibits nearly equal decreases for all water quality parameter values other than solids. Suspended solids concentrations are nearly the same under the stated options as they were before implementation. All other parameter values, with two exceptions, show less than a 26 percent reduction due to the adoption of these options. Obviously, the institution of nonstructural controls and improved land use management will result in changes in the water quality of the stream; however, the actual change in concentrations is not great.

The maximum parameter values given in Table VI-17 indicate that the Tennessee water quality standards for fecal coliforms (200 MPN/100 ml) will be violated at all locations except river mile 8.7. Ammonia-nitrogen concentrations will violate stream standards (1.5 mg/l) at most locations also. Both of these violations are of short duration however, and can be attributed to storm-induced runoff. It appears that implementation of these nonstructural runoff control options will reduce the mass loadings of pollutants to North Chickamauga Creek, but will not eliminate the water quality violations which occur under existing conditions. However, it should be pointed out that implementation of the proposed nonstructural runoff control options requires almost no expenditure of public funds, and that although water quality violations in North Chickamauga Creek are not eliminated, loadings to the Tennessee River for all parameters except suspended solids are reduced by approximately 25 percent. Also, implementation of these controls would enhance living conditions and the aesthetic quality of the area.

South Chickamauga Creek

The options considered for the modeled portion of South Chickamauga Creek are identical to those discussed in the previous section on the modeling of North Chickamauga Creek. The effect of implementation of those options on the water quality in South Chickamauga is detailed below.

Figures VI-15 and VI-16 and Tables VI-19 and VI-20 demonstrate the result enforcement of the stated options will have on water quality during the chosen storm event. The figures present values for various water quality parameters plotted against the time since the beginning of the storm. Data for two locations are graphed, river mile 0.0, the junction of South Chickamauga Creek and the Tennessee River and river mile 9.7. Table VI-19 presents the maximum, minimum, and average wet weather values of five water quality parameters under nonstructural control options. These data are given for several locations along the modeled stream reach. Table VI-20 lists the percent reduction in stream loadings of various pollutants achieved through the adoption of the stated options. Analyses of these data are presented below.

Examination of the data presented in Figures VI-15 and VI-16 indicates that ammonia-nitrogen and BOD values at each location follow the same general trend. At river mile 9.7, the BOD and ammonia-nitrogen maximums occur during hour 2 of the storm event. At river mile 0.0, they occur later during hour seven of the storm event. Fecal coliform concentrations reach their peak during hour six for both locations. Storm runoff causes solids to increase up to the fifth or sixth hour, after which they begin to decline. The minimum dissolved oxygen values occur during hour seven at river mile 9.7 and a little later (hour 9) at the downstream location.

Table VI-19 shows the impact of the tributary stream at river mile 7.4 on the water quality of South Chickamauga Creek. The concentrations of BOD, suspended solids, and fecal coliforms all decrease from the river mile 13.8 to this point whereupon the confluence with the tributary stream produces a marked increase in all values. Downstream from this point, concentrations gradually decrease once again. Ammonia-nitrogen values show an initial maximum due to the effluent from the wastewater treatment facility located at river mile 13.8. Concentrations gradually decrease with increased stream length. Dissolved oxygen values remain fairly constant throughout the stream length.

The percent reductions in mass loadings displayed in Table VI-20 are due to the implementation of nonstructural control options. For all parameters, other than suspended solids, a 20 to 25 percent reduction was observed. Solids are reduced by about 3 percent overall. The options considered do not directly reduce the amount of runoff from the drainage area, so solids which are largely the result of erosion are not dramatically reduced. Institution of nonstructural control options will obviously cause a definite improvement on stream water quality, but the multiplicity of dischargers limit the effectiveness of these measures.

The Tennessee water quality statutes will be violated for dissolved oxygen at nearly all stream locations. This is a result of the rather poor water quality of the stream stemming from the various dischargers located along the modeled reach. Ammonia-nitrogen values exceed the prescribed standard levels at two locations, river mile 13.8 and 9.7.

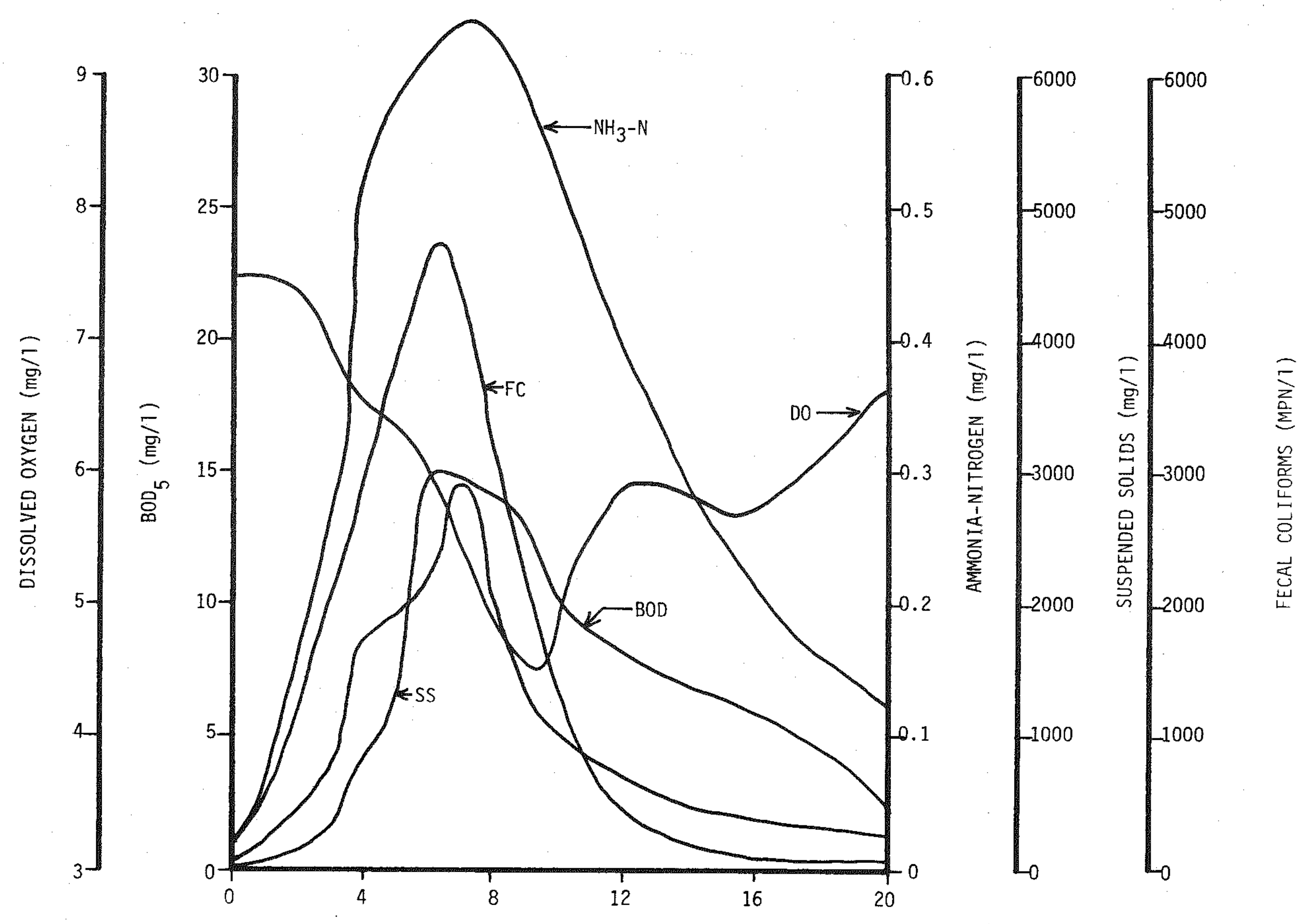


FIGURE VI-15: Water Quality in South Chickamauga Creek (River Mile 0.0) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

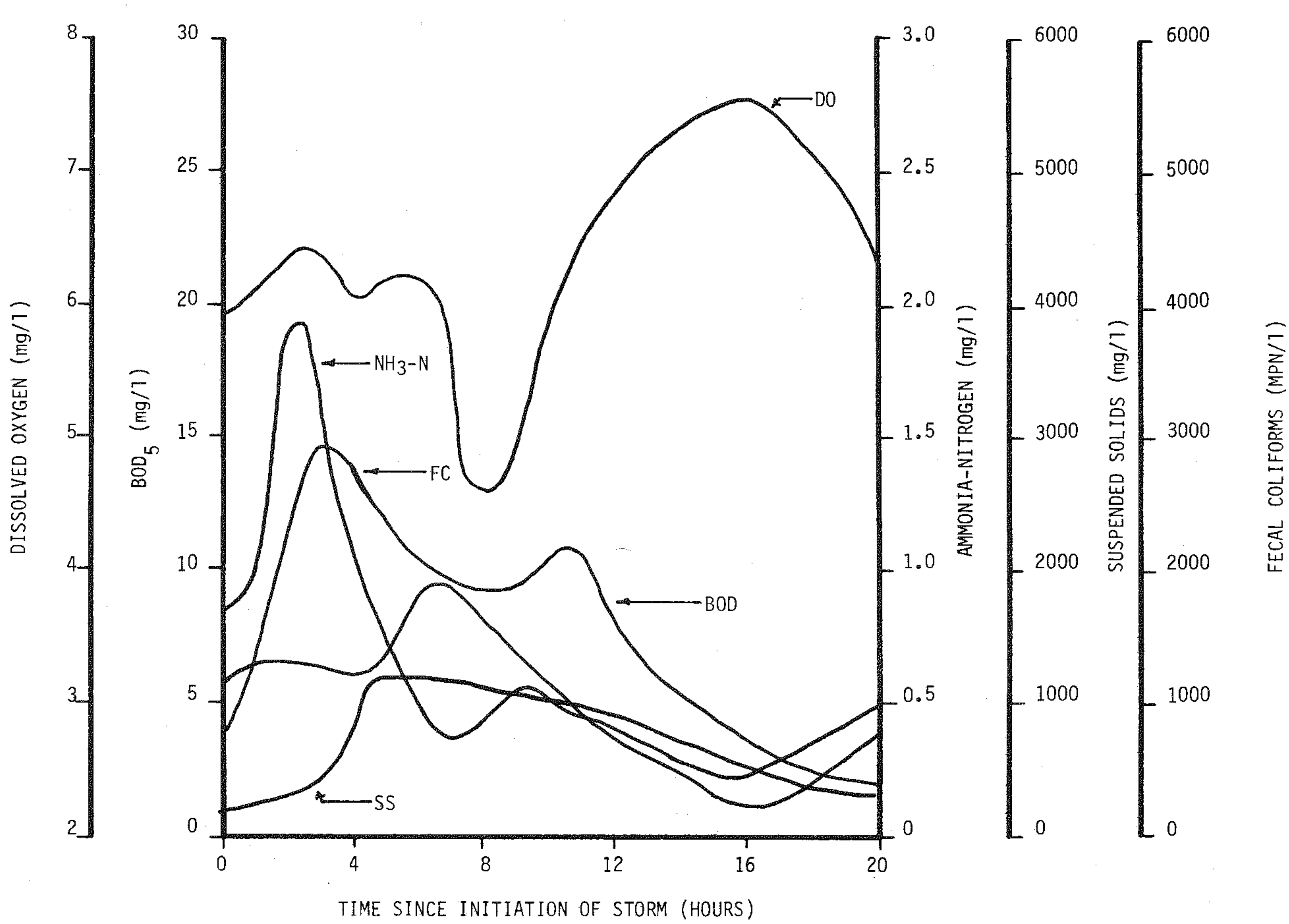


FIGURE VI-16: Water Quality in South Chickamauga Creek (River Mile 9.7) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

TABLE VI-19

WATER QUALITY PARAMETER VALUES FOR SOUTH CHICKAMAUGA CREEK
DURING WET WEATHER UNDER NONSTRUCTURAL RUNOFF CONTROL OPTIONS

River Mile	BOD_5 (mg/l) Avg.	BOD_5 (mg/l) Max.	BOD_5 (mg/l) Min.	TSS (mg/l) Avg.	TSS (mg/l) Max.	TSS (mg/l) Min.	Fecal Coliform (#/100 ml) Avg.	Fecal Coliform (#/100 ml) Max.	Fecal Coliform (#/100 ml) Min.	NH_3-N (mg/l) Avg.	NH_3-N (mg/l) Max.	NH_3-N (mg/l) Min.	D.O. (mg/l) Avg.	D.O. (mg/l) Max.	D.O. (mg/l) Min.
13.8	6.2	13.7	2.9	617	1890	13.4	81	498	0	0.78	1.52	0.36	6.4	7.9	3.7
12.5	5.1	14.2	1.8	505	1340	12.0	43	286	6	0.43	0.93	0.16	6.6	7.8	4.9
10.8	5.0	13.7	1.7	490	1330	10.8	35	243	5	0.40	0.87	0.15	6.4	7.8	4.5
9.7	5.2	20.1	1.5	514	1410	10.7	36	192	4	0.51	1.91	0.19	6.6	7.8	4.5
8.8	4.0	11.9	1.0	481	1140	12.7	27	189	4	0.35	0.92	0.10	6.8	7.9	5.0
7.4	4.7	14.2	1.0	837	6110	12.6	163	3250	3	0.38	1.20	0.09	6.8	7.9	5.0
5.6	4.4	11.6	1.1	740	4130	12.4	74	1240	3	0.36	0.99	0.10	6.6	7.8	4.8
3.6	4.3	11.3	1.2	737	4110	10.5	60	1010	2	0.34	0.92	0.11	6.4	7.6	4.6
1.6	4.2	10.5	1.2	768	3270	8.2	50	686	4	0.32	0.84	0.12	6.4	7.6	4.9
1.1	4.2	10.0	1.3	751	3200	7.2	42	572	4	0.31	0.77	0.11	6.4	7.5	4.8
0.0	4.1	9.7	0.9	744	3200	6.0	35	489	1	0.29	0.72	0.05	6.2	7.6	4.5

TABLE VI-20

MASS LOADINGS AND % REDUCTION ACHIEVED UNDER NONSTRUCTURAL RUNOFF CONTROL OPTIONS FOR SOUTH CHICKAMAUGA CREEK

Hour	BOD (lb/hr)	TSS (lb/hr)	Fecal Coliform (lb/hr)	NH_3-N (lb/hr)	BOD (% reduced)	TSS (% reduced)	Fecal Coliform (% reduced)	NH_3-N (% reduced)
1	63.63	279.1	$4.39x10^6$	2.27	0	0	0	0
2	396.2	2057	$1.50x10^8$	17.89	-1.9	0.5	20.6	0
3	2776	$1.55x10^5$	$2.10x10^9$	190.0	14.6	4.3	23.4	15.1
4	$1.33x10^4$	$1.28x10^6$	$3.78x10^9$	855.7	22.2	3.0	23.5	22.1
5	$1.20x10^4$	$1.37x10^6$	$1.80x10^9$	765.9	23.6	3.5	23.7	22.6
6	9220	$3.15x10^6$	$3.64x10^{10}$	463.0	22.5	1.0	24.9	20.5
7	$1.11x10^4$	$1.52x10^6$	$3.37x10^9$	546.5	25.0	2.6	23.0	25.1
8	4562	$2.33x10^5$	$3.39x10^8$	266.2	22.2	6.4	20.8	20.3
9	7158	$5.60x10^5$	$2.57x10^9$	300.1	20.7	3.6	24.6	23.9
10	5121	$2.09x10^5$	$1.87x10^8$	268.0	24.4	7.1	19.7	24.3
11	2819	$2.28x10^5$	$1.04x10^9$	139.8	16.9	1.7	22.4	22.4
12	3366	$4.86x10^5$	$2.62x10^8$	130.1	22.0	2.0	21.8	21.1
13	2405	$2.66x10^5$	$1.33x10^9$	87.46	21.5	2.6	24.4	21.4
14	3334	$1.92x10^5$	$4.88x10^8$	114.6	23.8	2.5	23.6	23.0
15	2315	$1.80x10^5$	$2.49x10^8$	83.06	23.6	2.1	22.4	23.3
16	1935	$2.34x10^5$	$1.60x10^8$	70.54	23.6	1.7	20.8	22.2
17	1748	$2.50x10^5$	$1.10x10^8$	64.87	23.7	1.6	19.1	19.2
18	1386	$2.10x10^5$	$8.10x10^7$	49.61	23.8	1.9	17.8	21.7
19	1001	$1.67x10^5$	$6.24x10^7$	38.42	23.6	1.2	16.7	20.0
20	710.0	$1.29x10^5$	$4.80x10^7$	28.98	23.3	1.0	15.3	17.6
21	520.2	$1.01x10^5$	$3.99x10^7$	21.30	22.9	1.0	14.6	20.0
22	392.8	$8.03x10^4$	$3.28x10^7$	16.68	22.4	1.2	14.1	21.4
23	303.3	$6.54x10^4$	$2.74x10^7$	14.26	22.0	1.4	13.3	15.4
24	239.6	$5.41x10^4$	$2.27x10^7$	11.09	21.8	1.3	12.7	16.7

Both are sites of municipal treatment plants. The violations which occur under implementation of the nonstructural control options are not as severe as those that are present during existing wet weather conditions, but they occur with similar frequency. It appears that these violations are more attributable to the numerous point source dischargers than they are the result of wet weather runoff conditions. However, as was pointed out in the discussion of North Chickamauga Creek, implementation of the nonstructural control options will result in a significant decrease in loadings to the Tennessee River, together with improved aesthetic and living conditions.

Chattanooga Creek

The options to be evaluated for the modeled portion of Chattanooga Creek are the same as those evaluated for North Chickamauga Creek and South Chickamauga Creek with one exception. A swirl concentrator for treatment of the combined sewer overflow at stream mile 2.1 is included. The effect of implementation of the above options on the water quality in Chattanooga Creek is detailed below.

Figures VI-17 and VI-18 and Tables VI-21 and VI-22 demonstrate the effect of the imposed options on water quality during the chosen storm event. The figures present values for various water quality parameters plotted against the time since the beginning of the storm. Data for two locations are graphed, river mile 0.0, the junction of Chattanooga Creek and the Tennessee River and river mile 0.8, the point at which the minimum dissolved oxygen value for the stream was observed. Table VI-21 presents the maximum, minimum, and average wet weather values of five water quality parameters occurring under the nonstructural runoff control options. These data are given for several locations along the modeled stream reach. Table VI-22 presents the percent reduction in various stream pollutants achieved under nonstructural control options. An analysis of these data are presented below.

The data graphed in Figures VI-17 and VI-18 display two major influences on water quality. The first is that produced by the storm event. This effect is evident in the values for BOD, suspended solids, and fecal coliforms. The maximum concentrations of all three parameters occur between hours 4 and 6 of the storm event, following the period of maximum runoff due to the rainfall in hours 2 and 3 of the storm event. The second influence on water quality is that produced by the point source dischargers lying directly upstream from the graphed locations. The ammonia-nitrogen and dissolved oxygen profiles show the significant effect of these dischargers on the creek's water quality. The critical values for these parameters occur at hour 1 before the storm event begins. The runoff from the storm serves to dilute the discharger effluents so ammonia-nitrogen levels decrease as streamflow increases and dissolved oxygen values increase with time of storm.

Table VI-21 also demonstrates the effect of dischargers and tributaries on Chattanooga Creek's water quality. BOD, solids, and fecal coliform values all show significant changes at river miles 5.5 and 6.3, both being

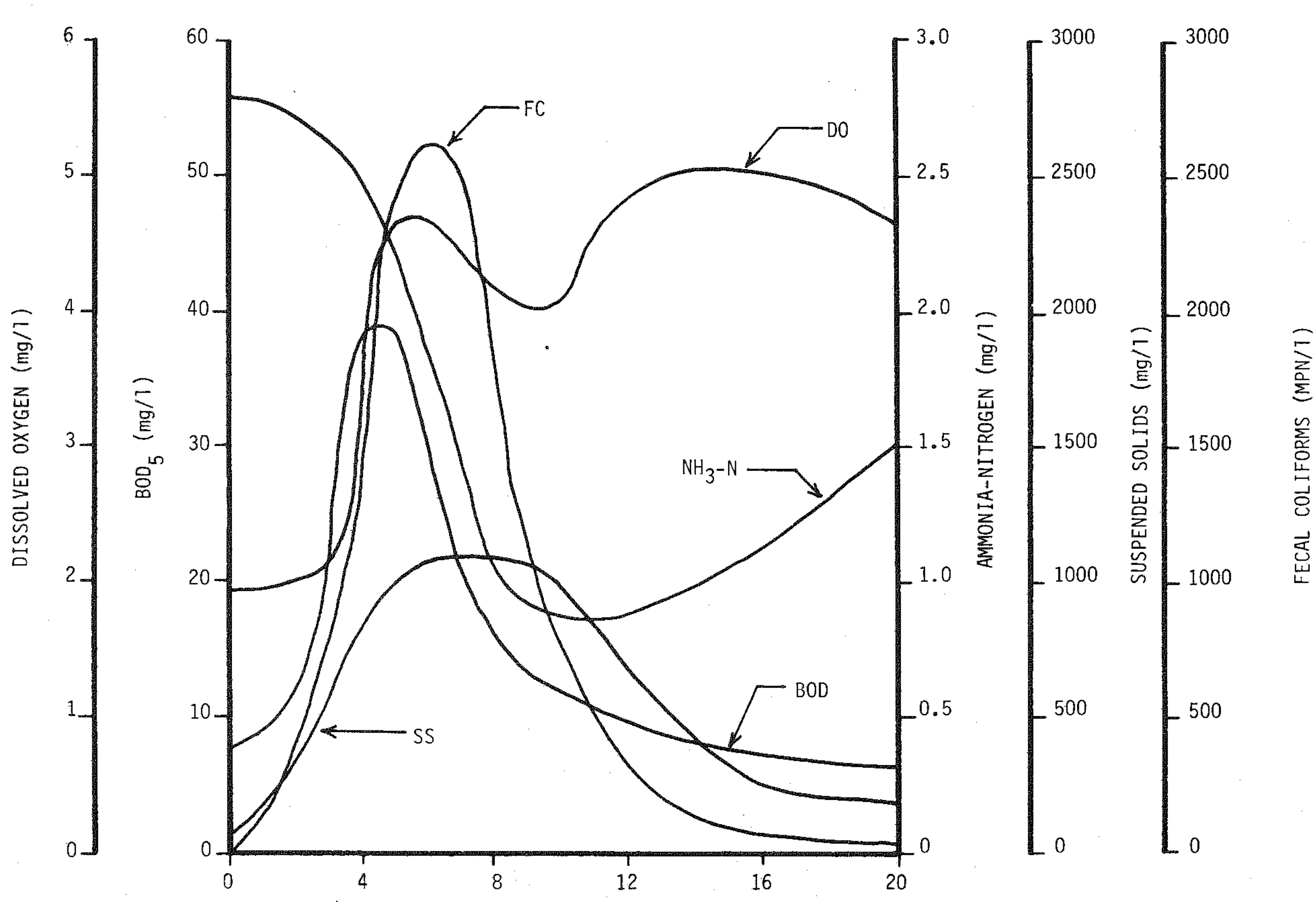


FIGURE VI-17: Water Quality in Chattanooga Creek (River Mile 0.0) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

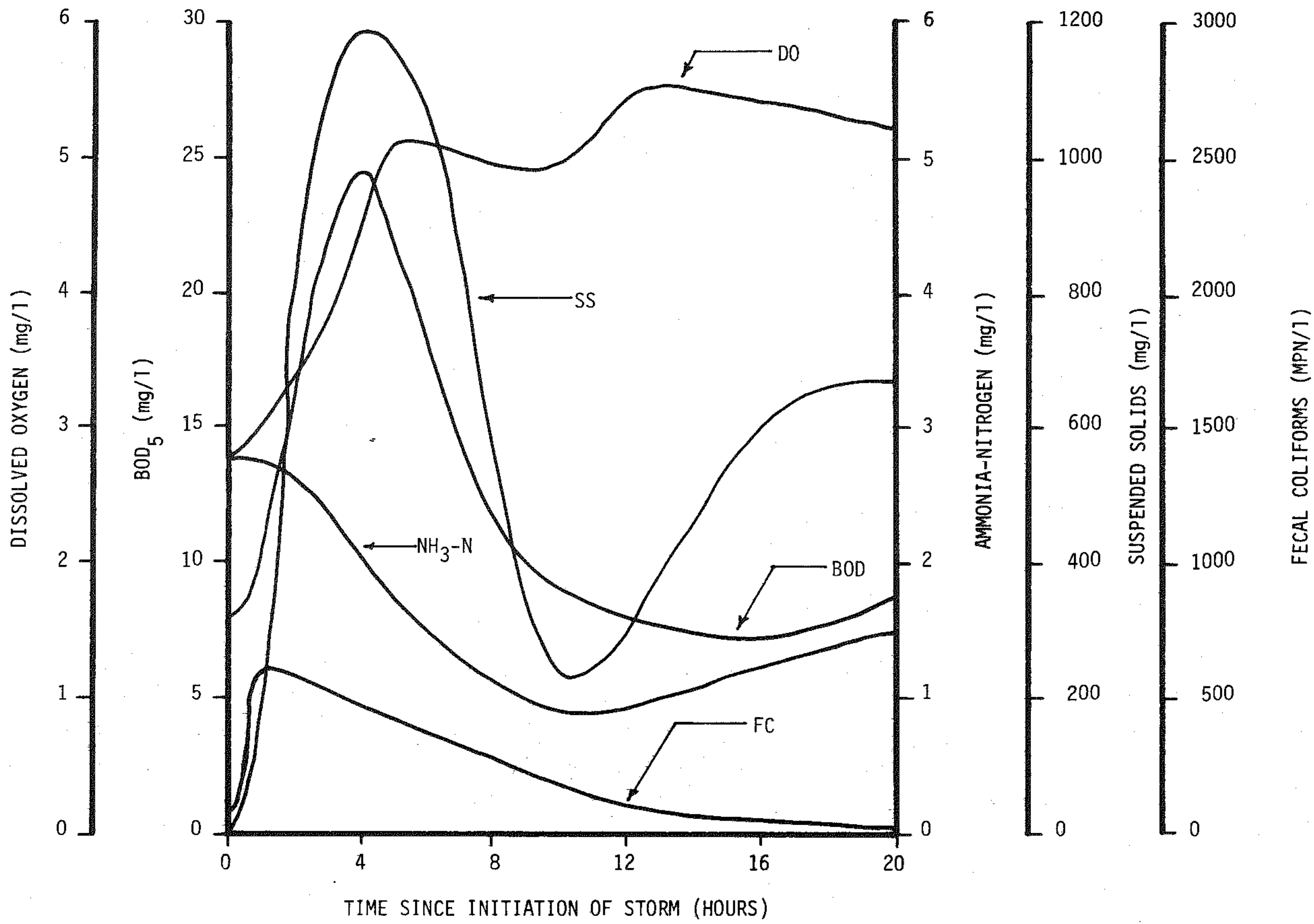


FIGURE VI-18: Water Quality in Chattanooga Creek (River Mile 0.8) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

TABLE VI-21

WATER QUALITY PARAMETER VALUES FOR CHATTANOOGA CREEK
DURING WET WEATHER UNDER NONSTRUCTURAL RUNOFF CONTROLS

River Mile	BOD_5 (mg/l) Avg.	BOD_5 (mg/l) Max.	BOD_5 (mg/l) Min.	TSS (mg/l) Avg.	TSS (mg/l) Max.	TSS (mg/l) Min.	Fecal Coliform (#/100 ml) Avg.	Fecal Coliform (#/100 ml) Max.	Fecal Coliform (#/100 ml) Min.	NH_3-N (mg/l) Avg.	NH_3-N (mg/l) Max.	NH_3-N (mg/l) Min.	D.O. (mg/l) Avg.	D.O. (mg/l) Max.	D.O. (mg/l) Min.
11.4	3.4	25.5	0	3340	13000	0	646	1790	0	0.31	1.81	0	7.8	8.2	5.7
9.5	4.5	25.1	0.7	324	2700	0	26	222	0	0.27	2.05	0	7.9	8.2	6.6
8.0	3.3	38.9	0	4310	28000	0	217	4620	0	0.25	3.08	0.01	8.0	8.2	6.2
6.3	5.3	24.3	1.4	1870	8070	0	200	1730	0	0.33	1.94	0.07	7.7	8.1	6.1
5.5	2.6	13.6	0.6	1130	4480	<1	1010	18000	0	0.22	1.09	0.04	7.9	8.2	6.6
4.7	3.3	12.2	1.3	990	3930	<1	515	8720	0	1.99	3.80	1.10	7.5	7.8	6.1
2.6	3.3	10.5	1.3	970	3360	<1	401	6950	0	1.75	3.43	1.04	6.8	7.5	4.6
2.1	6.1	10.8	4.1	564	1100	<1	273	3760	0	1.58	3.12	0.91	5.5	6.0	3.8
0.8	6.0	9.8	4.4	50000	1200000	3	227	3140	0	1.50	2.86	0.87	4.8	5.5	2.7
0.0	5.7	9.5	4.3	50000	1200000	3	193	2680	0	1.46	2.72	0.83	4.3	5.2	1.9

TABLE VI-22

PERCENT REDUCTION IN STREAM POLLUTANTS IN CHATTANOOGA CREEK UNDER NONSTRUCTURAL RUNOFF CONTROL OPTIONS

River Mile	BOD % reduction	TSS % reduction	NH_3-N % reduction
11.4	25.0	1.8	22.7
9.5	13.6	1.8	17.5
8.0	22.4	<1	24.0
6.3	19.1	0	23.1
5.5	28.6	5.8	30.6
4.7	22.0	5.7	5.2
2.6	21.2	4.9	4.9
2.1	26.6	12.8	9.2
0.8	26.0	-	9.6
0.0	25.9	-	8.8

junctions with tributary streams. The concentrations for suspended solids and BOD also show significant increases at river miles 0.8 and 2.1, respectively. These changes may be attributed to the dischargers located at these points. The ammonia-nitrogen profile shows a great increase in concentration at river mile 4.7, corresponding to a discharger location. The dissolved oxygen profile clearly begins the sag phase at river mile 2.6 and shows no sign of recovery at mile 0.0. The combined sewer overflows from the city of Chattanooga located along this reach, as well as the decreased reaeration capability of the backwater areas of the Tennessee River account for this phenomenon.

The data presented in Table VI-22 shows that for most locations, BOD and ammonia-nitrogen values are reduced from 20 to 30 percent by implementation of nonstructural control options. Ammonia-nitrogen values from river mile 4.7 to river mile 0.0 show much lower figures for percent reduction. The dischargers located at river mile 4.7 account for this phenomenon since their effluent will be affected by the options evaluated. Suspended solids concentrations are not markedly changed by option implementation since erosion from the storm event is the major contributor to these values.

The applicable state water quality standards for fecal coliforms and ammonia-nitrogen are violated at all measured points except one. Dissolved oxygen standards are violated at four locations. These violations are nearly the same as those which occur prior to application of the evaluated options, indicating that these options will not significantly reduce the number of violations even though they improve the water quality in Chattanooga Creek.

It is apparent from the results of the water quality modeling that the water quality problems along Chattanooga Creek are primarily a result of the point source dischargers located along the creek. The modeled water quality of Chattanooga Creek improves during the storm event. The nonstructural control options can be recommended because they require little expenditure of public funds. Until such time as 1983, when controls are implemented for point source discharges, there does not appear to be justification for the expense of inclusion of swirl concentrators for combined sewer overflow on Chattanooga Creek.

Nickajack Reservoir

The options to be evaluated for Nickajack Reservoir include the nonstructural controls discussed in the preceeding sections and improved street sweeping practices in the downtown Chattanooga area. The modeled storm event is the 10 year, 24 hour storm described earlier. Existing conditions for Nickajack Reservoir have been outlined earlier and will be used as the basis for comparison with water quality conditions under option implementation.

The results of the modeling effort are presented in Figures VI-19 and VI-20, and VI-21, and Table VI-23. These figures present water quality parameter values for Nickajack Reservoir plotted against time since the

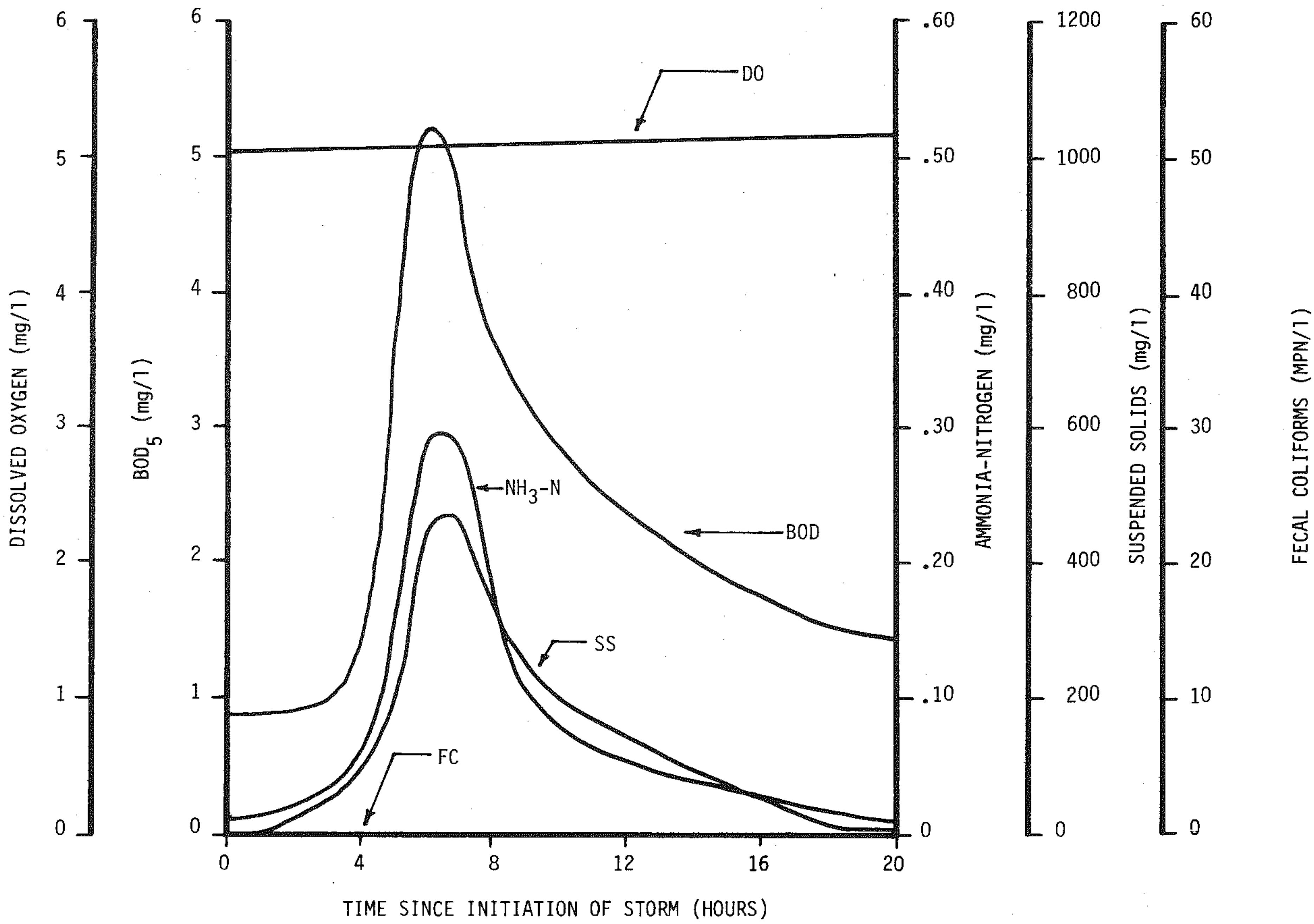


FIGURE VI-19: Water Quality in Nickajack Reservoir (TRM 469.9) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

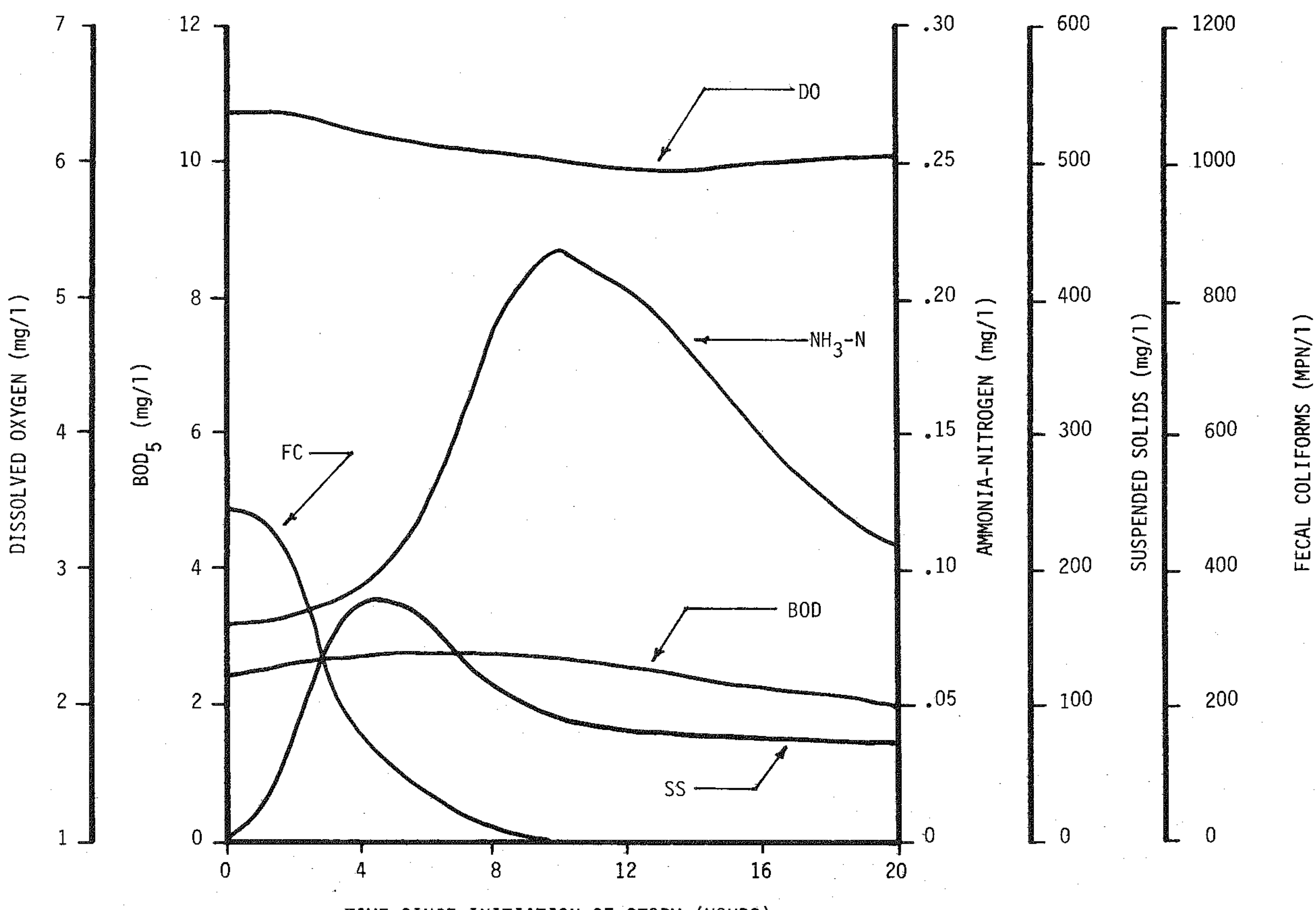


FIGURE VI-20: Water Quality in Nickajack Reservoir (TRM 457.8) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

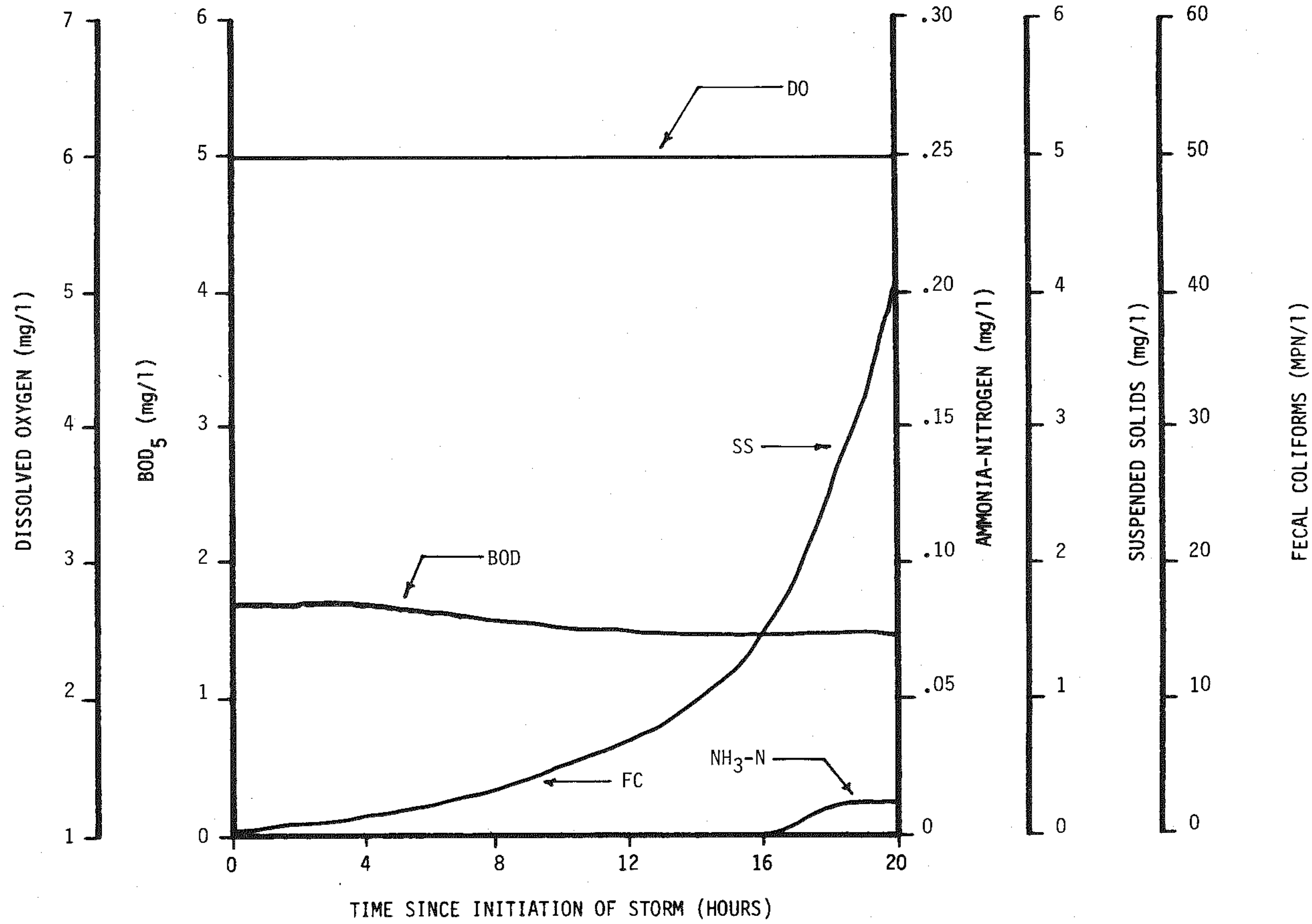


FIGURE VI-21: Water Quality in Nickajack Reservoir (TRM 443) under Q_{10-7} Low Stream Flow with Nonpoint Source Options

TABLE VI-23

PERCENT REDUCTION IN MASS LOADINGS UNDER NONSTRUCTURAL OPTIONS FOR NICKAJACK RESERVOIR

Hour	BOD_5 % Reduced TRM 469.9	BOD_5 % Reduced TRM 457.8	TSS % Reduced TRM 469.9	TSS % Reduced TRM 457.8	NH_3-N % Reduced TRM 469.9	NH_3-N % Reduced TRM 457.8
1	0	0	0	0	0	0
2	0	4.0	0	0.8	0	11.1
3	0	2.4	0	0.5	0	-
4	0	7.5	0	1.0	0	10.0
5	17.8	8.8	1.4	1.2	22.7	8.2
6	19.8	10.1	2.0	3.1	22.6	8.0
7	18.2	12.6	1.8	7.1	22.7	44.4
8	17.0	23.6	2.3	9.2	22.2	13.6
9	15.4	32.2	2.4	9.5	21.4	37.5
10	14.5	37.3	2.5	8.8	25.0	12.0
11	13.4	40.2	2.9	8.1	20.0	12.0
12	12.0	41.3	2.7	7.6	12.5	12.5
13	10.1	41.4	2.5	7.3	43.9	13.6
14	10.5	40.6	2.4	7.3	20.0	14.3
15	6.7	39.6	2.2	7.3	25.0	15.8
16	5.0	37.5	1.8	7.5	0	11.8
17	4.2	35.7	1.4	7.7	33.3	12.5
18	6.9	33.3	8.7	7.7	0	7.1
19	1.9	31.0	0.8	7.6	0	7.7
20	1.3	28.7	0.6	7.5	0	2.7
21	0.7	26.2	0.5	7.2	50.0	16.7
22	0.7	24.0	0.4	6.7	0	9.1
23	0.7	22.1	0.4	6.1	0	9.1
24	0	20.3	0.3	5.5	0	9.1

beginning of storm. Three locations are graphed: a point at the beginning of the dissolved oxygen sag curve, TRM 469.9; a point located at a combined sewer overflow, TRM 457.8; and a point far downstream from the overflows, TRM 443. Table VI-23 shows the percent reduction in mass loadings at the first two locations achieved under the evaluated options. An analysis of these data is presented below.

Figure VI-19 for Tennessee River mile 469.9 demonstrates the effect of the storm event on the water quality at this location. The critical values for dissolved oxygen, ammonia-nitrogen, and BOD all occur during hour 6 of the storm. This is shortly after the heaviest rainfall of the storm and can be attributed to stormwater runoff. The maximum concentration of suspended solids occurs slightly earlier, during hour 5. Fecal coliform values, while nearly constant, are somewhat lower during this period due to the dilution from runoff. The background levels of pollutants at this location show that only ammonia-nitrogen and suspended solids increase significantly during the modeled storm event. The highest concentrations for these values do not indicate any serious water quality problems however.

The data presented in Figure VI-20 for TRM 457.8 display a different trend than that for the upstream location due, in larger part, to the combined sewer overflows located in the vicinity of this point. Once again, the maximum suspended solids value occurs during hour 5 following the period of the heaviest rainfall. The dissolved oxygen minimum does not take place until much later in the storm (approximately hour 14) as would be expected from this downstream location. The BOD and ammonia-nitrogen maximums occur during hour 8 when the combined sewer overflows reach the stream. Fecal coliform values decline steadily from their initial high value as runoff produced a dilution effect.

Figure VI-21, illustrating the data from TRM 443.0, is nearly identical to the figure for this point under existing conditions. This is due to the downstream location of this site where most of the water quality phenomena are a result of the upstream dischargers. Ammonia-nitrogen and dissolved oxygen values appear constant throughout the storm. BOD levels decrease continuously from their initial value as runoff dilutes the discharger effluents. Suspended solids increase steadily as stormwater runoff contributes to the stream loadings. No parameter values indicate any serious water quality problems at this location.

Table VI-23 presents the reduction in loadings achieved under the control options for the two upstream locations only, since no significant differences were noted at the downstream location. The site of combined sewer overflows shows a higher percent reduction for BOD and suspended solids values than the upstream location. This is primarily the result of the improved street cleaning techniques evaluated for the downtown Chattanooga area. Maximum BOD reduction achieved at this point was 41 percent of the existing condition value. The upstream location showed a maximum BOD reduction of only about half this amount. Suspended solids reduction values were much less at both points (maximums of 8.7 and 9.5 percent) since most of the solids are the result of erosion. Ammonia-nitrogen values appear to be reduced by approximately the same amount at each location with the maximum being a 50 percent reduction. The percent reduction for all parameters varies widely with time since beginning of storm due to the various factors (runoff, dischargers, combined sewer overflows) influencing the water quality at the different locations.

The only Tennessee water quality standards violations which occur in Nickajack Reservoir during the modeled storm event are short lived fecal coliform violations at combined sewer overflow points and below the Moccasin Bend wastewater treatment facility. The violations predicated by the modeling are somewhat less than those reported by TVA in their sampling program. The water quality model used predicts average concentrations across the width of the river, while the TVA sampling program measured water quality parameters in the immediate vicinity of the combined sewer overflows. Disinfection of both the combined sewer overflows and the effluent from the Moccasin Bend facility should alleviate these violations.

F. PRIORITY DETERMINATION AND PROJECT COSTS

In this section of the plan, the priority determinations and estimated project costs for the urban runoff preferred areawide plan are presented.

1. Cost of Nonstructural Controls and Priority Development

Due to the fact that the cost of nonstructural or source control options listed in the previous sections vary widely according to specific sites and applications, it is virtually impossible to assign a cost to their implementation with respect to the CARCOG/SETDD 208 Study Area. At such time as specific programs and site controls are detailed and responsibility for control practices is delineated, estimated implementation costs can be established. Previously, an attempt has been made to illustrate relative costs which might be expected through the application of these control options to typical sites. Reference is made to this area for future information concerning cost of implementation for nonstructural options for urban stormwater runoff.

With regard to priority development, the discussion includes a statement of estimated implementation costs and required effort and responsibility for accomplishment of the recommended options, strategies, or techniques.

It is recommended that the first priority for nonstructural or source control options be given to the development of a comprehensive erosion and sediment control ordinance. This ordinance should entail several problem areas and should have the necessary enforcement capabilities. This ordinance should address construction site erosion control in the urban area, areas presently without satisfactory cover to prevent erosion, and existing drainage water ways which are unprotected from washout. The ordinance should also be directed at new construction and development areas to prevent mass stripping of protective vegetative growth and uncontrolled paving and covering of areas. It should also address building code requirements for increased use of porous paving materials whenever possible. Building codes could also require various construction practices, such as parking lot short term storage to detain runoff and therefore reduce erosion.

This type of ordinance would not require a great amount of money for initiation, but might require some additional funding to the responsible agency for enforcement and inspection. This cost could be offset by permit fees and fines. The cost of implementing the controls would be the burden of the private construction firms and the private sector.

The second priority is given to the recommendation that industrial areas and storage facilities in the CARCOG/SETDD 208 Study Area be examined by federal and state representatives to determine if they should be considered point source dischargers or require pretreatment of site runoff. There are several areas in the study area where it appears that water quality problems exist due to this type of runoff. The requirement of NPDES permits or pretreatment for these sources could significantly enhance existing conditions. This recommendation would not have any significant costs associated with it. Any pollution abatement requirements that are established as a result of this recommendation would be the responsibility of the industries in question.

The third priority is given to the recommendation that a parking ordinance be established in the urban area to remove automobiles from curbs for street cleaning. Presently, there does not appear to be any requirements to have curb free areas for the street sweepers. As stated earlier, the majority of filth collects within six inches of the curb. If a substantial street sweeping program is going to be continued and a significant amount of public funds expended for this effort, the program should be as efficient as possible. A parking ordinance would increase the street cleaning efficiency tremendously.

Costs associated with this recommendation would be found in the purchase of no parking signs, posting of the signs, and additional manpower required for enforcement. A major portion of these costs could be recouped through fines and tow-in charges.

The fourth priority is for the recommended strict enforcement of litter control laws and ordinances. It is felt that if some effort is made to encourage courts to apply severe punishment to littering offenders and a public education program is established, the reduction in litter can be substantial with little expenditure of public funds. The establishment of this type of civic pride can serve to improve water quality, make the study area more aesthetically pleasing, and save litter cleanup costs for little initial investment of the taxpayers' money.

The remaining nonstructural or source control options listed in this report are not given recommended priorities for implementation. It is recommended that these other control options be implemented at such time as necessary agencies, ordinances, funding, and specific site needs are established. It is important to note that implementation of recommended nonstructural or source control options is on a voluntary basis and the extent of their application will be dependent upon local and federal funding. It is also important to note that these nonstructural controls are applicable to all the urban areas in the study area as indicated in Figure XI-11.

2. Cost of Structural Controls and Priority Development

The 17 combined sewer subareas in the CARCOG/SETDD 208 Study Area vary in size from 6.9 to 633.7 acres. Nine of these subareas are greater than 150 acres in size. Four of the subareas discharge to Chattanooga Creek, while the remainder drain to the Tennessee River. Of the 13 subareas discharging to the Tennessee River, only one, C-10, discharges along the right or north side of the Tennessee River where significant water quality deterioration has not been observed.

Based upon the water quality modeling evaluation of existing wet weather conditions and urban runoff control options, it is recommended that the construction of disinfection facilities at the points of combined sewer overflows on the Tennessee River be given first priority (Group I, Table VI-24). It is believed that implementation of Group I priorities, as shown in Table VI-24, will be sufficient to adequately improve water quality in the Tennessee River during wet weather. These should be undertaken in the first five years of the planning period.

It is also recommended that second priority (Group II, Table VI-24) be given the construction of disinfection facilities and swirl concentrator/regulator chambers at points of combined sewer overflows on Chattanooga Creek. Group II priorities are recommended for construction during the twenty-year planning period.

The cost of implementation of the recommended structural controls will depend upon the desired design storm event selected. Table VI-25 lists cost estimates for varing sizes of disinfection facilities, while Table VI-26 lists cost estimates for swirl concentrators/regulators.

It is important to note that the structural component of the proposed plan for urban runoff control represents a contingency plan which will only be implemented when and if federal funds become available.

TABLE VI-24

PRIORITIES FOR CONSTRUCTION OF URBAN RUNOFF CONTROLS

GROUP I

Priority	Subarea	Receiving Stream	Size (Acres)
1	C-9	Tennessee River	401.8
2	C-6	Tennessee River	243.4
3	C-13	Tennessee River	174.5
4	C-17	Tennessee River	174.5
5	C-5	Tennessee River	165.3
6	C-14	Tennessee River	153.8
7	C-11	Tennessee River	59.7
8	C-7	Tennessee River	52.8
9	C-12	Tennessee River	25.3
10	C-18	Tennessee River	20.7
11	C-15	Tennessee River	13.8
12	C-16	Tennessee River	6.9

GROUP II

Priority	Subarea	Receiving Stream	Size (Acres)
1	C-2	Chattanooga Creek	633.7
2	C-1	Chattanooga Creek	183.7
3	C-3	Chattanooga Creek	55.1
4	C-4	Chattanooga Creek	32.1

TABLE VI-25

RAPID MIX CHLORINATION FACILITIES COST ESTIMATE

Item	Capacity (cfs)		
	25	50	100
Capital Cost	$40,000	$66,000	$109,000
Operation and Maintenance Cost ($/year):			
Labor	1,000	1,850	3,450
Supplies	180	290	480
Power	870	1,750	3,500
TOTAL ESTIMATED COST	$42,050	$69,890	$116,430

TABLE VI-26

SWIRL CONCENTRATOR/REGULATOR CONSTRUCTION COST ESTIMATE

Item	Capacity (cfs)		
	25	50	100
A. Concentrator			
1. Structure	$45,000	$54,000	$71,000
2. Weir & Baffle	3,900	4,700	6,200
3. Walkway	2,250	2,250	3,000
B. Miscellaneous			
1. Controls, Pumps, Sewers	30,000	30,000	30,000
Sub-Total (A-B)	$81,150	$91,200	$110,200
C. Engineering 7%	5,680	6,390	7,720
D. Field Exploration 3%	2,440	2,740	3,310
E. Operation Training & Start-up	---	---	---
F. Administration & Legal Services 1%	820	920	1,110
G. Land Acquisition	2,000	2,000	2,000
H. Right-of-Way & Easements	---	---	---
Sub-Total (A-H)	$92,090	$103,250	$124,340
I. Contingencies 10%	9,210	10,330	12,440
Total Estimated Cost	$101,300	$113,580	$136,780

VII - RURAL RUNOFF AREAWIDE PLAN

VII
RURAL RUNOFF AREAWIDE PLAN

A. INTRODUCTION

This chapter contains a description of the rural runoff control plan for the CARCOG/SETDD 208 Waste Treatment Management Planning Area. Included in this chapter is the inventory and assessment of nonpoint problems in the area; a discussion of the best management control options for rural runoff; the rural runoff null alternative; the rural runoff preferred areawide plan; and priority determination and project costs for implementation of the proposed plan.

The CARCOG/SETDD 208 Waste Treatment Management Planning Area encompasses approximately 1.3 million acres. Of this amount, about 7 percent may be classified as urban, while 93 percent of the planning area is classified as rural. This plan is concerned with control of nonpoint pollution runoff from the rural area.

1. Nonpoint Pollutants

The term nonpoint source pollution refers to water pollution resulting from human activities that cannot be directly related to a point source, such as a pipe discharge, but is generally a non-confined source, such as runoff from a field. More precisely defined, nonpoint source pollution is pollution from any nonconfined area from which pollutants are discharged directly or indirectly into a body of water. Several general statements that relate to nonpoint source pollution include:

- Nonpoint source discharges enter the water in a diffused manner and at intermittent intervals.
- The pollutants are picked up from an extensive area of land and are transmitted overland before they enter surface waters.
- Nonpoint sources generally cannot be monitored at their point of origin, and their exact source is seldom traceable.
- Elimination or control of pollutants usually must be directed at specific sites.
- In general, the most effective controls are land management techniques and conservation practices.
- The extent of nonpoint source pollution is related in part to certain uncontrollable climatic events, as well as soil, vegetative cover, and geologic conditions, and greatly differ from location to location.

Potentially all of the rural land in the planning area is a source of nonpoint pollution, as is a substantial fraction of the urban area. Several types of nonpoint pollution arise on rural land as the result of agricultural, silvicultural, construction, mining, and other land use and management activities. The major nonpoint pollutants of concern originating on rural lands are sediment, nutrients, pesticides, organic wastes, acid mine drainage, and pathogens.

The major rural nonpoint pollutant, by volume, is sediment. Sediment resulting from soil erosion is regarded as the largest pollutant that affects water quality in rural areas. Sediment may originate from sheet, rill, and gully erosion on agricultural land, forest land, construction sites, housing developments, roadbanks, and mining areas. The principal sources of sediment pollution are disturbances caused by man. Cropland is the greatest source of sediment (total quantity), contributing 50 percent of the total sediment nationally. Construction and surface mining activities yield large quantities of sediment in relatively small regions of impact. Well managed forests are exceptionally free of erosion, but soils disturbed by timber harvest may be highly erodible. Sediment also carries with it significant quantities of plant nutrients, pesticides, organic matter, and pathogens.

Nutrient elements, particularly nitrogen and phosphorus, are major nonpoint pollutants from rural land. These elements are abundant in nature and it is difficult to determine the specific origin of most nutrient elements in streams. Phosphates and nitrates are pollutants of concern because of their role in the eutrophication of aquatic ecosystems. In addition to naturally available nitrogen and phosphorus, these elements are derived in large quantity from fertilizers and livestock wastes. The rates of emission are greatest from lands managed for intensive production of crops and livestock. About 300 pounds per acre of commercial fertilizers, containing roughly 44 percent nitrogen, 25 percent phosphorus, and 31 percent potassium, are applied annually to croplands in the planning area. Pasturelands that are treated receive an average of 150 pounds per acre of fertilizer and 3 tons per acre of lime (over a 5 year treatment interval). Some of these nutrients are transported, together with naturally occurring nutrient elements, to surface and groundwaters.

Pesticides are widely used in agricultural operations, and to a lesser extent in silviculture, construction, and mining activities. Pesticides may be transported to water resources by various means such as careless application, spray drift, runoff, and seepage or infiltration. The extent of the pollutional hazard associated with pesticides depends upon the properties of the pesticide and the care exercised in its use. The major categories of pesticides that are potential rural nonpoint source pollutants in the CARCOG/SETDD 208 planning area are herbicides, insecticides, rodenticides, and fungicides. It is important to note that a certain percent of pesticides escape and cause serious problems because of their persistence and accumulation in ecosystems.

Agricultural and silvicultural activities generate tremendous quantities of natural organic waste materials that are potential rural nonpoint pollutants. The major sources of organic waste material are livestock wastes, crop debris, forest litter, and waste petroleum products (lubricating oils and greases, waste crankcase oil, and pesticide solvents or dispersents). Other less significant sources are cleaning solvents, waste paints and degraded surface coatings, waste material from building and construction activities, and rural waste items. A majority of the organic waste materials deposited in streams are transported by erosion and runoff.

A serious rural nonpoint source pollutant arising from coal mining activities is acid mine drainage. Acid mine drainage is a mixture of sulfuric acid and iron and aluminum salts which results when any opening of the earth causes pyritic materials to be exposed to air and moisture. Acid mine drainage arises from both underground and surface mining sources. Acid mine drainage can find its way into surface waters, where the acid and sulfate may result in severe deterioration of stream quality. Acid mine drainage also has the potential of leaching toxic heavy metals from soil and rock strata through which it passes.

Organic wastes of animal and human origin are a source of bacterial pollutants, some of which are disease producing. The rural nonpoint source discharge of pathogens is associated most closely with agricultural wastes and livestock production. Diseases may be transmitted through soil and water when these wastes come in contact with plants and animals. Improperly functioning septic systems and wastewater are often significant sources of coliform bacteria (pathogen indicator organisms).

2. Rural Nonpoint Pollutant Transport

Nonpoint pollutants may be dissolved and carried by water, or may be absorbed and transported with sediment. Runoff from rural and agricultural lands is the major mode of transport of pollutants that enter a water course. Subsurface drainage may also carry significant quantities of pollutants that are dissolved in water. Surface water carries suspended sediment in large quantities. Many pollutants such as phosphates and pesticides are tightly bound to sediments and transported by sediment-laden runoff. Groundwater pollution stems mainly from increased nitrate concentration from percolation and infiltration.

Movement of potential nonpoint pollutants into waterways is a complex process which depends on many factors. Some of these factors are the physical and chemical nature of the pollutant, the rate or method of its application, tillage methods, topography, distance between point of application and the waterway, weather conditions, and soil properties.

Erosion is a common geologic phenomenon, but is often accelerated beyond normal rates by soil disturbance activities. It is this accelerated erosion which introduces increased dissolved and suspended rural nonpoint source pollutant material into streams. Erosion and sedimentation by water include the processes of detachment, transportation, and deposition of soil particles. The major erosive agents are impacting raindrops and runoff flowing over the soil surface.

The magnitude of the impacts of nonpoint pollutants vary in direct proportion to the quality of management of specific activities such as agriculture, silviculture, construction, and mining. Nationally nonpoint sources account for 92 percent of the total loadings of suspended solids, 79 percent of the total daily nitrogen loadings, 53 percent of the phosphorus loadings, and over 98 percent of the bacterial loadings to receiving waters.

3. <u>Rural Nonpoint Source Inventory</u>

The Soil Conservation Districts (SCDs), because of their historic involvement in the identification and treatment of conservation land treatment problems, were determined to be the most capable organization to inventory and evaluate the nonpoint problems in the planning area. With the assistance of the Soil Conservation Service, the SCDs conducted the inventory of potential rural nonpoint pollutant sources in the CARCOG/SETDD 208 Study Area.

The inventory was based primarily upon observation of existing problems, a knowledge of the soil and water resources, their capabilities, and their general uses within the study area. Land evaluation indicators were mainly visual, cartographic, and mathematical (Universal Soil Loss Equation) in nature. The inventory began with a categorization of the rural nonpoint sources. Each source category was inventoried and individual source category maps locating each potential rural nonpoint source were developed for each county within the study area.

The initial assessment addressed seven broad categories of rural nonpoint pollution sources, as suggested by EPA. These were:

- Urban
- Construction
- Hydrologic Modification
- Agriculture
- Forestry
- Mining
- Disposal Areas

The current rural nonpoint source assessment and areawide plan development addresses only hydrologic modifications, agricultural, forestry, and mining categories from the above list. Nonpoint source runoff from urban areas and construction activities are addressed in Chapter VI of this plan, while solid waste disposal areas are addressed in Chapter VIII.

Hydrologic modifications are implemented primarily for flood control, erosion reduction, or for drainage purposes. In addition, there are many land development activities which, if not properly planned, may result in an undesirable hydrologic modification. Hydrologic modifications resulting in nonpoint source pollution are activities that either directly or indirectly adversely affect the natural stream flow and associated groundwater regime. Pollutants (mainly sediment or suspended solids) are consequently added to the surface and groundwaters from diffuse runoff or by percolation. This assessment deals with man-made hydrologic stream modifications that have created rural nonpoint pollution problems in the planning area.

Rural nonpoint agricultural pollutants are organic and inorganic materials entering surface and groundwater in sufficient quantity to constitute a pollution problem. They include sediment, plant nutrients, pesticides, and animal wastes from croplands, pastureland, and farm woodlots. Sediment is the major pollutant in terms of volume and is usually a carrier of some pesticides and plant nutrients. Agricultural nonpoint sources are a broad category covering all crop and animal production activities. The movement of agricultural pollutants is strongly dependent upon climatic events, but may also be dependent upon many other variables including soil types, topography, crop and animal types, and production methods. Activities that can produce the potential for nonpoint source pollution include: disturbance of soil by tillage, alteration of natural vegetative patterns during conversion to cropland, application of fertilizers, application of pesticides, concentration of animals in a particular area, overgrazing of pasturelands, and concentrating of animals along stream banks. Because all agricultural activities rely on some degree of fertilizer and pesticide usage and rural nonpoint pollution from fertilizers and pesticides is positively correlated with erosion rates, the assessment of agricultural nonpoint sources was divided into sediment sources and animal waste production sources such as dairy herds, swine producers, and poultry producers.

The cultivation and harvesting of timber for commercial purposes (silviculture) can result in the development of significant sources of pollutants which may reach surface or groundwater. All activities related to silviculture including crop regeneration, intermediate practices, and harvesting can result in nonpoint pollutants, primarily sediment and organic wastes. A major silvicultural sediment source, however, is access systems (log roads and other transport systems).

Nonpoint pollution caused by drainage from mining activities occurs when dissolved, suspended, or other solid mineral wastes and debris from mining enter receiving streams and groundwater. The most serious pollutant arising from mining activities is acid mine drainage. Mining refuse waste materials and overburden (spoil) are highly erosive and are sediment sources. Mine drainage includes both water flowing from surface mines and deep mines.

4. Rural Nonpoint Source Assessment Summary

The rural nonpoint source inventory located 217 sources of rural nonpoint pollution that are found on approximately 10,960 acres in the CARCOG/SETDD 208 Study Area. Table VII-1 lists each site located in the inventory together with their category/description, size, and receiving stream. Of the nonpoint sources located, approximately 70 percent were agricultural, 22 percent were mining, 6 percent were hydrologic modification, and 1 percent were forestry category sources. Figure VII-1 illustrates the location of each rural nonpoint source problem area within the 208 study area while Table VII-2 lists the number of sites and acres by county affected by each category of rural nonpoint source pollution.

B. BEST MANAGEMENT CONTROL OPTIONS

1. Best Management Practices

Best Management Practices (BMPs) are those methods or combinations of methods which are the most practical, effective, and economic means of achieving sediment, nutrient, and pesticide discharge levels compatible with the goals of Public Law 92-500, Section 208. These practices are listed in Table VII-3 along with brief descriptions of each.

Best Management Practices accomplish those purposes stated above in several ways. They increase infiltration of precipitation, limit the extent of erosive conditions and time of exposure, divert runoff around erosive surfaces, store runoff, allow pollutant entrapment and/or deposition, and reduce runoff velocity.

2. BMP Unit Cost

Table VII-3 lists the Best Management Practices together with approximate unit costs for each BMP. These estimated costs reflect best available information at time of formulation. As such, they can be expected to vary among regions just as they vary in individual problem areas. As systems are planned and implemented, more complete data will be available for those practices which are now not widespread.

3. Effects of BMP Application

Several facts are known about nonpoint source pollutants which evolve from agricultural activities: they tend to be dispersed over large land areas, they are associated with the process of erosion, they enter aquatic ecosystems via surface runoff and/or groundwater interflow, and they can be controlled to varying degrees by various mechanical and cultural land management practices. Historically,

TABLE VII-1
INVENTORY OF NONPOINT SOURCE LOCATIONS

Site No.	Category-Description	Size(Ac.)	Receiving Stream
Hamilton County			
H-1	Hydrologic Modification	1	Possum Ck.
H-2	Hydrologic Modification	3	N. Chickamauga Ck.
H-3	Hydrologic Modification	2	Falling Water Ck.
A-1	Agriculture - Sediment	200	Sale Ck.
A-2	Agriculture - Sediment	300	Possum Ck.
A-3	Agriculture - Animal Waste	5	Gunstocker Ck.
A-4	Agriculture - Sediment	500	Gunstocker Ck.
A-5	Agriculture - Sediment	400	Savannah Ck.
A-6	Agriculture - Animal Waste	6	Thatch Br.
A-7	Agriculture - Sediment	400	Savannah Ck.
A-8	Agriculture - Animal Waste	4	Tennessee River
A-9	Agriculture - Sediment	300	Norman Br.
A-10	Agriculture - Sediment	300	Runyan Br.
A-11	Agriculture - Sediment	200	Tennessee River
A-12	Agriculture - Sediment	400	Savannah Ck.
A-13	Agriculture - Animal Waste	5	Savannah Ck.
A-14	Agriculture - Animal Waste	5	Savannah Ck.
A-15	Agriculture - Sediment	300	Soddy Ck.
A-16	Agriculture - Sediment	300	Savannah Ck.
A-17	Agriculture - Animal Waste	5	Rogers Br.
A-18	Agriculture - Animal Waste	5	Cat Ck.
A-19	Agriculture - Sediment	200	Johnson Br.
A-20	Agriculture - Sediment	200	Chestnut Ck.
A-21	Agriculture - Sediment	300	Johnson Ck.
A-22	Agriculture - Sediment	200	Johnson Ck.
A-23	Agriculture - Sediment	200	Lookout Ck.
G-1	Mining - Surface Mine	15	Clemmons Ck.
G-2	Mining - Surface Mine	15	Possum Ck.
G-3	Mining - Surface Mine	33	Possum Ck.
G-4	Mining - Surface Mine	25	Possum Ck.
G-5	Mining - Surface Mine	75	Camp Ck.
G-6	Mining - Surface Mine	15	Soddy Ck.
G-7	Mining - Surface Mine	5	Middle Ck.
Catoosa County			
A-24	Agriculture - Animal Waste - Poultry	2	Sugar Ck.
A-25	Agriculture - Animal Waste - Poultry	2	East Chickamauga Ck.
A-26	Agriculture - Animal Waste - Poultry	2	East Chickamauga Ck.
A-27	Agriculture - Animal Waste - Poultry	2	Dry Ck.
A-28	Agriculture - Animal Waste - Poultry	2	Cat Ck.
A-29	Agriculture - Animal Waste - Swine	2	Hurricane Ck.

TABLE VII-1
INVENTORY OF NONPOINT SOURCE LOCATIONS (Continued)

Site No.	Category-Description	Size(Ac.)	Receiving Stream
Sequatchie County			
G-42	Mining - Surface Mine	20	Sequatchie River
G-43	Mining - Surface Mine	10	Sequatchie River
G-44	Mining - Surface Mine	20	Sequatchie River
G-45	Mining - Deep Mine	-	Sequatchie River
G-46	Mining - Surface Mine	10	Sequatchie River
G-47	Mining - Deep Mine	-	Sequatchie River
G-48	Mining - Deep Mine	-	Sequatchie River

TABLE VII-1
INVENTORY OF NONPOINT SOURCE LOCATIONS (Continued)

Site No.	Category-Description	Size(Ac.)	Receiving Stream
Sequatchie County			
A-135	Agriculture - Animal Waste - Beef Cattle	10	Sequatchie River
A-136	Agriculture - Animal Waste - Beef Cattle	10	Soddy Ck.
A-137	Agriculture - Animal Waste - Beef Cattle	10	Sequatchie River
A-138	Agriculture - Animal Waste - Beef Cattle	10	Sequatchie River
A-139	Agriculture - Animal Waste - Swine	5	Sequatchie River
A-140	Agriculture - Animal Waste - Swine	5	Sequatchie River
A-141	Agriculture - Animal Waste - Swine	5	Big Brush Ck.
A-142	Agriculture - Animal Waste - Swine	5	Big Brush Ck.
A-143	Agriculture - Animal Waste - Swine	5	Soddy Ck.
A-144	Agriculture - Animal Waste - Swine	5	N. Chickamauga Ck.
A-145	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-146	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-147	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-148	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-149	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-150	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-151	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-152	Agriculture - Animal Waste - Dairy	10	Sequatchie River
A-153	Agriculture - Animal Waste - Dairy	10	Sequatchie River
F-3	Forestry	800	Big Brush Ck.
G-15	Mining - Surface Mine	30	Big Brush Ck.
G-16	Mining - Surface Mine	20	Big Brush Ck.
G-17	Mining - Surface Mine	20	Dry Ck.
G-18	Mining - Surface Mine	50	Dry Ck.
G-19	Mining - Surface Mine	20	Dry Ck.
G-20	Mining - Surface Mine	30	Dry Ck.
G-21	Mining - Surface Mine	10	Big Brush Ck.
G-22	Mining - Surface Mine	10	Big Brush Ck.
G-23	Mining - Deep Mine	-	Big Brush Ck.
G-24	Mining - Surface Mine	10	Big Brush Ck.
G-25	Mining - Surface Mine	30	Soddy Ck.
G-26	Mining - Surface Mine	10	Soddy Ck.
G-27	Mining - Surface Mine	30	Soddy Ck.
G-28	Mining - Deep Mine	-	N. Chickamauga Ck.
G-29	Mining - Deep Mine	-	N. Chickamauga Ck.
G-30	Mining - Surface Mine	30	N. Chickamauga Ck.
G-31	Mining - Surface Mine	50	N. Chickamauga Ck.
G-32	Mining - Deep Mine	-	N. Chickamauga Ck.
G-33	Mining - Surface Mine	10	N. Chickamauga Ck.
G-34	Mining - Surface Mine	10	N. Chickamauga Ck.
G-35	Mining - Deep Mine	-	N. Chickamauga Ck.
G-36	Mining - Deep Mine	-	N. Chickamauga Ck.
G-37	Mining - Surface Mine	10	N. Chickamauga Ck.
G-38	Mining - Surface Mine	10	Sequatchie River
G-39	Mining - Surface Mine	40	Sequatchie River
G-40	Mining - Deep Mine	-	Sequatchie River
G-41	Mining - Deep Mine	-	Sequatchie River

TABLE VII-1
INVENTORY OF NONPOINT SOURCE LOCATIONS (Continued)

Site No.	Category-Description	Size(Ac.)	Receiving Stream
Sequatchie County			
G-42	Mining - Surface Mine	20	Sequatchie River
G-43	Mining - Surface Mine	10	Sequatchie River
G-44	Mining - Surface Mine	20	Sequatchie River
G-45	Mining - Deep Mine	-	Sequatchie River
G-46	Mining - Surface Mine	10	Sequatchie River
G-47	Mining - Deep Mine	-	Sequatchie River
G-48	Mining - Deep Mine	-	Sequatchie River

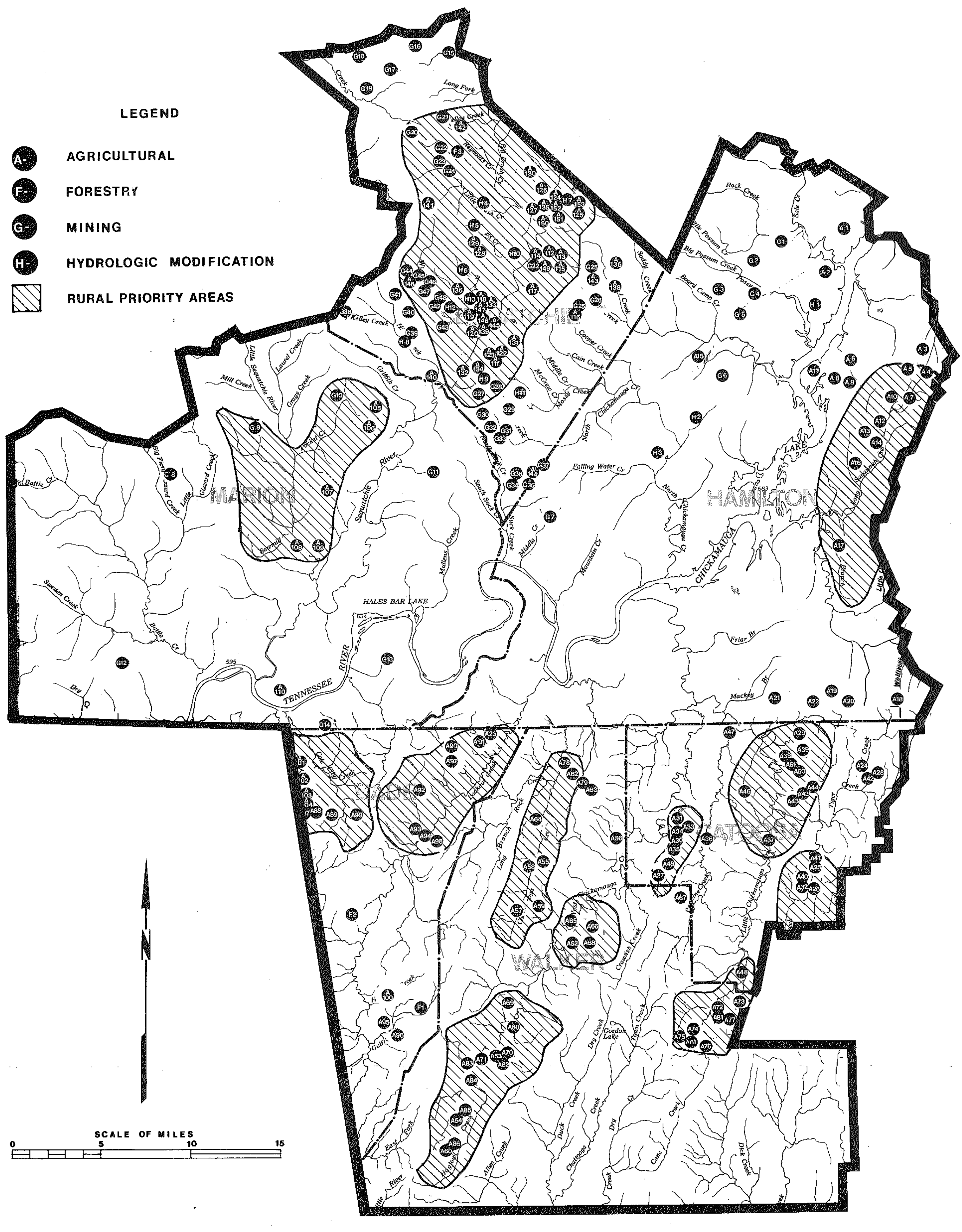


FIGURE VII-I
RURAL NONPOINT SOURCES
AND
PRIORITY AREAS

TABLE VII-2
NONPOINT SOURCE INVENTORY
SUMMARY OF SITES

Nonpoint Source Category	Counties						
	Sequatchie	Marion	Hamilton	Dade	Walker	Catoosa	Total
C. Hydrologic Modification							
Sites	10	-	3	-	-	-	13
Acres	40	-	6	-	-	-	46
E. Agriculture							
1. Sediment							
Sites	22	5	16	4	3	6	56
Acres	2015	150	4700	192	330	825	8212
2. Animal Waste							
Sites	21	1	7	14	32	22	97
Acres	180	10	35	37	222	100	584
F. Forestry							
Sites	1	-	-	2	-	-	3
Acres	800	-	-	20	-	-	820
G. Mining							
Sites	34	7	7	-	-	-	48
Acres	490	625	183	-	-	-	1298
Total							
Sites	88	13	33	20	35	28	217
Acres	3525	785	4924	249	552	925	10960

TABLE VII-3
PROPOSED BEST MANAGEMENT PRACTICES

Practice Code	Practice Name	Technical Guide #	Technical Comment	Unit	Unit Cost
1	Animal Waste Management System	313	A system of structural works designed to retain liquid and solid waste and polluted runoff from animal feeding areas, milking areas, and other confinement areas and to provide for their subsequent disposal or use.	No	a*
2	Conservation Cropping System	328	Growing crops in combination with needed cultural and management measure; e.g. cropping systems using rotation of grasses and legumes or other crop species.	Acre	$22.00
3	Contour Farming	330	The practice of cultivation, planting, and other practices are done with the topographic contour as opposed to with the slope.	Acre	6.00
4	Correct Pesticide Use		The uses of all pesticides according to registered label instructions to minimize pollution of water, soil, or air, or injury to non-target species. This includes disposal of containers and residues in a manner prescribed by label instructions.	Acre	b
5	Critical Area Planning	342	Planting vegetation such as trees, shrubs, vines, grasses, or legumes on critically eroding areas.	Acre	c
6	Crop Residue Use	344	Using plant residues such as stems, stover, leaves, etc. to protect cultivated fields during periods of greatest erosion potential.	Acre	4.00
7	Debris (Settling) Basin	350	A barrier or dam constructed across a waterway or other suitable locations to form a catch-basin for eroded soil.	No	d
8	Diversion	362	A channel (with supporting ridges on the lower side) constructed across a slope to break slope lengths, reduce over land runoff volume, and to reduce erosion.	Ft.	0.65

TABLE VII-3
PROPOSED BEST MANAGEMENT PRACTICES (Continued)

Practice Code	Practice Name	Technical Guide #	Technical Comment	Unit	Unit Cost
9	Field Border (Filter Strip)	386	A strip of permanent vegetation (trees, shrubs, grasses, or legumes) established along field margins to trap eroded soil and associated pollutants.	Ft.	0.50
10	Field Windbreak	392	A strip of trees established to reduce wind velocities across crop fields to the areas subject to wind erosion.	Ft.	0.02
11	Floodwater (Runoff) Retarding Structure	402	A dam constructed across a watercourse to provide temporary floodwater storage and storage of suspended sediment and associated pollutants.	No, and Acre Ft.	e
12	Grade Stabilization Structure	410	A structure to stabilize the grade or to control head cutting (active erosion) in natural or artificial channels.	No	$2500.00
13	Grassed Waterway or Outlet	412	A natural or constructed waterway or water outlet, shaped or graded as needed and established with suitable vegetation, for safe disposal of field, diversion, or terrace runoff. Acts as a trap for sediment and associated pollutants.	Acre	350.00
14	Integrated Pest Management		The use of biological and various chemical control agents to limit populations of harmful agricultural pests. Integrated management seeks to decrease environmental pollution while suppressing pest populations below defined economic injury levels.	Acre	f
15	Land Absorption Areas		Areas provided for surface disposal, detoxifying, settling, or recycling of agricultural pollutants by means of plant utilization or passage through the soil.	Acre	g
16	Land Use Conversion		The alteration of land use on an area from one of intensive use to one of low-intensity use; e.g. conversion from row crops to woodland on Class VIIe land.	Acre	h

TABLE VII-3
PROPOSED BEST MANAGEMENT PRACTICES (Continued)

Practice Code	Practice Name	Technical Guide #	Technical Comment	Unit	Unit Cost
17	Minimum Tillage	478	Limiting the number of cultural operations to only those properly timed and essential to produce a crop and prevent excessive soil loss. This entails planting in stubble from previous crops or double-crop planting with minimal soil disturbance.	Acre	18.00
18	Mulching	484	The application of plant residues, or other materials not produced on-site, to the soil surface to reduce erosion, conserve moisture, and help establish plant cover.	Acre	310.00
19	Pasture and Hayland Management	510	The proper treatment and use of land planted in grasses and/or legume to prolong forage life, to protect the soil, and to reduce water loss.	Acre	i
20	Pasture and Hayland Planting	512	The establishment of long-term stands of adapted forage plants to control erosion, produce forage, and to adjust land use.	Acre	115.00
21	Pond	378	A water impoundment made by constructing a dam or by excavating a pit.	No	j
22	Proper Application of Fertilizer		Management of fertilizer by proper placement and application rate so that plant utilization is maximized and loss is minimized.	Acre	k
23	Slow Release Soil Amendments		The use of urea or other nitrogenous fertilizers which, by nature of their release, will not contribute excessive nitrates to soil or ground water.	Acre	l
24	Streambank Protection	580	Stabilizing streambanks with vegetation or suitable armoring to prevent scour and erosion.	Ft.	14.00

TABLE VII-3
PROPOSED BEST MANAGEMENT PRACTICES (Continued)

Practice Code	Practice Name	Technical Guide #	Technical Comment	Unit	Unit Cost
25	Stripcropping (Contour)	585	The practice of growing contour strips of grass or close-growing crops alternated with strips of clean tilled crops or fallow land to reduce soil erosion.	Acre	30.00
26	Terrace	600	An earthen embankment, channel, or a combination ridge and channel constructed across a slope so as to conduct runoff water at a nonerosive rate to a stable outlet.	Ft.	0.70
27	Tree Planting	612	The planting of tree species to conserve soil and moisture, protect a watershed, or to adjust land use.	Acre	55.00
28	Wetland Protection and Preservation		The incorporation of existing wetlands into water management plans to serve as stable outlets for on-farm water management systems.	Acre	m
29	Woodland Direct Seeding	652	Planting tree seed to establish a stand of trees that will conserve soil and moisture and provide other benefits.	Acre	50.00
30	Woodland Site Preparation	490	Treating areas by soil scarification, disking, chopping, shearing, or herbicides to encourage natural seeding of desirable trees.	Acre	85.00
A	Access Road	560	A road constructed to minimize soil erosion while providing proper base for traffic.	Ft.	1.25
B	Biological Pest Control		The use of natural pedators or biological attractants as elements in a system of integrated pest management.	Acre	n
C	Fencing	382	The use of fence material to create a barrier to livestock or other traffic which would create erosive conditions on treated or untreated areas.	Ft.	0.43

TABLE VII-3
PROPOSED BEST MANAGEMENT PRACTICES (Continued)

Practice Code	Practice Name	Technical Guide #	Technical Comment	Unit	Unit Cost
D	Firebreak	394	A strip of bare land or fire-retarding vegetation established to prevent spread of woods fires.	Ft.	1.00
E	Land Smoothing	466	Removing irregularities of land surface so that needed best management practices can be applied.	Acre	135.00
F	Livestock Exclusion	472	The practice of excluding livestock from areas where grazing and traffic would increase erosion.	Acre	25.00
G	Pipeline	576	The use of pipes to accomplish dispersal of stock watering sites.	Ft.	0.75
H	Planned Grazing Systems	556	The management of grassland or grass-legume pastures to provide sustained production for livestock while minimizing soil erosion.	Acre	o
I	Pond Sealing and Lining	521	The installation of a fixed lining of impervious material or the treating of the soil mechanically or chemically to impede or prevent excessive water and pollutant infiltration into the soil.	No	p
J	Prescribed Burning	338	The use of fire as a management tool to accomplish proper stand growth and maintain forest hydrologic capacity.	Acre	
K	Row Arrangement	577	The establishment of a system of crop rows on planned grades and lengths primarily to facilitate drainage and erosion control.	Acre	q
L	Soil Test Analysis		The use of chemical tests of soil fertility to determine proper application rates of lime and fertilizer amendments.	Acre	0.15
M	Subsurface Drain	606	A conduit placed at specific depth and spacing to facilitate leaching, lower water table, remove surface runoff, regulate groundwater, and serve as a drain outlet.	Ft.	0.65

TABLE VII-3
PROPOSED BEST MANAGEMENT PRACTICES (Continued)

Practice Code	Practice Name	Technical Guide #	Technical Comment	Unit	Unit Cost
N	Water Supply Dispersal		The scattering of water supply to prevent concentrations of livestock which would cause erosion or pollute waterways.	Acre	r
O	Woodland Improved	654	Selective removal of merchantable trees from woodland to encourage regeneration and/or normal stand development.	Acre	100.00

*See key to footnotes on following pages.

FOOTNOTES TO TABLE VII-3

a. Costs associated with animal waste management systems vary according to type of system (lagoon, stack, and spread, holding area, etc.), the region of the state, and the size and composition of herd for which the system is designed. Average cost of systems in upper East Tennessee for which data are available range from $6,000 for dry-stacking waste storage systems to $20,000 for large-volume, reinforced concrete holding systems.

b. Correct pesticide use has an associated cost which is an integral part of crop production costs. Incorrect use, either by applying to little or too much, can cost the land user an entire crop and/or excess expense or can be detrimental to the physical environment as well.

c. $100.00 per acre for tree planting as stabilization; $600.00 per acre for stabilization with grass and/or legumes. Land shaping costs are included.

d. Class I structures (drainage areas 5 acres) average $1500.00. Class II structures (drainage area 5 acre) average $1.00 per linear foot.

e. Costs vary depending upon terrain, economy of the region, and amount of sediment storage desired.

f. Costs vary with pest and crop. Research indicated initial investment on system components can be high, but yearly costs become quite low.

g. Cost of land absorption areas are those associated with cost of equipment required to transport and disperse the waste slurry over the land surface.

h. Land use conversion from cropland to grassland or to woodland costs, approximately $70.00 and $35.00 per acre, respectively.

i. Primary unit costs for this practice are those associated with maintenance of the pasture vegetation. These costs are approximately $30.00 per acre every 2-3 years for fertilizer and from $4.50 to $8.00 per acre every 2-3 years for weed control.

j. Average cost for a quarter-acre pond is $800, while cost of half-acre pond average $1500.

k. Cost varies with crop species, soil test analysis, and soil type.

l. Sulfur-coated urea costs about $215 per ton.

m. No direct costs are associated with wetland preservation when incorporated into a water or waste management system.

FOOTNOTES TO TABLE VII-3
(Continued)

n. Cost varies depending upon type of control, pest species, and host crop. Costs can range from $30.00 per acre upward. Initial investment usually high. Future cost per acre will vary due to current reevaluation of economic thresholds and survey techniques by agricultural entomologists.

o. A management input which has no readily derived unit cost.

p. Depending upon methodology (soil dispersant or liner) cost will vary. Using a soil dispersant to seal a ¼ to ½ acre pond will cost about $350.

q. Row arrangement cost research is not conclusive; however, University of Tennessee Extension researchers have indicated that the practice aids erosion control while not decreasing field machine efficiency.

r. Depends upon water sources, amount of equipment necessary, etc. Costs could range from $300.00 for a watering tank and lines to several thousand dollars.

much attention has been given to on-land effects of agricultural practices. Research and casual observation have confirmed the reliability of certain practices to control erosion and to retain water. At the same time, not much attention has been paid to effects of practices on water quality, and water quality monitoring has not been intensive enough in rural areas to provide the type of baseline information needed to fully evaluate BMP effectiveness.

From a working knowledge of how nutrients and pesticides move from the land to the water, the effectiveness of the proposed BMPs on water quality can be inferred. Tables VII-4 and VII-5 show which BMPs affect the various rural nonpoint source pollutant categories and the compatibility of each of these practices in a comprehensive pollutant reduction program. By controlling and decreasing erosion rates, the volume of sediment entering streams is reduced. This decreases inputs of bedload and fine material. Practices which reduce sediment inputs also tend to decrease the total amount of sediment bound minerals and pesticides. BMPs which increase infiltration and/or reduce volume of runoff will tend to reduce the hydrologic peak during storm events. Those practices will tend to reduce the amount of nitrates and water soluble pesticides entering aquatic ecosystems.

Aquatic ecosystems, especially flowing water systems, are in a state of dynamic equilibrium. Practices on the land which reduce terrestrial inputs of solids and water may alter that equilibrium. For some period of time following installation of practices, one could expect certain physical and chemical parameters to change little.

Because of decreased sediment inputs, the stream may undergo a period of increased streambank and streambottom erosion until new flow equilibria are established. Sediments and other elements brought into suspension and solution during this time could produce water quality quite similar to preimplementation conditions. However, following stream equilibrium, water quality should show improvements in these areas (especially during periods of storm runoffs):

- Decreased suspended solids
- Decreased dissolved solids
- Decreased turbidity
- Decreased levels of NO_3
- Decreased biological oxygen demand
- Decreased levels of pesticides in water

Other changes may be observed, such as increased dissolved oxygen, increased photosynthetic activity, increased plankton and benthos diversity and numbers, and increased ecosystem production.

TABLE VII-4
CONTROL OF RURAL NONPOINT SOURCE POLLUTANT CATEGORIES BY BEST MANAGEMENT PRACTICES

Practice Code	Sediment			Plant Nutrients		Pesticides		Animal Wastes		
	Cropland	Grassland	Woodland	Sediment Fraction	Aqueous Fraction	Sediment Fraction	Aqueous Fraction	Unconfined Herds	Feed Lots & Confined Herds	Dairy
1									x	x
2	x			x	x					
3	x			x	x					
4	x	x	x	x		x	x			
5	x			x						
6	x			x	x	x	x			
7	x			x		x	x		x	x
8	x			x	x					
9	x			x	x			x	x	x
10				x					x	x
11	x	x	x	x	x	x	x			
12	x			x						
13	x			x	x	x	x			
14						x	x			
15									x	x
16	x			x						
17	x			x	x	x	x			

TABLE VII-4
CONTROL OF RURAL NONPOINT SOURCE POLLUTANT CATEGORIES BY BEST MANAGEMENT PRACTICES (Continued)

Practice Code	Sediment			Plant Nutrients		Pesticides		Animal Wastes		
	Cropland	Grassland	Woodland	Sediment Fraction	Aqueous Fraction	Sediment Fraction	Aqueous Fraction	Unconfined Herds	Feed Lots & Confined Herds	Dairy
18	x			x		x				
19		x		x	x	x				
20		x		x						
21	x	x		x	x	x	x			
22	x	x		x	x					
23	x	x		x	x					
24		x				x				
25	x			x	x	x				
26	x			x		x				
27			x	x	x					
28				x	x			x	x	x
29			x	x	x					
30			x	x	x					
A	x		x	x						
B						x	x			
C		x	x	x						
D			x	x	x					

TABLE VII-4

CONTROL OF RURAL NONPOINT SOURCE POLLUTANT CATEGORIES BY BEST MANAGEMENT PRACTICES (Continued)

Practice Code	Sediment			Plant Nutrients		Pesticides		Animal Wastes		
	Cropland	Grassland	Woodland	Sediment Fraction	Aqueous Fraction	Sediment Fraction	Aqueous Fraction	Unconfined Herds	Feed Lots & Confined Herds	Dairy
E	x			x		x				
F			x	x	x					
G	x	x								
H		x		x	x			x		
J				x						
K	x			x		x				
L				x	x					
M										
N								x		
O			x	x	x					

TABLE VII-5
BASIC COMPATIBILITY OF BEST MANAGEMENT PRACTICES

BMP CODE #	PRACTICE CODE #'s AND LETTERS
1	2, 3, 7, 9, 15, 19, 21, 22, 28, F
2	3, 4, 6, 9, 13, 14, 15, 17, 22, 23, 25, B, C, E, F, K, L, M
3	4, 6, 9, 12, 13, 14, 15, 22, 23, 25, F
4	14, 22, 23, B
5	7, 9, 16, 18, 20, 22, 27, A, C
6	2, 3, 17
7	1, 2, 3, 5, F, K
8	1, 2, 3, 14, 15, 19, K
9	1, 2, 3, 5, 13, 15, 19, 24, 27, 29, 30
10	2, 3, 19
11	12, 15, I, N
12	11, 15, 24, 26, C
13	1, 2, 3, 9, 25, 26, C, F, K, M
14	4, B
15	1, 2, 3, 7, 8, 9, 11, 12, 19, 21, 22, 28, C, F, G, H, M, N
16	8, 19, 20, 22, 23, 27, C, F
17	2, 4, 6, 13, 14, 22, 23, B, C, F
18	5, 27, 29
19	1, 4, 8, 10, 14, 15, 21, 22, 23, B, H, L, N
20	4, 18, 22, 23, B, C, L
21	1, 19, 21, 26, C, F, H, I, N
22	1, 2, 3, 5, 14, 17, 20, 25, 27, 29, L
23	2, 3, 5, 9, 14, 17, 25, 27, 29, L
24	9, 11, 13, 24, 27, 30, C, F

TABLE VII-5
BASIC COMPATIBILITY OF BEST MANAGEMENT PRACTICES (Continued)

BMP CODE #	PRACTICE CODE #'s AND LETTERS
25	2, 3, 4, 6, 9, 22, 23
26	2, 12, 13, 15, C, F, K
27	5, 9, 10, 15, 16, 18, 22, 23, 24, 30, C, D, F, L
28	1, 15, M
29	9, 22, 23, C, D, F, L
30	9, 24, 27, C, J, O

C. AREAWIDE RURAL RUNOFF NULL ALTERNATIVE

Soil (and water) conservation districts, since their beginning, have promoted soil and water conservation practices to reduce soil losses and improve plant production. The objective of conservation districts is to have a complete soil and water conservation program in effect on every acre within the district. The conservation district program is a voluntary program with assistance being provided to landusers upon request. As each landuser takes care of his own acreage, the goal of the district wide conservation program is achieved.

1. Study Area Setting

The CARCOG/SETDD 208 Study Area comprises 1,350,208 acres or 2,101 square miles in southeast Tennessee and northeast Georgia. The role of agriculture in the CARCOG/SETDD 208 Study Area continues to decrease. The number of farms in the area is approximately 2,213 which is a decrease of 11 percent from 1969. During the same period, the total acreage in farms has decreased by 8 percent. There are approximately 147,620 acres of cropland in the area, which is approximately 10 percent of the total study area. There are 684 farms producing corn, silage, and sorghum crops and 121 farms producing soybeans. Seventy-two farms in the area produce small grains, while 107 farms produce vegetables and 334 farms produce hogs. There are 86 dairy farms and approximately 1,845 beef cattle farms in the study area. Farming in the area tends to be a secondary occupation. Approximately 60 percent of the farm operators have a primary occupation that is nonfarm related. Most of the agriculture income is derived from livestock sales rather than crop sales, and agriculture in the region will probably continue in its decreasing economic role. The number of farms will probably not decrease as rapidly as in the past; however, agricultural land will continue to be converted to other uses.

Woodland comprises approximately sixty-one percent of the study area. Nonpoint source pollution from these areas can be expected to increase as these areas are impacted by the encroachment of the urban population. The advent of "off road" vehicles is contributing to the expansion of nonpoint sources of pollution from woodland areas. The clear cutting and site preparation techniques being employed by some woodland owners without regard to off site impacts can be expected to continue.

The existing nonpoint source areas resulting from coal mining will improve as these areas are treated under current programs. Other existing nonpoint sources resulting from other types of mining are expected to remain as active sources of nonpoint pollution.

2. Description of On-going Programs

Several federal, state, and local programs are providing technical and financial assistance for planning and application of conservation practices in cooperation with the conservation districts. Included in these groups are the Resource Conservation and Development (RC&D) Projects. The RC&D projects provide financial and technical assistance to units of government for the planning and application of conservation measures. These practices are planned and implemented on land owned or controlled by units of government or on private land where significant public benefit can be accrued. The Orphan Mine Spoil Reclamation Program being carried out by districts in cooperation with the Tennessee Department of Conservation, SCS, and TVA provides limited funds for planning and application of needed conservation practices. Application assistance consist of furnishing both materials and labor for practice installation. The Agriculture Conservation Program (ACP) provides limited cost share assistance to landusers. The cost share is limited to providing cost share assistance to install certain practices on farmland. The Forest Incentives Program (FIP) provides financial assistance for harvesting, removing diseased and unwanted trees and planting areas with adopted tree species on farmlands. The Farmers Home Administration (FmHA) provides financial loan programs for landusers to install conservation practices on farmlands. In Hamilton County, assistance is provided for intensive soil-site evaluation for subsurface sewage disposal by the county health department in cooperation with the district.

Federal agencies cooperating with the soil (and water) conservation districts include the Agricultural Research Service, Agricultural Stabilization and Conservation Service, Corps of Engineers, Extension Service, Fish and Wildlife Service, Forest Service, Soil Conservation Service, Tennessee Valley Authority, and others. The departments of state government providing assistance to districts include Forestry, Agriculture, Highways, Education, Wildlife, Health, Natural Resources, the land grant university, and others.

Many conservation practices are traditionally planned and applied on the land. The application of these soil and water conservation practices are contributing significantly to the enhancement of water quality. Hydrologic modification of the streams in the area is resulting from both direct and indirect causes. Stream channels, to a limited degree, are being directly modified by widening, realignment, bank sloping, and similar activities. Most of these activities are being conducted without the assistance of the districts. Where district assistance is provided, this work is being performed in keeping with the provisions of Section 404 of Public Law 92-500. The streams are also being subjected to indirect hydrologic modification resulting from changes in land use and treatment in the areas upstream from the points of modification. The major hydrological modification of this type results from the conversion of less intensive land uses to urban use. The modification resulting from this conversion consists of streambank erosion, and degradation of the stream channel. This type of modification is produced principally as the result of increased peak flow. Currently, none of the conservation districts have a storm water management program.

Conservation practices being planned and applied for erosion and sediment control, chemical and pesticide runoff control, as well as agricultural waste control on cropland and grassland include conservation cropping systems, critical area planting, grassed waterways, minimum tillage, terraces, ponds, diversions, debris basins, pasture and hayland planting, pasture and hayland management, and others.

Forestry practices being applied in the area include firelanes, tree planting, woodland improvement, and others.

The soil conservation districts are cooperating with the Tennessee Valley Authority and the Tennessee Department of Conservation, on the implementation of an Orphan Mine Spoil Reclamation Program. This program consist of the installation of grade control structures and limited critical area treatment. Some improvement in water quality is resulting from the limited detention of water by the grade control structures.

3. Results of Null Alternative

Anticipated accomplishments in treating nonpoint sources of pollution under the null alternative are shown in Table VII-6.

D. PREFERRED RURAL NONPOINT AREAWIDE PLAN

The rural nonpoint component of the preferred areawide plan is that portion of the plan which addresses the control of problem land areas that are degrading water quality values. Resource problems result from the activities of man as soil is disturbed or land is used for disposal of waste materials and industrial by-products. Sediment and the chemicals it carries, animal waste, human waste, improper land disposal areas, and improper land use, are all detrimental to the water quality of the area. Four categories of rural nonpoint sources have been identified in the inventory and plan development. These are:

- Hydrologic Modification Problem Areas
- Agriculture Areas
- Forestry Areas
- Mining Areas

The land areas involved with each source category can be seen in Tables VII-1 and VII-2. In the CARCOG/SETDD 208 Study Area, over 10,900 acres have been identified as having rural nonpoint sources.

TABLE VII-6
RURAL NONPOINT SOURCE NULL ALTERNATIVE PROJECTED ACCOMPLISHMENTS

CONSERVATION MEASURE	UNITS	1975 1976 1977	YEARLY AVERAGE	1978–1980	1980–1985	1985–1990	1990–1995	1995–2000
Conservation Plans	Number	249	83	200	400	390	380	370
Inventories and Evaluations	Number	384	128	220	500	550	600	650
Agricultural Waste Management Systems	Number	6	2	20	50	20	15	10
Critical Area Planting	Acres	126	42	80	200	190	180	180
Ponds	Number	102	34	65	150	150	150	150
Grassed Waterway	Acres	51	17	36	100	95	90	85
Minimum Tillage	Acres	741	247	500	1,200	1,500	1,800	2,000
Pasture and Hayland Planting	Acres	6,951	2,317	5,000	12,000	11,000	10,000	10,000
Strip Cropping	Acres	0	0	50	200	100	100	100
Tree Planting	Acres	2,358	786	780	3,500	3,500	3,300	3,300
Woodland Improvement	Acres	219	73	100	500	700	900	1,000
Mine Reclamation	Acres	24	8	100	500	50	---	---

All Soil and Water Conservation Measures in these categories provide tangible pollution abatement benefits by reducing sediment production and movement.

1. The Plan

A preferred rural nonpoint areawide plan is one that is structured to treat problem areas in a cost-effective manner at the present time, yet retains enough internal flexibility to allow for changing technologies and socio-economic realities in the future. It is the plan accepted by the people of the area as the way in which they can participate with a minimum of impact on their lifestyle, and it is the plan acceptable to involved agencies as the one which can be implemented.

Within the overarching plan concept, several criteria were selected to serve as guidelines for plan element formulation. First of all, the criteria for sediment control were based upon the premise that land treated according to its needs and used according to its capabilities is likely to erode (and produce sediment) at a rate compatible with good water quality. This assumption led planners to use soil loss tolerance values as baseline criteria for physical practices which control sediment. Resource material for relating land management practices to erosion and sediment control are available from the Soil Conservation Service and the Agricultural Extension Service.

Parts of the plan which address the control and management of fecal waste were developed in line with regulations published by the Tennessee Division of Water Quality Control. Criteria for animal wastes systems and land applications of wastewater are contained therein, as are water quality parameters which have use-related standards.

Agricultural chemicals which are likely to be present in streams are either adsorbed onto sediment or in solution. Best Management Practices (BMPs) were selected based on the criteria that practices which control erosion, sedimentation, and runoff would limit chemical pollution loads; and that practices which limit the application of chemicals would also limit the amount available to enter streams.

2. Plan Strategy

Areas in each county have been identified as in need of some practice or system of practices to control nonpoint source pollution. Each area and each site within each area have differing treatment needs which are a function of soil type, topography, surrounding land use, drainage area, type of pollutant, and extent of area needing treatment. Because of the site specific nature of nonpoint source control, the plan was constructed so that BMPs could be combined into effective site control plans without the drawbacks inherent in predetermining detailed treatment systems prior to site investigation. Each of the seven pollution source categories has been assigned a set of primary and supporting BMPs to serve as the nucleus for site plan formulation.

Among the control strategies offered within categories are physical practices which alter runoff volumes and reduce runoff velocities, reduce erosion rates, sediment, increase infiltration rates, and store polluted material for land or other disposal. Nonstructural practices include permanent vegetation, conversion of land use, and the exercise of floodplain regulation and soil development interpretations. Although the last two are in the realm of regulation, they are two "best planning constraints" within which BMP application can be most effective.

3. <u>BMP Plan Elements by Category</u>

<u>Hydrologic Modification Nonpoint Source Controls</u>

The Best Management Practices for hydrologic modifications are the most practical and effective measures or combination of measures which will prevent or reduce the generation of pollutants, upon implementation, to a level compatible with water quality goals. Essential treatment consists of: streambank protection where loss of bank materials is accelerated beyond natural erosion loss, and construction of grade stabilization structures to control excessive degradation of channel bottom. These practices will serve to protect and stabilize the watercourse against accelerated erosion, sedimentation, and pollution.

The BMP selected for a specific hydrologic modification will not necessarily be the same in different areas of the country. Soil types, topography, climate, existing conditions, local zoning and land use regulations, etc., must be considered in assessing the problem. The final determination of which BMP alternatives to apply in any specific case must suit the site conditions, and include appropriate public participation. BMP must be considered at the earliest stage practicable, and throughout the problem identification and analysis planning, design and construction phases.

The principal emphasis should be placed on measures that will prevent, or minimize nonpoint source pollutants which would be generated by the specific hydrologic modification. All preventive measures must be fully integrated into the total management system for every hydrologic modification. In brief, the changes introduced should produce conditions similar to those existing in nature which past experience has proved will effectively control the potential pollutants, and maintain or improve the water quality, while avoiding changes which would be detrimental.

As in other areas of nonpoint source pollution, erosion control measures are an essential feature of most hydrologic modifications. Controlling sediment bearing runoff will reduce the amount of adsorbed nutrients, pesticides, and other chemicals that reach the nation's waters. Designs for modification must recognize this problem and provide suitable construction provisions as a part of the project. With respect to pesticides, integrated pest management must be given suitable consideration. Subsequent operation and maintenance activities must continue to apply best management practices to assure the continued success of the pollution prevention measures.

The potential for thermal pollution problems must be assessed for some types of hydrologic modification, and suitable control measures must be applied. The choice of type of modification may even be determined by the need to control pollution of this type.

In general, the BMPs relating to hydrographic modification are:

- Use of field borders
- Construction of grade stabilization structures
- Streambank protection
- Tree planting

In addition to practices listed above which are BMPs for control of in-stream and bank erosion, there are several supporting practices and BMPs necessary in the drainage basin to promote stream stability. These include:

- Debris basins
- Critical area planting
- Livestock exclusion
- Fencing
- Conservation cropping system
- Stripcropping

Agricultural Nonpoint Source Control

An agricultural nonpoint source water pollution control program will necessarily be composed of the management practices and systems of practices designed to control soil erosion, reduce runoff, and effectively manage the associated applications of commercial fertilizers, animal wastes, and pesticides to rural lands.

Nonpoint pollution control technology is based essentially upon the selection of Best Management Practices to reduce soil erosion and animal waste runoff from lands, and to properly use needed pesticides and nutrients. This involves selection of crops best suited to soils and application of the appropriate management to increase soil cover, improve soil physical condition, and modify natural erosive potentials to topography.

Because of the variability in production methods, crops and animals, soil types, topography, climate, etc., the BMP for any specific agricultural management unit or area will vary. The selection of Best Management Practices for a particular agricultural management unit or area is a complex process. Any measure or combination of measures applied to an agricultural management unit or area which will achieve water quality goals is a potential BMP. However, the measures are generally the type that are incorporated into a soil and water conservation plan as developed by a landowner or landuser, with the assistance of a conservation district and/or the Soil Conservation Service, Extension Service, Forest Service, and others. The BMPs relating to agriculture include:

- Conservation Cropping Systems
- Contour Farming
- Correct Pesticide Use
- Critical Area Planting
- Crop Residue Use
- Debris Basins
- Diversions
- Field Borders
- Grassed Waterways
- Integrated Pest Management
- Land Use Conversion
- Minimum Tillage
- Mulching
- Pasture and Hayland Management
- Pond Sealing and Lining
- Land Absorption Areas
- Pasture and Hayland Planting
- Ponds
- Proper Application of Fertilizer
- Slow Release Soil Amendments
- Streambank Protection
- Stripcropping (contour)
- Terraces
- Access Roads
- Fencing
- Land Smoothing
- Pipelines
- Planned Grazing Systems
- Row Arrangement
- Water Supply Dispersal
- Wetland Protection and Preservation
- Animal Waste Management Systems

The principle emphasis should be placed on measures that will prevent or control the runoff, seepage or percolation of sediment and pollutants from crop or animal production management units. Control of sediment refers to the reduction of soil loss to below the tolerance level, while the control of animal wastes seeks to minimize the discharge of such wastes to receiving streams, and at the same, allow for their use as soil amendments. Preventive measures must be fully integrated into the total production management system of the agricultural management units. In essence, the soils, nutrients, and pesticides should be kept on the land where they perform their intended agricultural function.

Because of the widespread nature of sediment runoff, erosion control measures should be a principle means of controlling pollution from each agricultural management unit. Control of erosion not only will prevent soils from leaving the land, but also will materially reduce the nutrients and pesticides that reach the nation's waters adsorbed to soil particles. Where necessary, to further prevent or reduce the entrance of sediments into water bodies, supplemental measures such as debris and sediment retention basins should be utilized.

In cases where excess amounts of nutrients, pesticides, and animal wastes cause particular problems in surface or groundwaters, additional control measures may be necessary. These measures might relate, for example, to the application (timing and amount) of fertilizers and pesticides, the prevention of the concentration of animals, and the collection and adequate dispoal of the animal wastes.

Present technology for erosion control and management of agricultural enterprises that are economically profitable in relation to the landuser's objectives are based on soil interpretations. A field requiring Best Management Practices may consist of a single soil type or several soils of very different characteristics and qualities. Often the needed practices must be determined acre by acre.

Selection of proper practices to control sediment loss from cropland can be facilitated by looking to the land capability classification of each soil for cropland. Effective treatment practices are then indicated by what classification the soil type is given. Such a BMP selection guide can be seen as Table VII-7. There are eight capability classes of soils designated by Roman numerals I through VIII. Within the class, soils are grouped according to highest sustaining land uses. As the numerals increase to VII, soils have progressively greater limitations and narrower choices for practical uses. Class I soils have few limitations that restrict their use and are suited to the widest choice of plants with the least required conservation management. Class I through IV soils are suited to cultivated crops, grasslands, forests, wildlife and recreation.

Forest Nonpoint Source Control

Methods to control pollution resulting from silvicultural activities must include ways to prevent polluting effects from sediments, pesticides, chemical fertilizers, fire retardant chemicals, and thermal effects on streams resulting from the removal. Best Management Practices for silvicultural sources are the most practical and effective measures or combination of measures which, when applied to the forest management unit, will prevent or reduce the generation of pollutants to a level compatible with water quality goals. The desired effects of BMP application are: reduction of sheet and rill erosion to within soil loss tolerance values; control of erosion on roads, trails, landings, or other open areas; and sustained tree cover.

In BMP selection, it should be recognized that the variability in sources, topography, climate, soils, etc. will in most cases preclude a single BMP covering all activities or situations. The BMP must be tailored to the needs of the particular source and physical conditions.

The principle emphasis should be placed on measures that will prevent or reduce the pollutants in the runoff, seepage, or percolation from the forest management unit. The preventive measures must be fully integrated into the total management system for the particular forest management unit. In essence, the soils, nutrients, pesticides, and other chemicals must be kept on the land area where they perform their intended function of assisting tree growth.

TABLE VII-7
SELECTION GUIDE FOR SEDIMENT CONTROL BMP's ON CROPLAND
BASED ON LAND CAPABILITY CLASSIFICATION

Practice	Land Capability Class I	II	III	IV	V	VI
Conservation Cropping System	a	x	x	x		
Contour Farming	a	x	x	x		
Correct Pesticide Use	x	x	x	x		
Critical Area Planting	a			x	x	x
Crop Residue Use	x	x	x	x		
Debris Basin	a		x	x		
Diversion	a	x	x	x		
Field Border	x	x	x	x		
Grassed Waterway	a	x	x	x		
Integrated Pest Management	x	x	x	x		
Land Use Conversion	a				x	x
Minimum Tillage	b	x	x	x		
Mulching	a	x	x	x		
Pasture/Hayland Management	a				x	x
Pasture/Hayland Planting	a				x	x
Pond	a	x	x	x	x	x
Proper Fertilizer Application	x	x	x	x		
Slow Release Soil Amendments	x	x	x	x		
Streambank Protection	x	x	x	x		
Stripcropping	a	x	x	x		
Terrace	a	x	x			
Access Road	x	x	x	x		
Land Smoothing	a	x	x			
Pipeline	a	x	x	x		
Row Arrangement	a	x	x	x		

a - Class I land does not require these treatments.
b - Double cropped class I is a common practice.

Because of the widespread nature of sediment runoff, erosion control measures must be a principal thrust of the preventive program of each management unit. Particular attention must be paid to erosion prevention measures for logging roads and harvesting activities. In addition to primary control measures, supplemental measures such as debris and sediment basins should be included where necessary to further reduce or prevent the entrance of sediments, slash, and debris into water bodies. Where nutrients, pesticides and other chemicals cause particular problems in surface or groundwaters, further control measures may be necessary. The measures would principally relate to the application (timing, method, and amount), utilization, and management of the fertilizers, pesticides, and fire retardant chemicals. Care must be exercised to insure that thermal problems in streams are not created by removal of shade canopy. Attention to proper forest management, engineering and harvesting principles can substantially reduce all pollution attributable to silviculture. The BMPs related to silviculture include:

- Correct Pesticide Use
- Floodwater Retarding Structures
- Tree Planting
- Woodland Seeding
- Woodland Preparation
- Access Roads
- Fencing
- Firebreaks
- Livestock Exclusion
- Woodland Improved Harvesting

Mining Nonpoint Source Control

The control of water pollution from mining activities is achieved through proper operational management and utilization of preventive techniques, and by mine water treatment. Control of mining nonpoint pollution sources is best achieved through prevention or avoidance. The utilization of preventive and management techniques is the primary thrust for the control of nonpoint mining pollutants.

There are four premises upon which mine related nonpoint source pollution control is based:

- That any disturbance of the earth for mineral extraction alters the hydrologic environment to form some amount of water pollutants.

- That each mine site represents a unique set of chemical/physical and hydrologic conditions.

- That effective and efficient environmental protection from mining impact requires the formulation of a total mining plan covering the implementation of management controls and preventive measures throughout the mining cycle. Thus, the plan must cover activities initiated and implemented during the pre-extraction and extraction phases, and conclude after extraction has terminated and adequate restoration of the site has been accomplished.

- That a combination of several management and engineering techniques is usually required to effect a complete pollution control plan that prevents or minimizes pollutants reaching ground or surface waters.

Best Management Practices for mining activities are the most practical and effective measures, or combination of measures, which when applied to a mine production site, will prevent or reduce the generation of pollutants to a level compatible with water quality goals.

The desired effects of BMP application are to reduce soil loss and sediment damage off site, reclaim site with the spoil material least toxic to permanent vegetation, reduce toxic effluents from the site, and maintain water quality.

Each identified BMP will differ with the kind of mining, geographic area and conditions, and the extent and age of the mine. A new mine may have a different BMP than an older mine in the same locale. BMP judgements for any specific site will recognize special problems such as poor soils, unstable slopes, toxic conditions, and unfavorable geologic structure. Existing regulatory requirements, future land use, and economic effects will influence BMP developments. The BMPs relating to mining activities include the use of:

- Critical Area Planting
- Debris Basins
- Diversions
- Field Borders (filter strip)
- Grade Stabilization Structure
- Mulching
- Ponds
- Streambank Protection
- Tree Planting
- Fencing
- Land Smoothing
- Soil Tests
- Subsurface Drains
- Stabilization of Access Roads

There are a wide variety of measures available that will materially reduce the amount of pollutants generated at a surface or underground mine site. Selection and blending of the appropriate measures through the mining cycle can be categorized in terms of four objectives. These are described below.

<u>Prevention of an increase in the mineralization of the ground or surface water intercepted by earth disturbance activities</u>: The quantity and quality of mine water produced can be greatly influenced by various techniques of surface diversion, subsurface dewatering and collection, segregration of toxic mineral matter, and proper management and handling of intercepted water.

<u>Minimization of erosion and sediment transport from all surfaces necessarily removed of cover</u>: Erosion and sediment transport are problems of surface mining and surface facilities of underground mining. Measures to mitigate these phenomena should include grading, compaction, sediment traps and early revegetation of disturbed areas.

Careful residuals management of all mining wastes to prevent leaching and erosion: Measures to control the adverse affects of residual materials stored on the land surface are generally the same as those used in water diversions and erosion control.

Prevention of post-operative pollution via proper mine closure and/or reclamation measures: Mine closure and land reclamation are critical processes in the total mining plan. Closure of underground mines to prevent continued polluting drainage is more difficult than surface activity, but a number of sealing and diversion techniques are effective in preventing or reducing continuing problems. A multitude of surface reclamation practices are effective and available. They can be classed as measures to segregate overburden and bury toxic materials, return topsoil, control erosion and sedimentation, moderate topography, stabilize disturbed areas, and permanently revegetate the area.

E. PRIORITY DETERMINATION AND PROJECT COSTS

1. Determination of Priority by Categories

Categories of rural nonpoint pollution sources are hydrologic modification, agriculture, woodland, and mining. In order to meet the objectives of the Federal Water Pollution Control Act, treatment is needed for all rural nonpoint sources of pollution. This treatment should be initiated as soon as possible and should proceed as rapidly as money and other inputs will permit. Priority order by categories for this area should be:

1. Agriculture
2. Mining
3. Forestry
4. Hydrologic Modification

Agricultural sites account for the greatest area needing treatment and for the greatest source of pollutants of water by volume. The primary agricultural pollutants are sediment, livestock waste, nutrients, and pesticides.

Mining accounts for the second greatest land area among the categories. Both quantity of pollutants, primarily sediment and acid, and severity of water quality degradation are greater from this source than from forestry and hydrologic modification.

Forests account for a sizeable acreage of contributing areas and a greater total quantity of pollutant (sediment) than does the remaining category. Some degree of instability of streambanks and channels is a natural phenomena.

2. Determination of Priorities by Areas

Twelve areas are identified as priority areas (see Figure VII-1). These were designated as high priority areas or priority number 1 because rural nonpoint pollution sources are concentrated within drainage areas of the included stream segments. Cumulative effects of pollution from within these areas will have a greater detrimental effect on water quality than the other sources which are dispersed more widely over the study area. These areas are designated as high priority from a rationale of treating the worst pollutional areas first. Other sources of nonpoint pollution were assigned a secondary or number 2 priority.

3. Schedule and Costs to Implement Plan

Table VII-8 illustrates the total acres of nonpoint pollution sources by category and by priority rating for the six counties within the study area. It is proposed that all priority 1 areas should be treated by 1985. Marked improvement in water quality should be discernable as a result of this treatment.

Table VII-9 lists the estimated costs (present worth) of implementation of rural runoff control options during the planning period. This table lists the costs in three phases: initial coordination, priority 1 areas as indicated in Figure VII-1, and remaining or priority 2 areas. The estimated total costs (present worth) as indicated in Table VII-9 is just under $14,600,000.

In addition to the above costs, there will be an additional cost associated with maintaining all areas within the study area in a condition that will not contribute to water pollution. This will be a requirement as long as people make demands upon natural resources for food, fiber, minerals, etc. A program of maintenance includes land use planning throughout the area with proper regard for the capability of the land and for treatment of areas that are mined or that are used for other intensive purposes. Primary requirements for maintenance programs are information and education, and technical assistance in the development of conservation plans.

Information and education relating to conservation plans is a continuing process. Conservation practices tend to blend into the landscape once they are applied and are not noticed by the general population. This is true of even the most serious problems such as surfaced mined areas. Once they are established to grass or trees, they appear no different than other grassland or forests.

Conservation plans must be continued as long as people make demands upon natural resources. These plans must be updated at three to ten year intervals to reflect changing economic conditions and land ownership changes.

TABLE VII-8

TOTAL ACRES OF RURAL NONPOINT POLLUTION SOURCES IN CARCOG/SETDD 208 STUDY AREA

Rural Nonpoint Source Category	Hamilton	Marion	Sequatchie	Catoosa	Walker	Dade	Totals
Agriculture							
Sediment							
Priority 1	2300	100	1465	886	444	192	5387
Remaining or Priority 2	310	50	150	24	--	26	3350
Animal Waste							
Priority 1	4*	1*	15*	16*	21*	11*	68*
Remaining or Priority 2	3*	--	5*	4*	4*	3*	19*
Forestry							
Priority 1	--	--	800	--	--	--	800
Remaining or Priority 2	--	--	--	--	--	20	20
Mining							
Deep Mines							
Priority 1	--	--	5*	--	--	--	5*
Remaining or Priority 2	--	--	6*	--	--	--	6*
Surface Mines							
Priority 1	--	400	120	--	--	--	520
Remaining or Priority 2	183	225	370	--	--	--	778
Hydrologic Modifications							
Priority 1	--	--	38	--	--	--	38
Remaining or Priority 2	6	--	4	--	--	--	10

*Indicates number of sites.

TABLE VII-9
ESTIMATED COSTS OF IMPLEMENTATION OF RURAL NONPOINT SOURCE CONTROLS

Activity	Initial Coordination (1979-1980)($)	Priority 1 Areas (1981-1985)($)	Remaining Or Priority 2 Areas (1986-2000)($)
Information and Education	40,000/yr.	100,000/yr.	160,000/yr.
Technical Assistance In Plan Development	60,000/yr.	150,000/yr.	160,000/yr.
Treatment Costs			
Agricultural Sediemnt	45,000/yr.	112,500/yr.	44,600/yr.
Livestock Waste Management	90,000/yr.	225,000/yr.	39,000/yr.
Forestry Sediment	8,500/yr.	21,440/yr.	3,300/yr.
Deep Mining	--	20,000/yr.	16,000/yr.
Surface Mining	86,000/yr.	215,000/yr.	208,000/yr.
Hydrologic Modifications	12,000/yr.	30,000/yr.	5,400/yr.
Totals	$341,500/yr.	$873,940/yr.	$636,300/yr.
Totals For Planning Period	$683,000	$4,369,700	$9,544,500

F. RURAL NONPOINT SOURCE MANAGEMENT

The five soil (and water) conservation districts will be responsible for implementation of the rural nonpoint source plan for the CARCOG/SETDD 208 Study Area. This will require the districts to increase their management activities. Increased funding and personnel will be needed to implement the plan.

Each of the soil conservation districts will need to further identify nonpoint sources of pollution and develop a plan tailored to the individual needs of the district which projects the remedial treatment needs and cost for adequate treatment of these areas. Specific planning activities include: the development of long range nonpoint source plans for each soil conservation district utilizing the data gathered during the development of this plan as a basis; secondly, to provide an annual inventory assessment and plan update; and third, develop annual plan of work for nonpoint source control.

During the course of the development of the CARCOG/SETDD 208 Plan, a number of differences in rules, regulations, and guidelines affecting the conservation districts in Georgia and Tennessee have surfaced. These differences have prevented the conservation districts from establishing a legal organization at the regional level or project level. In addition, the implementation of the CARCOG/SETDD 208 Plan will necessitate the development of the agreements with the several units of government involved in the planning and implementation of the program. The specific agreements that will be needed to implement this plan are:

- A legal association of conservation districts for the CARCOG/SETDD 208 Study Area.
- Memoranda of Understanding between the conservation districts and local units of government and other agencies and groups involved in nonpoint source control.
- Memoranda of Understanding between the conservation districts and the designated 208 agencies in each of the two states will be needed to spell out the duties and responsibilities of each group.

Additional regulations will be needed at both the state and local level to achieve the objectives of the plan. This includes providing technical assistance to the units of government in the 208 planning area to develop erosion and sediment control ordinances, subdivision regulations, and zoning ordinances to effectively prevent and treat nonpoint sources of pollution in urban areas. This activity also includes the cost of working closely with the designated 208 agencies in each of the two states on proposed regulations involving nonpoint pollution.

The conservation districts will coordinate an extensive informational and educational program in each of the six counties of the planning area, in cooperation with the Extension Service, the Forest Service, the Soil Conservation Service, and others.

Much of the technical information available on land treatment and waste management techniques have not been correlated with the impact of these activities on water quality. This includes the development of needed interpretations to relate this information for local and state units of government.

The inventories for the CARCOG/SETDD 208 Study Area identified appreciable eroding nonpoint source areas related to urban land uses. Many of these sources are located on private land and have been in existence for a number of years. Cost share for stabilization of these areas will be sought from EPA in cooperation with local units of government and individual landowners.

A rural cost share program is projected for treatment of the nonpoint source areas on farmland. Funding for this portion of the program will be sought from the Agricultural Stabilization and Conservation Service, the Environmental Protection Agency, and other sources.

In addition to the orphan strip mine program now being conducted in cooperation with the Tennessee Department of Conservation and TVA, funds will be sought under the Rural Orphan Mine Reclamation Act to effectively treat the existing mine spoil areas in the study area.

Subsurface waste disposal results in appreciable amounts of nonpoint source pollution throughout the area. Additional assistance is needed to address this problem from a technical point of view and to further define and demonstrate effective methods of subsurface waste disposal in the study area in cooperation with county and state health departments.

Technical assistance will be needed to provide on site evaluation for proposed subsurface sewage disposal systems before site development. Also, additional investigation and evaluation of potential groundwater pollution resulting from above and below ground disposal of solid waste is needed. Funding for these activities will be sought through local units of government from EPA, the two states and from individuals benefiting from the service.

Detailed soils information is needed throughout the area to facilitate planning and implementation of nonpoint source control, as well as other purposes. Marion County is the only county with a published soil survey. The soil survey of Hamilton County is nearing completion.

A program will be developed for completion of the soil surveys for Walker, Catoosa, and Date Counties in Georgia, and Sequatchie County in Tennessee as funds can be obtained. Funding for this program, as well as additional technical assistance needed for the rural nonpoint source control program planning and implementation will be sought from the counties, states, Soil Conservation Service, and other sources.

CHAPTER VIII - RESIDUAL WASTES AREAWIDE PLAN

VIII
RESIDUAL WASTES AREAWIDE PLAN

A. INTRODUCTION

Two distinct types of residual problems, industrial sludges and solid waste disposal sites, exist within the CARCOG/SETDD 208 Study Area. Both of these residual waste problems are considered to be adversely impacting the area's water quality. The Federal Water Pollution Control Act Amendments of 1972 and the federal regulations require that an areawide waste treatment management plan address the control and disposal of residuals and solid waste. Specifically, Section 208 (b)(2)(J) and (K) of PL 92-500 states that any areawide water quality management plan shall include: "(J) a process to control the disposition of all residual wastes generated in such area which could affect water quality; and (K) a process to control the disposal of pollutants on land or subsurface excavations within such area to protect ground and surface water quality." Furthermore, the federal regulations per 40 CFR 131.11 November 28, 1975, state that areawide waste treatment management plans must contain "an identification and evaluation of all measures necessary to produce the desired level of control through application of best management practices for non-point sources of water pollution including waste disposal on land, in wells, or in subsurface excavations" (Section 131.11 (j)(3)(v)) and "an identification of necessary controls to be established over the disposition of residual wastes which could affect water quality... and over the disposition of pollutants on land or in subsurface excavations to protect ground and surface water quality and a description of the proposed actions necessary to achieve such controls" (Section 131.11 (K)(1)and(2)).

The following sections of this chapter discuss water pollution problems and control options associated with residual wastes in the CARCOG/SETDD 208 Study Area. A plan for dealing with these water pollution problems is also presented.

B. RESIDUAL WASTES INVENTORY

1. Solid Waste Disposal Sites

Numerous solid waste disposal sites are located in the 208 planning area. These sites include open and closed sanitary landfills, closed dumps, and outlaw dumps.

Seven landfills and twenty closed dumps were inventoried early in the planning process (Tables VIII-1 and VIII-2 summarize the results of these respective inventories). A geological report was developed for each of these sites to identify general characteristics of the areas. (These geological reports are contained in Work Element 108.) Soil maps, site inspections, and previous reports supplied by the U.S. Soil Conservation Service were utilized in developing the reports. Since no drilling or sampling was done, the accuracy of subsurface data depended solely on the soil maps. Utilizing this

TABLE VIII-1
OPEN LANDFILLS

Site No.	Landfill Owner	Location	Size (Est. Acres)	Site Equipment	Employees	Adequately Fenced	Erosion	Pollution Problems	Overall Condition	Slide No.
1	Marion County	Shellmound Road, Jasper	4	A(2)	4	Yes	Moderate	G, H	Fair	1, 2
2	Oscar Ritchie	Lovell Road, Soddy-Daisy	6	A(1)	None at Site	No	Minor	G, H, J	Poor	3, 4, 5
3	Hamilton County	Route 1, Harrison	4[a]	A(2), B(1), C(1), D(1), F(1)	10	Yes	Minor	None	Very Good	6, 7
4	City of Chattanooga	Woodland Drive, Ooltewah	60[b]	A(5), C(1), D(4), E(1)	15	Yes	Minor	J	Good	8, 9, 10
5	Dade County	Black Valley Road	10	A(1)	1	Yes	Minor	G, H, I, J	Poor	11, 12, 13, 14
6	Walker County	Marble Top Road	10	A(1), D(1), F(1)	3	Yes	Minor	G, H, J	Good	15, 16
7	Catoosa County	Highway 151, Ringgold	20[c]	A(1), B(1), F(1)	6 (2 are part-time)	Yes	Minor	J	Good	17, 18, 19

Legend: A - Bulldozer
B - Loader
C - Grader
D - Scraper (Pan)
E - Dragline
F - Dump Truck
G - Leachate
H - Odor
I - Burning
J - Litter

[a] 230 acres in total site
[b] 160 acres in proposed site
[c] 100 acres in total site

TABLE VIII-2
CLOSED LANDFILL/DUMP SITES

Site No.	Site Name	Land Owner	Location	Size (Est. Acres)	Approx-imate Depth	Adequately Fenced	Erosion	Ground Cover	Pollution Problems	Overall Condition	Slide No.
	Sequatchie County										
8	Dunlap Dump	Arnet Harmon	U.S. 127, Dunlap	2	10'	No	Minor	Fair	E	Fair	20, 21
	Marion County										
9	Marion County Landfill	T.V.A.	Shellmound Road, Jasper	5	15'	Yes	Moderate	Fair	D	Good	22
10	Jasper Dump	Cities of Jasper and Kimball	U.S. 41, Jasper	3	25'	Yes	Minor	Good	None	Good	23, 24
11	South Pittsburg Dump	South Pittsburg	U.S. 27	6	15'	No	None	Good	E	Good	25, 26
	Hamilton County										
12	Red Bank Dump	Red Bank	Pine Breeze Road	5	5'-50'	Yes	Minor	Poor	A, B, D	Poor	27, 28
13	Signal Mountain Dump	State of Tennessee	Edwards Point Road, Prentice Cooper State Park	4	40'	Yes	Major	Poor	A, D	Poor	29, 30, 31
14	Alton Park Dump	Robert Beasley, Jr.	Alton Park Blvd.	5	50'	No	Moderate	Poor	A, D	Poor	32, 33, 34
15	38th Street Dump	S. M. Warren	38th Street at Polk Street	20	30'	No	Minor	Poor	E	Fair	35, 36 37
16	Lookout Mountain Dump	KAYO Oil Company	U.S. 41 at Lookout Creek	10	10'	Yes	Minor	Fair	-	Good	38, 39

TABLE VIII-2
CLOSED LANDFILL/DUMP SITES (Continued)

Site No.	Site Name	Land Owner	Location	Size (Est. Acres)	Approximate Depth	Adequately Fenced	Erosion	Ground Cover	Pollution Problems	Overall Condition	Slide No.
17	Hoote White Dump	Service Collectors	Green Shanty Road, Ooltewah - Summit	13	75'	No	Major	Poor	A, D	Poor	40, 41, 42
18	Amnicola Highway Dump	Consolidated Latex	Old Curtain Rod Road	20	20'	Yes	None	Good	-	Good	43
19	North Hawthorne Street Dump	R. P. Scott	End of North Hawthorne Street	10	50'	No	Moderate	Fair	A, D, E	Poor	44, 45, 46
20	Pete Bible Dump	Virginia Johnson	Boy Scout Road	10	10'	No	Moderate	Poor	D, E	Poor	47, 48
	Dade County										
21	Charlie Page Dump	Charlie Page	Black Valley Road, Dade County	3	20'	No	Moderate	Poor	A, E	Good	49, 50
	Walker County										
22	Groves-Wallin Dump	J. H. Groves and K. D. Wallin	Marble Top Road, SW, of Chickamauga, Georgia	5	20'	No	Moderate	Poor	C, E	Good	51, 52
23	Lafayette Dump	City of Lafayette	Highway 27	10	40'	Yes	Major	Poor	D	Fair	53, 54, 55
24	Rossville Dump	City of Rossville	Mission Ridge Road	3	20'	No	Moderate	Fair	D, E	Fair	56, 57
	Catoosa County										
25	Fort Oglethorpe Dump	Forte Oglethorpe	Highway 2 (by Chickamauga Battlefield)	6	10'	Yes	Minor	Good	D	Good	58, 59

TABLE VIII-2
CLOSED LANDFILL/DUMP SITES (Continued)

Site No.	Site Name	Land Owner	Location	Size (Est. Acres)	Approx-imate Depth	Adequately Fenced	Erosion	Ground Cover	Pollution Problems	Overall Condition	Slide No.
26	Anderson Dump	E.R. Anderson	Ringgold (Off U.S. 41)	5	10'	No	Major	Poor	D, E	Fair	60, 61
27	Ringgold Dump	City of Ringgold	Highway 2A and I-75	5	20'	No	Minor	Poor	D	Good	62, 63

Legend: A - Leachate
B - Odor
C - Burning
D - Eroded Litter
E - Recent Dumpings

information, sixteen sites were identified for additional study and ranked according to the degree of its water quality problem. The following list reflects this ranking, with the most severe site being ranked number one:

1. North Hawthorne Street Closed Dump
2. Alton Park Boulevard (Chattanooga Creek) Closed Dump
3. Red Bank Closed Dump
4. Signal Mountain Closed Dump
5. Dade County Landfill
6. Hoote White Closed Dump
7. Oscar Ritchie's Landfill
8. Amnicola Highway Closed Dump
9. 38th Street Closed Dump
10. Marion County Landfill
11. Marion County Closed Landfill
12. Ringgold Closed Dump
13. Catoosa County Landfill
14. Walker County Landfill
15. City of Chattanooga Landfill
16. Hamilton County Landfill

It should be noted that this ranking was based on field observation of each site. Sampling of leachate was not performed to arrive at this ranking.

Figure VIII-1 provides the locations of solid waste disposal sites within the CARCOG/SETDD 208 Study Area.

2. Industrial Sludges

A survey of industrial residual outputs and current management practices of local industries within the 208 study area revealed that the management of industrial residual wastes is developing into a problem in the six county 208 area. Inadequate management practices including improper handling, storage, and disposal are affecting surface waters within the industrially developed areas of Chattanooga. Common practices of waste management by local industry include frequent spills of bulk materials at manufacturing sites, storage of bulk materials with direct exposure to rainfall and subsequent runoff, and illegal disposal of waste products on land and in surface waters. The survey utilized data obtained from previous reports and publications; previous state solid waste surveys; the Chattanooga, Tennessee-Georgia Wastewater Facilities Plan; NPDES permits; Tennessee Water Quality Control permits; and interviews with individuals knowledgeable in local waste management activities including federal, state, and local government personnel; health department and Chattanooga-Hamilton County Air Pollution Control Board personnel; and private waste haulers. Table VIII-3 shows a listing of industrial residuals generated, estimated quantities where available, and current residuals management and disposal practices. Also indicated are the number of industries on which information was gathered. In most cases they are the major

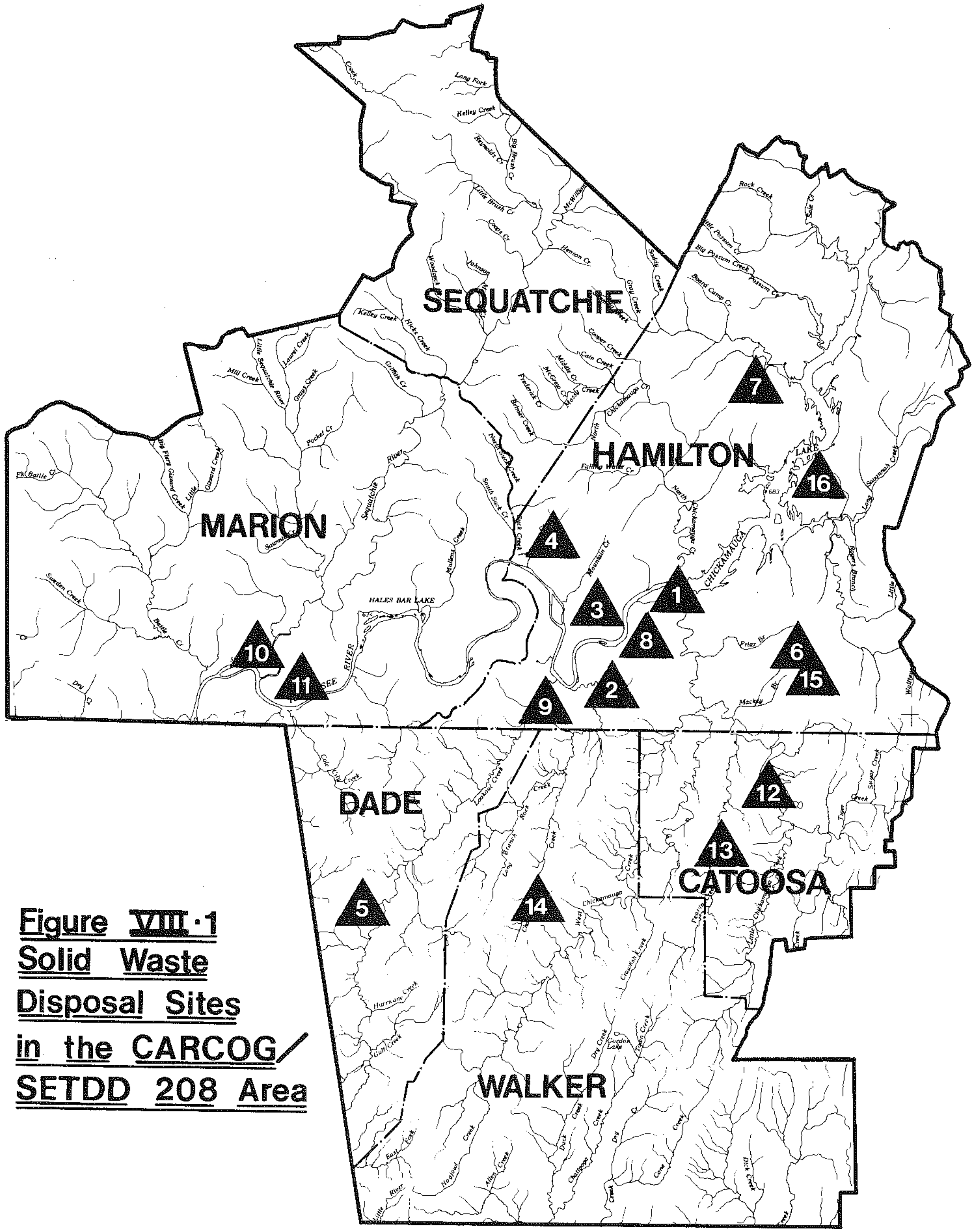


**Figure VIII-1
Solid Waste
Disposal Sites
in the CARCOG/
SETDD 208 Area**

TABLE VIII-3
INDUSTRIAL RESIDUALS SURVEY (Continued)

Industrial Classification	No. of Industries Included	Type of Residual	Residuals Management/ Disposal Practices
		Herbicides*	Stored on-site; out-of-state disposal.
Leather and Leather Products (SIC 31)			
	3	Hide fleshings, lime, sodium sulfide, and chromic hydroxide sludge alum*	Hauled from site; discharged to sewers.
Stone, Clay, Glass, and Concrete Products (SIC 32)			
	16	Calcium phosphate sludge	Settling ponds.
		Sodium hydroxide sludge	Settling ponds.
		Thorium hydroxide sludge and rare earths waste, concrete, glass, clay, ceramics, etc., air pollution control equipment*	Settling ponds used; fill plant property; radioactive residuals removed to special landfill site.
		Chromic acid, tolulene acetone, chlorinated hydroxide, and beryllium oxide*	Hauled off-site; settling pond; stored on-site.
Primary Metal Industries (SIC 33)			
	16	Foundry dry waste including sand, cupola dirt; particles from air pollution control equipment may contain phenols, bonding agents, fluorides, cyanides, and heavy metals*	Stored on plant site; landfilled.
		Scrap metal, grindings, and cutting oil	Sold as intermediate product.

TABLE VIII-3
INDUSTRIAL RESIDUALS SURVEY (Continued)

Industrial Classification	No. of Industries Included	Type of Residual	Residuals Management/ Disposal Practices
Fabricated Metal Products, Machinery, and Electrical and Electronic Machinery (SIC 34, 35, 36)			
	45	Air pollution residuals*	Discharged to sewers; disposed of on plant property.
		Sand, shot blast metal grindings, and scrap metal	Sold as scrap metal; stored on property.
		Aluminum wastes*	Hauled off-site.
		Cutting oils, solvents, and paint wastes*	Discharged to sewers; stored on property; hauled to landfill.
		Slag, pickling solutions, lime sludge, chromium, cyanide, cadmium, zinc, and arsenic*	Lime sludge put in barrels and hauled to landfill.
		Sawdust	Hauled off-site; stored on property.
		Caustic plating waste*	Put in drums and hauled off-site.
		Cyanide and chromium wastes*	Settling ponds.
		Electroplating wastes, i.e., etching solutions bath filter solids, and treatment sludge containing heavy metals*	Discharged to sewer; stored on-site; hauled off-site.

*Potentially hazardous residuals

SOURCE: Hensley-Schmidt, Inc.

Estimated quantities were derived from information obtained from the Chattanooga Air Pollution Control Bureau and Waste Landfill Demonstration Project, Tennessee-Georgia Regional Health Commission, City of Chattanooga, Tennessee, and the Tennessee Department of Public Health (January, 1975).

industries listed in the Chattanooga, Tennessee-Georgia 201 Wastewater Facilities Plan, supplemented by those industries outside the 201 Planning Area but within the Chattanooga 208 Study Area. Estimated residual quantities were either calculated from information obtained from the Chattanooga Air Pollution Control Bureau or extrapolated from quantities given in a previous survey conducted by the Tennessee Department of Public Health, Division of Solid Waste Management, and the Georgia-Tennessee Regional Health Commission. (Chemical Waste Landfill Demonstration Project.)

Because of the unavailability of direct information from the industries concerning residuals, no new estimates were attempted nor were the old ones updated. Previous reports indicate that estimates are usually much higher than actual outputs because they do not reflect the degree of process modification and recycling being practiced by a particular industry.

It should be noted that, because they represent nonproduct outputs, residuals from industrial wastewater treatment plants are included where data are available. Solid residuals such as non-process-related paper scraps, garbage, etc., generated by administrative offices, cafeterias, etc., are not included because they are nonprocess wastes per se. These types of solid wastes are disposed of by licensed contract haulers in regulated sanitary landfills.

C. RESIDUAL WASTE CONTROL OPTIONS

1. Solid Waste Disposal Sites

Four general alternatives were identified for the control of solid waste disposal site problems. These alternatives are:

- Alternative 1 - Do nothing
- Alternative 2 - Remove the waste
- Alternative 3 - Collect, treat, and recirculate the leachate
- Alternative 4 - Cover, grade, and seed the site

Alternative 1: Doing nothing to a site is the most economical alternative since no money is expended, but the water quality problem at the site remains. Leachate will continue to impact the water quality of the area until the dissolved and suspended materials are washed from the waste. Eventually the waste will finish decomposing and the site will stabilize. However, the leachate may present a health problem and need correcting if the closed dump is located in a populated area.

Alternative 2: To completely eliminate any possibility of leachate pollution to surface or subsurface water, waste from closed dumps would have to be removed and placed in a proper landfill. Leachate would then be nonexistent and the land could be reused. The area should be graded, topsoil spread on the site, and the area seeded and mulched.

Excavation procedures in areas adjacent to waterways would be difficult because of the high water tables, and the waste at the leaching dumps would be wet. Since most of the problem dumps are in the city of Chattanooga, the excavated waste would have to be placed in the city of Chattanooga landfill. However, the estimated volume of waste in the five problem dumps in the city limits exceeds the one million-cubic-yard capacity of the proposed city of Chattanooga landfill expansion. The excavated waste could be deposited on a nearby suitable site. The cost of the excavation averages over $100,000 an acre because of the type of method required. Since it is a major problem to locate a new landfill near the city of Chattanooga due to public opposition and lack of a suitable site, it is impractical and uneconomical to dig up solid waste that is already buried. The benefits gained do not justify the large cost of excavation. Even with the major drawbacks to this alternative, it has been considered at all closed sites since removing the waste may be the only way to lessen the impact on water quality.

<u>Alternative 3</u>: Collection and recirculation of leachate is a procedure which has been used successfully in the state of Tennessee. Recirculation is a procedure whereby the leachate is collected and pumped back onto the site. Two useful purposes are served by recirculation:

- The leachate is caught before it flows into nearby streams, thus immediately stopping the pollution.
- Recirculation aids in the decomposition of solid waste and the eventual stabilization of the site.

In solid waste the optimum moisture content for biological decomposition is between 50 and 70 percent. This moisture content accelerates microbial activity, which increases the rate of decomposition. Leachate at the site is collected in a pond located at the toe of the site, and the off-site uncontaminated surface runoff is rerouted so that it does not enter the pond. Only water that could be polluted (leachate and site runoff) is collected in the pond. The collection pond, which should be as impervious as possible to avoid leachate seepage, can be constructed of compacted soil in its natural state or with soil additives such as lime, pozzolana, and other soil cements.

If lime is utilized, it also serves as a buffering agent to help neutralize leachate and promote an optimal microbial environment for solid waste degradation. If soil is not available to construct an impervious pond, asphalt or polymer liners can be used. Polymer liners should be protected with a soil covering since the pond may have to be dredged at some time in the future. A sump pump should be installed in the pond on a concrete pad and regulated by a float switch. The pump intake should be screened and protected from siltation, and the equipment should be secured against vandalism since the closed site will not have frequent inspections. The leachate is pumped back onto the surface of the site through pipes and distributed by means of sprinklers. The sprinklers are used to avoid saturating a limited area of the site.

An alternate leachate distribution method would entail the use of field lines, similar to the lines for a septic tank, to distribute the leachate. This method keeps the leachate off the surface of the site but eliminates any evaporation benefits. Recirculation would continue until the leachate quality becomes suitable for release from the site. This process is different from a planned leachate recirculation landfill where continued pumping and additional water are required to keep the moisture content high at all times. Leachate at the site is collected to prevent water pollution, and recirculated as a means of disposal. The major problem with leachate recirculation is the danger of leachate entering the groundwater. Recirculation involves more water flowing through the waste and more leachate produced, but these effects may not pose a problem if the water table is at a sufficient depth below the surface. Planned recirculation landfills have impervious liners, while closed dumps were located on the original ground and in some cases in abandoned mine pits. Without a preconstructed impervious liner, pollution of the groundwater is a possibility even with leachate recirculation.

In areas where city sewers are available, the possibility exists for leachate to be pumped into the sewer instead of being recirculated. The leachate would then be treated at a treatment plant; however, pretreatment of the leachate may be required. This procedure would decrease the time of pumping per year, but would increase the time it would take to stabilize the waste. Without recirculation, the threat of groundwater contamination would be reduced. Since the leachate is discharged to a sewer, the leachate quantity pumped must be monitored or an estimate made to determine the cost of treatment. A problem might arise as to who pays for the treatment, so an agreement would have to be reached between the city and the property owners.

Another drawback to leachate recirculation is the annual overhead and maintenance cost. Until the leachate reaches a quality when it can be released, there will be electrical and maintenance costs on the recirculation equipment, excavation cost if the pond fills with silt, and costs for periodic inspections of the site. Because of recirculation and increased settlement, the land could be used for no other purpose during this period.

Alternative 4: The most common solution to a problem site is to cover and stabilize the area with compacted cover soil, seed, and mulch. This method helps to eliminate percolation into the waste which causes leachate. First, the site should be graded to drain properly so that the rainwater will flow off the site along the shortest possible route. Cutoff ditches around the site will channel the runoff and off-site drainage around the site and into the nearest waterway. The minimum slope should be approximately 3 percent when possible. On large, steep sites, impervious cross ditches should be built to reduce erosion.

After grading the site, cover soil should be added. A minimum of 2 feet of cover material should be added and compacted to form an impervious layer. The soil should be a workable material as described previously. Many of the sites inventoried are located in areas of soil with high chert content. This soil is porous and difficult to compact, and should not be used as a cover material. Topsoil is added after the cover is completed, and the area is seeded and mulched. The vegetation will control the erosion and beautify the site. If a site is properly covered and grassed, percolation should decrease and leachate should stop so that the land could be reused.

Since open dumps were not adequately compacted, the possibility of settlement discourages construction of large buildings. Problems also arise with the production of methane gas in the waste. This gas could escape into adjacent structures causing odor and explosion problems. The site could be used for equipment storage or for a minimally used green area. If the leachate does not stop in the future following proper covering of the site, it may be necessary to collect and recirculate or treat the leachate. Such correction should, however, be done as a second phase. After the problems are corrected, the site requires periodic inspection. As the waste decomposes, the site may settle causing ponding areas or cracks which must be corrected by filling, grading, and revegetation.

Detailed evaluations of the alternatives for each problem site are contained in Work Element 601.

2. Industrial Residuals

Three general control approaches exist for the management of industrial residuals. One general approach deals only with the ultimate disposal of residuals, while the second approach deals with industrial management practices (i.e., material recovery and residual reduction). The third approach is essentially nonstructural in nature and focuses on cooperation between industries and regulatory control measures. It should be kept in mind that a comprehensive residual wastes management plan should integrate options from all three approaches in order that a cost-effective, environmentally sound plan may be effected. What follows is a description of the various disposal, industrial management, and nonstructural practices screened for industrial residuals management in the CARCOG/SETDD 208 Study Area. Table VIII-4 summarizes the industrial sludge options.

a. Ultimate Disposal Techniques

Stream Discharge: Before the passage of water quality legislation, many industrial residuals were discharged to surface waters. Current water quality regulations prevent this type of discharge, since this disposal technique is not consistent with water quality goals for the area. This method, therefore, cannot be considered as a viable management alternative.

TABLE VIII-4
SUMMARY OF INDUSTRIAL SLUDGE CONTROL OPTIONS

Ultimate Disposal Practices	Practice Features
Stream discharge	Direct discharge of industrial residuals to receiving streams or ditches.
Composting	Open land disposal of residuals and wastes.
Subsurface injection	Injection of liquid wastes into the subsurface environment.
Pyrolysis	Burning of residuals in nearly oxygen-free environment to convert to other forms.
Lagooning or ponding	Disposing of liquid residuals in open ponds.
Incineration	Burning of residuals to convert to disposable ash.
Landfilling	Burial of wastes in surface land.

Industrial Management Practices	Practice Features
Private residual processors	Shipment of residuals to private processor for processing of waste.
Public residual processors	Establishment of public or governmental residuals processor in area of industries.
Establishment of residuals landfill	Establishment of special landfill for residual disposal.

Nonstructural Practices	Practice Features
Waste exchange	Set up waste exchange agreements with industries for waste use.
Regulation of contract haulers	Outlaw unregulated dumping by various private haulers.
Local hazardous waste regulation	Establish local ordinances for control of industrial residual disposal.
Incentives	Provide incentives for industry to practice on-site residual waste management.
Zoning and planning	Zoning regulations and land use plans are implemented to provide proper spacing and concentrating of industries and their residual disposal sites.

Composting: Composting although practiced in Europe, has not been an effective disposal method in this country. It is also unsuitable for toxic or hazardous industrial wastes. For these reasons composting will not be considered as a management alternative.

Subsurface Injection: Due to geological formations, much of the Chattanooga 208 Study Area is generally unfavorable for this type of disposal. In addition, subsurface injection is a form of potential environmental pollution in which the unknowns far outnumber the knowns. Consequently, subsurface injection will not be considered as a management alternative.

Pyrolysis: Pyrolysis has traditionally been used to convert materials of low economic value such as wood chips and heavy hydrocarbons into materials with higher economic value such as charcoal, coke, fuel gas, and gas oil. The nature of the survey data limits an analysis to a general level. Nevertheless it appears that pyrolysis is a viable alternative for processing residuals within the area as part of a material recovery process to utilize nonproduct outputs from various industries. It is not known if any industries in the area are using pyrolysis at this time.

Lagooning or Ponding: Industries within the area employ this method to a great extent. In fact, for process and waste treatment sludges, it is the simplest and most economical means of disposal. Since a majority of sludge waste is hazardous, it accounts for much of the hazardous waste storage in the area. The principal drawbacks of lagoons or ponds are:

- The lagoon or pond should be protected from both surface and groundwater contamination. With the exception of some pits in naturally impervious soils or in very dry climates, such protection necessitates a lined pond. Liners may be made of clay, plastic sheeting, asphalt, etc., which are relatively expensive.

- Except for ponds in such dry climates as those found in the western United States, most ponds without discharge will eventually overflow from rainfall accumulation.

- Ponds and lagoons have a tendency to be flushed out whenever excessive rainfalls and floods inundate the disposal site. It is expensive to provide flood protection for ponds and lagoons, particularly in wet climates.

Upon enforcement of hazardous waste regulations, industries will be faced with the economic decision of either modifying their lagoons and ponds to meet requirements or finding another method of residuals disposal. Although it is not the most desirable method, lagooning or ponding that meets hazardous waste requirements should be considered a viable alternative for industries having available land.

Incineration: It appears that incineration of industrial residuals on a large scale does not take place within the planning area because incineration as practiced in the area is a volume-reduction process necessitating the ultimate disposal of waste residuals from the incineration process. Since incineration can be used to neutralize hazardous wastes allowing the resulting inert residual to be more easily disposed of, this method of disposal represents a viable management alternative. Incineration also offers the possibility of utilizing organic residuals in heat recovery systems.

Landfilling, Land Burial, and Storage: Other common methods for industrial process residuals disposal as practiced by local industries include landfilling, land burial, and storage. As is the case with lagooning or ponding, disposal directly onto or under land is an economical method for industries to dispose of residual wastes when land is available. Landfilling or storage techniques are at present utilized by local industries in the following ways:

- Rubble wastes such as concrete, glass, ceramics, stone, etc., are used as fill material to reclaim low-lying industrial properties.
- Foundry wastes and treatment sludges are disposed of on plant property.
- Some industrial wastes, with the approval of the respective state agencies, transport wastes to public sanitary landfill sites to be properly disposed of.
- Certain radioactive wastes are transported out of the region for proper land burial.
- Large quantities of hazardous wastes are being stored on plant property for either infrequent removal to disposal sites or processing facilities (usually out of the region) or until adequate and/or more economic disposal can take place.

Landfilling or storage techniques, especially for hazardous wastes, pose the same environmental threat as lagooning or ponding. Once proposed hazardous waste regulations are enacted, industries will make the decision of whether to modify existing landfilling or storage techniques to meet legal requirements or find alternative methods to manage their process residuals. Landfilling and storage must be considered as a viable alternative for managing residual waste outputs within the planning area.

b. Industrial Management Practices

Studies by the federal government indicate that many if not most industries will find it economical to transport their hazardous residuals off-site for processing to reduce the volume of wastes which are potentially hazardous. Data gathered from these studies indicate that there is a potential market for industrial residuals processing. Industries within the area will probably take advantage of this market to reduce the costs of their residuals management.

Possible alternatives for private processing facilities include chemical recovery plants utilizing material recovery, treatment facilities which would reduce the hazardous potential of residuals, incineration units utilized for residual reduction and energy recovery, or pyrolysis units for material recovery and residual reduction. The best alternative at present would most likely be a chemical residual recovery and treatment facility that would buy residuals from local industries and convert them into resalable materials. However, because of the lack of detailed survey data and information on what market conditions are, or will be, it is difficult at this point to choose a definite alternative.

Public Residuals Processors: Another possible strategy is for a public agency, government, or the waste management agency to provide facilities for residual processing such as those mentioned in the previous section. Once again, because of lack of detailed information, an exact strategy cannot be determined. It would appear that if a potential market for private processors exists, then it would be more cost-effective and efficient to rely on a private processor to supply the services based on their demand. Although this option does not rule out the provision of publicly financed services as an inducement for industries to locate within the area, it will not be considered as a viable alternative.

Industrial Residual/Hazardous Residual Landfill: Another possible alternative is the establishment of an industrial residual/hazardous residual landfill within the Chattanooga 208 Study Area. At present the nearest proposed site of this nature is at Murfreesboro, Tennessee. The principal drawback of this alternative is that the provision of a local hazardous waste site would counter some of the objectives of a waste management system. Providing a lower-cost alternative site would reduce or eliminate the amount of resources that would be spent on process modification, residual reductions, and material/energy recovery. This would result in merely shifting residuals from one site to another, not in reducing or eliminating them. Some benefit would be derived by storing the hazardous residuals (especially those in containers) at a controlled, centralized site rather than at the various industry locations. However, even this option does not seem to outweigh the effect it would have on a total management strategy.

Providing a chemical or sludge landfill to handle nonhazardous residuals is nonetheless a viable alternative in that ultimate land disposal will be required regardless of what type of residuals processing system is utilized. A facility of this type would greatly reduce the loading on public sanitary landfills while also providing specialized disposal procedures often required with sludges, semi-solid and liquid wastes.

c. Nonstructural Alternatives

Waste Exchange: In gathering data for the industrial residuals survey, it was evident that many industries within the area could enter into working agreements with other industries. Such agreements would eliminate a residuals problem at one plant while providing a low-cost supply of raw materials to another. However, there are currently no incentives to develop an industrial materials exchange program. Transportation costs generally offset the economic advantages of nonproduct output reuse, which leads to the discarding of potentially valuable materials.

The potential may exist within the planning area for a clearinghouse where industries can offer or bid for potentially salable nonproduct outputs. These types of exchanges have been successful in Europe, and several have been established in the United States.

Regulation of Contract Haulers: Outlaw dumping occurs on an infrequent basis within the planning area. Local regulations in conjunction with state hazardous waste legislation should be implemented to ensure added control of residual transportation and potential dump sites.

Local Hazardous Waste Regulation: A possible alternative would be for local governments or authorities to adopt a uniform hazardous waste ordinance to be enforced within the Chattanooga 208 Study Area. However, state hazardous waste laws appear to be adequate in enforcing necessary regulations, and local ordinances would not necessarily be required.

Incentives: A program of incentives for industry to practice on-site residual waste management could be initiated. These incentives could include tax credits, special financing arrangements, user charges, fees, taxes, rate structures, assessment, depreciation allowance schedules, etc. It is hoped that the regulatory approach taken by the federal government via state hazardous waste legislation will provide adequate incentive without purely economic measures becoming necessary. These incentives may also be applied to encourage private residual processing industries.

Zoning and Planning Alternatives: Zoning regulations and land use plans could be implemented to aid in the realization of an optimum spatial relationship between industries and disposal or processing facilities or between interdependent industries. Better spatial relationships will also facilitate transportation of waste exchange material and/or other recoverable residuals, thus promoting residual management because of lower costs.

D. RESIDUAL WASTES AREAWIDE NULL ALTERNATIVE

Regardless of the CARCOG/SETDD 208 Areawide Waste Treatment Management Plan, programs designed to control hazardous residual wastes will be effectuated. Since the passage of the Federal Resource Recovery Act of 1970 and the subsequent Resource Conservation and Recovery Act of 1976, the states of Tennessee and Georgia have moved toward state legislation that will control hazardous waste disposal. The state of Tennessee has enacted a Hazardous Waste Management Act in order:

> ...to provide for the classification of hazardous waste in Tennessee; to provide for the adequate storage, transportation, treatment and disposal of hazardous waste; to provide for the general supervision over the construction of hazardous waste storage facilities, treatment facilities and disposal facilities or sites and for the registration of facilities or sites. . . .

This Act will take effect on July 1, 1978. It is anticipated that the state of Georgia may have similar legislation in effect the following year. At this time, it is difficult to determine the actual impact this legislation will have on industrial hazardous residuals disposal since both states have existing legislation which permits the disposal of solid waste or one's own property so long as it does not create a public nuisance or a hazard to public health. Often it is impossible to determine whether privately disposed waste is causing a public nuisance or is a health and/or environmental hazard. However, under the assumption that the Act will be strictly enforced, the following residual waste control activities in the Chattanooga area are likely to occur:

- More participation by local industry in the waste management program.
- Development of more efficient hazardous waste management within the area. It is anticipated that reuse or recycling of hazardous waste will become more widely practiced.
- Development of long-range plans for adequate disposal of hazardous waste and solid waste in general.
- Increased pressure to develop a local landfill site for chemical and hazardous wastes.
- Increased enforcement of local and new state regulations regarding hazardous waste transporters.
- Compliance with state regulations on the part of any existing facility within the area that presently handles hazardous wastes.

Other than those activities relative to the hazardous waste legislation presented above and sludge management recommendations contained in the 201 facilities plans, the Residual Wastes Areawide Null Alternative provides for no new residual waste control activities. The following existing activities and practices are anticipated to continue:

- The continued operation of existing solid waste facilities with increased enforcement likely by the Tennessee Division of Solid Waste, DPH and the Georgia Solid Waste Management Section, Environmental Protection Division, DNR.
- The continuation of existing permitting and licensing procedures for solid waste disposal sites by the Tennessee DPH and Georgia DNR.

E. RESIDUAL WASTES PREFERRED AREAWIDE PLAN

1. Solid Waste Disposal Sites

The preferred areawide plan for residual wastes management contains recommendations concerning both solid waste disposal sites and industrial sludges. Recommended alternatives and associated costs for problem solid waste disposal sites are summarized in Table VIII-5. It should also be noted that after implementation of the recommended alternative, care should be taken to protect and maintain the disposal area. The site should be fenced to prevent littering and illegal dumping. These measures will not only reduce or eliminate water quality problems, but they will also reduce public concern over aesthetics. As existing landfills reach capacity, new sites must be established. This task will be much easier if public concern over aesthethics and other problems associated with existing disposal sites can be eliminated.

The existing laws governing solid waste disposal in Tennessee and Georgia appear to be adequate to assure proper disposal if they are properly enforced. However, it is recommended that the regulations be updated to define what types of soil can be used for proper cover material. Experience has revealed that while some soils may appear to be satisfactory when first applied and compacted, they tend to weather and erode easily resulting in future problems.

Stronger enforcement of existing solid waste disposal laws is also recommended. In order to facilitate this, the establishment of a Regional Office of the Tennessee Department of Public Health, Division of Solid Waste Management in Chattanooga is recommended.

2. Industrial Sludges

The CARCOG/SETDD Areawide Waste Treatment Management Plan recommends a residuals management strategy premised on optimizing the relationship among governmental officials, public agencies, the private sector, and industry. In order to accomplish this, an Industrial Residuals Management Committee would be established under the auspices of the Chattanooga Manufacturing Association. The responsibilities of the committee would be as follows:

TABLE VIII-5
SUMMARY OF RECOMMENDED ALTERNATIVES FOR PROBLEM SITES

Site	Recommendation	Cost
*North Hawthorne Street Closed Dump[1]	Alternative 4: Cover, grade, and seed	$ 41,900
*Alton Park Boulevard Closed Dump[1]	Alternative 4: Rockwell Plan (This plan calls for the elimination of leachate through drainage modification)	--
Red Bank Closed Dump[1]	Alternative 4: Cover, grade, and seed	43,100
Signal Mountain Closed Dump[1]	Alternative 4: Cover, grade, and seed	25,400
Dade County Landfill[2]	Correct operating procedures	--
Hoote White Closed Dump[1]	Alternative 4: Cover, grade, and seed	91,800
Oscar Ritchie's Landfill[2]	Proper closing procedures	--
*Amnicola Highway Closed Dump[1]	Alternative 4: Cover, grade, and seed	125,500
*38th Street Closed Dump[1]	Alternative 4: Cover, grade, and seed part of area	29,800
Marion County Landfill[2]	Correct operating procedures	--
Marion County Closed Landfill[1]	Alternative 4: Cover, grade, and seed	25,700
Ringgold Closed Dump[1]	Alternative 4: Cover, grade, and seed	20,500
Catoosa County Landfill[2]	Erosion and litter control	--
Walker County Landfill[2]	Vegetative cover & litter control	--
City of Chattanooga Landfill[2]	Litter control	--
Hamilton County Landfill[2]	Grass the side slopes	--

*These sites are located in a floodplain and should have further study to determine their impact on the water quality.
[1]Responsible Agency - Soil Conservation District
[2]Responsible Agency - Owner/Operator

- Waste Exchange Program - The immediate implementation of a waste exchange program, aside from its role in meeting residuals management objectives, is important in launching industry's active participation in the residual management program.

- Clearinghouse for Information Transfer - The industrial committee would assume a liaison function between industrial generators and government agencies, local officials, and the area waste management staff to funnel regulatory and technical information in both directions. One important function of the committee in the initial stages of the residuals management program would be to delineate industry's attitudes toward hazardous waste legislation, possible actions it will take, and problems that are foreseen.

- Promotional Programs - Because it may be likely that industries will want to encourage private residual processors to aid in meeting regulatory requirements, a program should be undertaken to:

  - Determine the feasibility of private processing in this area.
  - Start promotional activities (if industries feel that a need for private processing is present) through the committee to show these private processors that a market exists. Through cooperation from governmental agencies, local officials, local banks, businessmen, and CAWMCO, the committee staff could prepare a prospectus indicating market availability, financial incentives, and local government cooperation, to entice private processors to locate within the area.

- Planning - The industrial committee, in cooperation with the waste management staff, will participate in planning a coordinated residuals management strategy for the area. This strategy will become more important as the impacts of hazardous waste legislation are felt.

A detailed survey with industrial contacts should be carried out as part of the residuals management program. More detailed information is required for the more technical aspects of the management program, and a raw material analysis is needed for a waste exchange program. These surveys would be coordinated through the industrial management committee.

The waste management staff would coordinate with the proper local governments and/or agencies to encourage incorporation of the goals and objectives of a residuals management program into zoning ordinances, planning functions, and local ordinances.

The above strategies will initiate interaction between industries and the regulating agencies responsible for residuals management. Efforts must be made to overcome the inertia of industry, which most likely will not respond until hazardous waste regulations are enforced. Part of this enforcement sould be the establishment of a local TDPH Division of Solid Waste Management Office. The sooner positive steps such as those outlined above can be taken, the sooner active industrial participation can be obtained. Such participation will be highly desirable, if not necessary, for a successful residual management program.

Possible long-term management strategies should be reviewed and finalized when additional information becomes available as a result of the initial work program and the implementation of hazardous waste legislation.

The selected residuals management strategy involves coordinating industry's efforts at solving their waste management problems. The Chattanooga Manufacturers Association is a local organization capable of the necessary coordination. Some member industries are currently analyzing their waste management problems on an individual basis. These activities should be increased and coordinated by the Chattanooga Manufacturers Association with attention focused on source reduction of waste products to:

- Minimize the quantities of wastes requiring management.
- Conserve raw materials by utilizing them more efficiently.

Following source reduction, emphasis should be placed upon utilization of waste products as raw materials for other industries (waste exchange concept) as previously noted. Materials requiring short- or long-term storage should be properly contained and sheltered from winds and rainfall, as required in the Tennessee Hazardous Waste Management Act.

Residual wastes that cannot be utilized will require special facilities for disposal. The design of such facilities will depend on the nature and quantity of the materials under consideration and the needs and desires of local industry. The recommended disposal techniques which could possibly be utilized in disposing of problem residuals are presented in Table VIII-6.

Figure VIII-2 presents a management structure that will implement the strategies for disposing of the industrial residual sludges in the planning area.

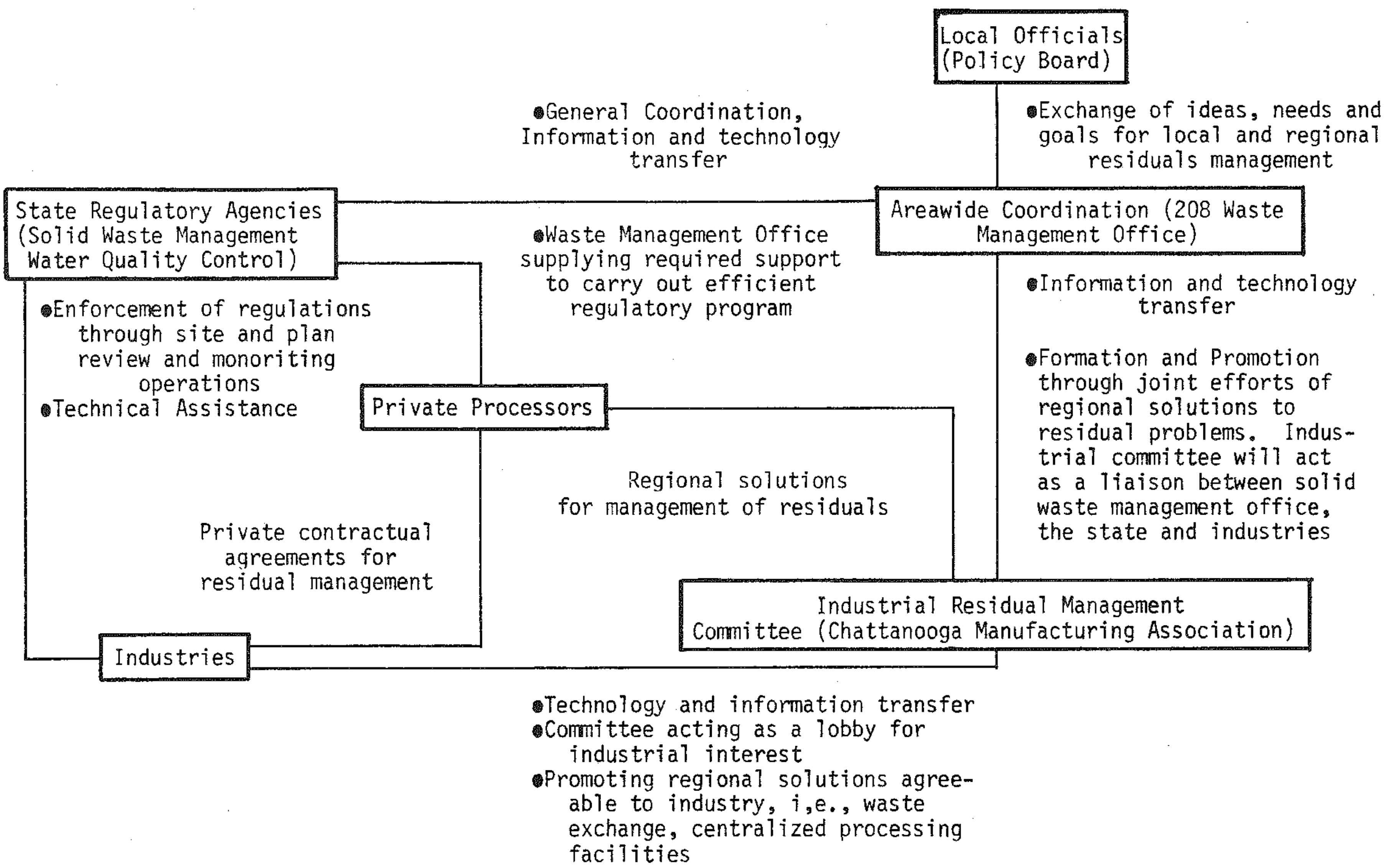
3. Water Treatment, Wastewater Treatment, and Septic Tank Sludges

Sludges from water treatment plants are disposed in a number of ways in the CARCOG/SETDD 208 Study Area. The Tennessee-American Water Company discharges its residuals to the sewer system of Chattanooga. Sludges from the Trenton, Georgia facility are dried and landfilled,

TABLE VIII-6
RECOMMENDED DISPOSAL TECHNIQUES

Methods	Benefits	Drawbacks	Possible Implementation
Pyrolysis	Material recovery volume	Residual released to atmosphere.	Construction of facility by local governments to comply with hazardous waste legislation or as means to promote regional industrial development. Construction of facilities by industries either as individuals or a group to solve their residuals problems. Construction of facility as part of state or federal program.
Sanitary Landfill	Material recovery	Hazardous or toxic materials cannot be disposed of due to leachate problems.	Utilize existing landfills.
Incineration	Volume reduction, material recovery possible, energy recovery	Residuals released to atmosphere.	By local governments, by industry, by state and federal governments.
Chemical landfill	Can accept hazardous materials, recovery	If properly managed it poses no environmental hazard. Care must be taken to contain runoff and leachate.	By local governments and industry. Utilize facilities under construction. Encourage state to locate regional facility in Chattanooga area.
Private chemical processors	Utilizing any or all of above methods to meet needs of client industries	Federal government feels that upon implementation of legislation a market will be needed for private processors. See drawbacks for method above.	Through industrial coordinating committee encourage and promote locating of private processors in area on behalf of industry.

FIGURE VIII-2
RESIDUAL SLUDGE MANAGEMENT STRUCTURE



while the treatment plant at Soddy-Daisy discharges sludge directly to Soddy Creek. No information concerning environmentally adverse impacts was documented during the 208 study. It is assumed that these sludge disposal practices will continue unless problems are documented and regulatory agencies require improvements.

Septic tank sludges are discharged to sanitary sewer systems and community wastewater treatment plants in the Tennessee portion of the 208 study area. In the Georgia portion of the study area, landfills are utilized for septic tank pumpings. No adverse impacts associated with these practices have been documented in the CARCOG/SETDD 208 Study Area. Therefore, the continuation of existing practices is anticipated.

Wastewater treatment residuals in the study area ultimately are deposited in landfills with one exception -- the Moccasin Bend Treatment Plant discharges sludge directly to the Tennessee River. Problems associated with sludge processing and disposal are contained in the various 201 facilities plans as are the recommended controls. The preferred areawide residuals management plan contains no additional controls for residuals management other than those contained in the 201 studies.

F. PRIORITY DETERMINATION AND COSTS

1. Solid Waste Disposal Sites

The total estimated cost of the recommended alternative for solid waste disposal sites is $403,100. Of the total cost, $20,500 is from Catoosa County, Georgia; $25,700 from Marion County, Tennessee; and the remaining $357,500 from Hamilton County, Tennessee. These estimates are based upon January, 1977 contractor prices. It should be noted that these costs could vary if the alternatives are altered after detailed study or if the work is done by city or county employees. Detailed cost estimates for all the alternatives considered are contained in Work Element 601. No costs were calculated for the recommendations for the seven open landfills since these recommendations coincide with state established operating procedures and should be incorporated into the daily work routine at the individual landfills. Costs for implementing the recommended alternative at individual sites are provided in Table VIII-5.

Local governments have not yet budgeted money to implement any of the alternatives at these sites. A demonstration grant is being sought from the U.S. Department of Agriculture to fund an approach to alleviate nonpoint pollution problems. Part of this funding, if received, would be used to implement some of the alternatives at the discussed sites. Should this money not be available or should funding from other sources not materialize, responsibility for correcting problems at the sites will fall on the owner/operators with the impetus for correcting water quality problems coming from the state water pollution control and solid waste management regulatory agencies.

Ideally, the recommended controls contained in Table VIII-5 should be implemented immediately. However, financial constraints must be considered since the availability of funding appears uncertain at this time. The following priority determination considers both financial constraints and the degree of water quality problems associated with the individual sites:

Priority	Site	Comments
Immediate	Dade County Landfill Marion County Landfill Catoosa County Landfill Walker County Landfill City of Chattanooga Landfill Hamilton County Landfill	The recommended controls for these sites reflect operating procedures contained in their respective state landfill permits. Recommendations can be incorporated into daily work routine at no additional cost.
1-3 years	North Hawthorne Street Closed Dump Alton Park Boulevard Closed Dump Red Bank Closed Dump Signal Mountain Closed Dump Oscar Ritchie's Landfill	These sites are identified as having significant leachate problems and are considered to have the most severe water quality problems. The Oscar Rithcie site should be closed as soon as a transfer station or other facility is made available in this area. Estimated costs for these controls total $110,400.
3-5 years	Hoote White Closed Dump Amnicola Highway Closed Dump	Costs for the recommended controls for these two sites represent more than one-half of the total estimated cost for all solid waste disposal site controls. If funding becomes available, consideration should be given to elevating the priority to 1-3 years.
5-10 years	38th Street Closed Dump Marion County Closed Landfill	Water quality problems associated with these sites are relatively minor. Estimated costs for the recommended controls total $76,000.

2. Industrial Residuals Management

No costs were estimated to implement the industrial residuals management portion of this plan due to lack of data. However, it is anticipated that industry will be required to assume the major cost burden for residual management as a result of the federal government's regulatory program for hazardous wastes.

Initial stages of the Industrial Residual Management Committee's operation would be on a voluntary basis. As administrative needs increase, operational expenses could be met in several ways:

- Small brokerage fees charged to industries that use the waste exchange could defray some operational cost (mostly supplies).
- Funds could be available from the states through the area's waste management agency for feasibility studies, surveys, analysis of market needs and marketing of recovered resources for projects involving resource recovery or conservation.
- Local governments may help to sustain the committee because its existence would be an aid in promoting further industrial development in the area. The committee could then be seen as a positive locational factor by prospective industries.
- Because the committee is formed by and for industry, industry should be willing to help finance the operation.
- Funds for capital projects might also be available through the area's waste management agency.

The elements of the industrial residuals management program areas are assigned priority codes (1 through 4) as follows:

Priority Code	Interpretation
1	Immediate (1 to 3 years)
2	Short-Term (3 to 5 years)
3	Long-Term (5 to 10 years)
4	Continuing

The elements of the industrial residuals management program and their corresponding priorities are summarized below:

Element	Priority
• Establish Industrial Residual Management Committee	1 and 4
• Establish Waste Exchange Program	1 and 4
• Establish clearinghouse for information transfer	1 and 4
• Promotional programs	2 and 4
• Planning a coordinated residual management strategy	1 and 4
• Detailed survey of industrial processes, raw material needs, and residuals generated	2

Element	Priority
• Coordinate and incorporate goals and objectives of residuals management with local governments' planning and zoning efforts and other ordinances	4
• Design and construct recommended disposal facilities	As needed
• Establish local TDPH, Division of Solid Waste Management office in Chattanooga	1

CHAPTER IX - AREAWIDE MANAGEMENT PLAN

IX
AREAWIDE MANAGEMENT PLAN

A. INTRODUCTION

This Plan not only identifies CARCOG/SETDD's major water quality problems and proposes controls for them, but it also establishes a mechanism as required by Section 208 of PL 92-500 under which specific governmental units and agencies shall be designated to carry out these controls.

Once the Plan is approved by the states of Georgia and Tennessee and the U.S. Environmental Protection Agency, it will become the official Waste Treatment Management Plan for the CARCOG/SETDD 208 Study Area. Thereafter,

- Only designated management agencies will be eligible for Section 201 water pollution control grant funds (Section 208(d), PL 92-500).
- No Section 201 funds will be granted for projects not in conformity with the Plan (Section 208(d), PL 92-500).
- No NPDES permits will be granted which are in conflict with the Plan (Section 208(e), PL 92-500).
- Only a designated Section 208 planning agency is eligible to receive continuing areawide waste treatment management planning funds (Section 208 (f)(1), PL 92-500).

1. Management System Requirements

Section 208 (c)(1) of PL 92-500 calls for the designation of one or more waste treatment management agencies which shall be responsible for implementing an areawide waste treatment management plan or a portion thereof. The designated management agencies may be existing or newly created local, regional, or state agencies, or political subdivisions. However, depending upon the agency's assigned responsibilities under the plan, the agency must have adequate authority which is defined in Section 208 (c)(2) of PL 92-500 as the authority:

- To carry out its assigned portions of an approved areawide water quality management plan.
- To effectively manage waste treatment works and related point and nonpoint source facilities and practices serving such areas in conformance with the approved plan.
- Directly or by contract, to design and construct new works, and to operate and maintain new and existing works as required by any approved water quality management plan developed...

- To accept and utilize grants or other funds from any source for waste treatment management or nonpoint source control purposes.

- To raise revenues, including the assessment of user charges.

- To incur short- and long-term indebtedness.

- To assure, in implementation of an approved water quality management plan, that each participating community pays its proportionate share of related costs.

- To refuse to receive any wastes from a municipality or subdivision thereof, which does not comply with any provision of an approved water quality management plan applicable to such areas.

- To accept for treatment industrial wastes.

Federal requirements further specify that areawide water quality management systems address four major program components: planning, operations, regulation, and finance. The requirements for each major program component are summarized below:

Planning requirements

- The designated 208 planning agency must establish an areawide planning process to develop the water quality management plan.

- Mechanisms are needed to ensure that the 208 plan and local 201 facility plans are coordinated and compatible.

- The areawide planning process must be coordinated with related planning activities such as land use and air quality.

- The areawide water quality management plan must include provisions for a continuing planning process to be implemented after the adoption of the initially developed 208 plan.

- Agencies designated to carry out planning activities under the continuing planning process must have the authority and capability of doing so.

Operational requirements

- Agencies designated to operate facilities under the areawide plan must be able to effectively manage waste treatment works and related point and nonpoint source control structural facilities and practices. This includes possession of the needed legal, institutional, management, and financial capability.

- Operational agencies must have the authority and capability to design and construct new works and maintain existing works as required by the areawide plan.
- Waste treatment agencies must have the authority and capability of accepting industrial wastes for treatment.
- Agencies designated to conduct nonpoint source control operations must have the operational capability to review proposals and conduct inspection and permitting programs.

Regulatory requirements

- Agencies designated to carry out regulatory programs under the areawide plan must have the authority and capability to carrying out their assigned tasks. This includes agencies designated as responsible for both point and nonpoint source pollution control activities at all levels of government.
- Treatment agencies must have the authority to refuse to receive wastes from entities that do not comply with the approved water quality plan.
- Provisions have to be made to ensure that the plan is implemented and that designated management agencies adequately carry out their assigned responsibilities.

Financial requirements

Agencies designated as waste treatment management agencies must have adequate authority and capability to:

- Accept and utilize grants.
- Incur short- and long-term indebtedness.
- Raise revenues, including the assessment of user charges.
- Assure that each participating community pays its proportionate share of related costs.
- Have user charge systems which meet the requirements of the U.S. Environmental Protection Agency.
- Have industrial cost recovery systems which meet the requirements of the U.S. Environmental Protection Agency.

2. Existing Management Systems

Federal, state, local, and private agencies have important responsibilities for water pollution control within the six county CARCOG/SETDD 208 Study Area. First, existing state and federal management systems and agencies are summarized by functional category (i.e., planning, operations, regulations, and financing) as documented in Work Element 702.2, followed by a description of existing local management efforts documented in Work Elements 106.2, 106.3, and 702.2.

Table IX-1 provides a summary of existing state and federal water quality management agencies and their functional responsibilities.

a. Planning - Federal and State

At the federal level, several agencies are responsible for planning activities related to water pollution control as indicated in Table IX-1. The U.S. Environmental Protection Agency is the federal agency primarily responsible for water quality management planning in the CARCOG/SETDD 208 Study Area. EPA administers its water quality planning program in accordance with Sections 201, 208, and 303(e) of PL 92-500.

The Forest Service of the U.S. Department of Agriculture manages federal forest lands and develops land management planning programs for them. It has a major role in planning for the acquisition, management, and restoration of lands within the critical watersheds under its stewardship.

The Soil Conservation Service (SCS) of the U.S. Department of Agriculture provides technical planning assistance through three Tennessee soil conservation districts and the two Georgia soil and water conservation districts in the CARCOG/SETDD 208 Study Area. The two Georgia soil and water conservation districts are also responsible for assisting the local governments in developing a soil erosion and sedimentation control program in accordance with state law.

The Tennessee Valley Authority (TVA) is a multipurpose federal agency responsible for the provision of power, for water management, and for economic development in the Tennessee River Valley. TVA's planning responsibility for water quality management includes the following:

- Assistance to states by providing data on stream flow and water quality.
- Review of draft basin plans.
- Collection of data on present and potential waste dischargers.

TABLE IX-1
EXISTING STATE AND FEDERAL WATER QUALITY MANAGEMENT AGENCIES AND FUNCTIONS

Federal Agencies	Planning	Operations	Regulations	Financing
U.S. Environmental Protection Agency			X	X
Tennessee Valley Authority	X	X	X	X
U.S. Soil Conservation Service	X	X		X
Agricultural Stabilization and Conservation Service	X	X		X
U.S. Geological Survey	X			
U.S. Department of Housing and Urban Development	X			X
U.S. Farmers Home Admin.	X			X
U.S. Forest Service	X	X	X	X
Economic Development Admin.	X			X
Appalachian Regional Commission	X			X
U.S. Army Corps of Engineers	X		X	X
Bureau of Outdoor Recreation	X			X
State Agencies				
TENNESSEE				
Water Quality Control Division	X		X	X
Solid Waste Division	X		X	
State Planning Office	X			X
State Parks System		X		
State Highway Department		X		
Wildlife Resources Agency		X	X	
Surface Mining and Reclamation Division	X		X	

TABLE IX-1
EXISTING STATE AND FEDERAL WATER QUALITY MANAGEMENT AGENCIES AND FUNCTIONS
(Continued)

State Agencies	Planning	Operations	Regulations	Financing
GEORGIA				
Environmental Protection Div.	X		X	X
Office of Planning and Budget	X			
State Parks System		X		
Department of Transportation		X		
Department of Community Affairs	X			

- Maintain an inventory of surface water quality.

- Conduct special studies related to water quality.

The United States Geological Survey (U.S.G.S.) of the U.S. Department of the Interior provides resource data on water quality and supply.

The Appalachian Regional Commission (ARC), a multi-state federal agency concerned with economic development, encompasses the CARCOG/SETDD 208 Study Area. ARC conducts certain water quality planning activities including mine, water and sewer, solid waste, and land use studies. In the CARCOG/SETDD 208 Study Area, ARC has cooperated with the U.S. Army Corps of Engineers in conducting an assessment of future water needs in the Chattanooga metropolitan region. Also, ARC has conducted an economic-engineering study of mine drainage in the region.

The Bureau of Outdoor Recreation of the U.S. Department of the Interior (BOR) reviews the recreational aspects of proposed federal water projects such as flood control, reclamation, and federally licensed hydroelectric projects, pursuant to the provisions of the Federal Water Project Recreation Act. Thus, it has some potential input into the planning of nonpoint source control activities.

The U.S. Department of Housing and Urban Development is a significant source of technical assistance and federal funds for local and areawide planning in the CARCOG/SETDD 208 Study Area. Under Section 701 of the Housing Act of 1954, local and areawide agencies develop plans for water quality related matters such as land use and housing.

The U.S. Army Corps of Engineers have been active in the CARCOG/SETDD 208 Study Area through their programs of planning and data gathering. These efforts have provided valuable information concerning nonpoint sources of pollution.

At the state level, Tennessee and Georgia each have a major water quality planning agency. The Tennessee Water Quality Control Division, and the Georgia Environmental Protection Division are the two agencies responsible for state level planning activities related to water quality. Both agencies are responsible for statewide 208 planning and for conducting statewide river basin planning in their respective jurisdictions. These activities provide the framework for all other water quality planning activities conducted within the states.

In addition to their responsibility for 208 water quality planning, the Tennessee Water Quality Control Division and the Georgia Environmental Protection Division are empowered by state legislation to carry out the following planning functions:

Regarding nonpoint source pollution control operations, the Tennessee Division of Forestry conducts an active program of controlling soil erosion and sedimentation problems on state forest lands through revegetation of cleared areas and by requiring contractors to comply with strict limits on land disturbing activities. There are two Tennessee state forests in the CARCOG/SETDD 208 Study Area, the Prentice Cooper and Franklin State Forests.

The Tennessee State Highway Department and the Georgia Department of Transportation are responsible for the construction and maintenance of storm drainage facilities in the CARCOG/SETDD 208 Study Area in conjunction with construction of highways and other road facilities.

c. Regulations - Federal and State

Federal, state, and local agencies share responsibility for the conduct of regulatory activities affecting water quality. Federal and state authorities have the primary responsibility for point source regulation while local governments focus on the regulation of nonpoint sources.

The U.S. Enviornmental Protection Agency (EPA) is the agency charged with administration of the provisions of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). The agency in meeting its responsibilities associated with PL 92-500 acts as both a funding and a regulatory agency.

EPA possesses significant regulatory authorities. Under PL 92-500, the agency is authorized to promulgate pollution standards for both industrial and municipal pollution discharges. Under the National Pollutant Discharge Elimination System (NPDES), all dischargers must obtain permits in order to discharge their pollutant wastes. These permits establish: effluent limitations; target dates for pollution abatement; and compliance schedules which must be met. EPA has delegated the permitting responsibility to the state of Georgia. The state of Tennessee has requested the same authority pending the outcome of proposed state legislation which will comply with EPA requirements for administering the system. EPA retains the authority to enforce permit requirements if the states fail to do so.

In addition to the Environmental Protection Agency, which has the overall regulatory control over water quality management activities, several federal agencies exercise regulatory authorities for nonpoint sources of pollution within the CARCOG/SETDD 208 Study Area. They are the U.S. Forest Service, the Tennessee Valley Authority, and the U.S. Army Corps of Engineers.

The U.S. Forest Service maintains land development regulatory control over forest service lands by issuing special permits for recreational sites and power distribution lines.

The TVA requires that anyone desiring to build on TVA property or obtain flowage easements must obtain approval from TVA. The authority requires that the structure not contribute to water pollution. A wastewater treatment plant, industrial treatment facility, septic tanks, or any potential pollution source which directly affects the Tennessee River is covered by this requirement. Also, the TVA requires that any property which it sells or leases must contain a covenant in the deed which requires that no pollution may result from any activity on the property.

The U.S. Army Corps of Engineers regulates nonpoint sources of pollution through its permit program. This regulatory power requires a permit for construction of any project in a navigable waterway or for dredge and fill operations in navigable waters.

While regulation of nonpoint sources of pollution is primarily a responsibility which rests with local governments through zoning and subdivision control programs, the states of Tennessee and Georgia do exercise a degree of nonpoint source regulatory authority in addition to point source controls. The following discusses state agency regulatory authorities and activities.

The Tennessee Water Quality Control Division and the Georgia Environmental Protection Division are the state regulatory agencies that administer the Tennessee and Georgia water pollution control programs. Both agencies are empowered to:

- Adopt a comprehensive program for the prevention, control, and abatement of water pollution.
- Adopt and enforce rules necessary to prevent, control, or abate water pollution.
- Adopt and promulgate water quality standards for the various waters of the state.
- Adopt standards for the discharge of pollutants in order to attain and maintain water quality standards.
- Review and approve proposed sewage treatment works.
- Administer a permit system for the discharge of pollutants into the state's water bodies. The Georgia EPD has also been authorized by EPA to administer the National Pollution Discharge Permit System (NPDES). Legislation is currently pending in the Tennessee General Assembly which would qualify the Tennessee WQCD for issuing the federal permits.

In addition to regulation of point source pollution through the issuance of permits for wastewater treatment facilities, the Georgia Environmental Protection Division exercises regulatory authority over certain types of nonpoint source pollution. The Division is responsible for developing regulations for subsurface sewage disposal systems, such as septic tanks. The actual approval of these systems, based on state standards, is carried out by county health departments. Furthermore, the Division is responsible for assuring that all local solid waste management plans and facilities are operated in an environmentally sound manner. The Division approves and monitors all landfill sites in the state.

Another regulatory activity administered by the Georgia Division of Environmental Protection is soil sedimentation and erosion control. A law passed in 1975 by the Georgia General Assembly requires that all cities and counties in the state must adopt a soil sedimentation and erosion control program in accordance with general standards described in the law. The Division is authorized to review and approve these local programs and actually administer a permit system for those jurisdictions which do not develop an acceptable program. Permits are to be issued by the local or state government for all land disturbing activities which could result in pollution of water bodies.

Finally, the Division administers the Georgia Surface Mining Act of 1968, as amended. This statute requires that any activity which removes minerals, ores, and other solid matter for sale or processing must obtain a permit from the Division. In order to obtain a permit, the operator of a surface mining activity must develop a land use plan which addresses grading, disposal of refuse, reclamation, and revegetation, and the time of completion of the activity. The Board of Natural Resources, upon a review and recommendation of the Division, issues a permit for surface mining.

In Tennessee, regulatory activities related to nonpoint source pollution are conducted by several divisions within the Department of Public Health, as well as several other state agencies. Regulations for subsurface sewage disposal systems (e.g., septic tanks) are administered by the Division of Sanitation. Actual implementation of the permit system and monitoring of subsurface disposal systems is conducted by the local county health departments.

The Division of Solid Waste within the State Public Health Department is responsible for administering the Tennessee Solid Waste Disposal Act. As authorized in the Act, the Division must approve and monitor all landfill sites in Tennessee. The Division coordinates its activity with the local county health departments.

The Tennessee Wildlife Resource Agency which is separate from the State Public Health Department is empowered to impose fines for pollution causing injury to fish and life, as well as to seek damages for the value of the fish killed.

The Division of Surface Mining and Reclamation located within the Tennessee Department of Conservation is responsible for the regulation of nonpoint source pollution resulting from mining activities. This Division operates under the Tennessee Surface Mining Law of 1972. The law established a permit system to control all surface mining activity in the state. The law also requires that all surface mining operators provide bonds for their operation to assure proper reclamation activities in the state and to ensure that they conform to state regulations. A key function of this division is its coordination with the Divisions of Water Quality Control to ensure that all mining operations have discharge permits prior to the issuance of a surface mining permit. The discharge permit is required to reduce the amount of mine related pollution reaching the lakes and streams.

d. Financing - Federal and State

The U.S. Environmental Protection Agency is the primary federal financier of water pollution control works. Through the Construction Grants Program under Section 201 of PL 92-500, EPA funds 75 percent of eligible point source pollution controls. Other federal funding sources for water pollution control include:

- Farmers Home Administration's service grant program (FmHA).
- U.S. Department of Housing and Water Development (HUD).
- Appalachian Regional Commission (ARC).
- Economic Development Administration (EDA).
- Agricultural Stabilization and Conservation Service (ASCS).

It should be noted that with the exception of ASCS, the above funding sources apply primarily to point source controls (i.e., sewers and wastewater treatment facilities). ASCS provides funds for certain conservation practices including: pasture land improvements, construction of farm ponds, and construction of treatment facilities for dairy barn and feedlot wastes.

The states of Georgia and Tennessee are limited but important sources of funding for water quality management programs in the CARCOG/SETDD 208 Study Area. Both states directly provide grants for overall planning activities on a limited basis. In Georgia, the Bureau of Community Affairs administers these funds while the State Planning Office of Tennessee performs this function.

Only the state of Tennessee conducts an active program to assist in the financing of water quality operations. The State Department of Public Health is authorized by state law to make loans to local governments for the purpose of constructing wastewater treatment facilities including interceptors and collection systems. Loans are limited to the nonfederal share of projects approved by EPA under Section 201 of PL 92-500.

The State Public Health Department also administers a loan program for construction of local water supply systems. This program is similar to the wastewater treatment construction financing program except that there is no restriction regarding use of a particular federal program.

The Georgia Department of Natural Resources is authorized by state law to provide grants to local governments and special districts for construction of wastewater treatment systems and facilities. However, the State General Assembly has not appropriated funds for this program.

The states of Georgia and Tennessee provide some funds directly to the soil conservation districts. However, these funds are small (approximately $500 to $1000 per year per district) and are limited to reimbursing district supervisors for attending district meetings and to the purchase of office supplies.

e. Local Management

In general, local water quality management efforts focus on three areas: the provision of potable water, the collection and treatment of wastewater, and the control of nonpoint sources of pollution through zoning and subdivision control ordinances.

The present management system consists of the CARCOG/SETDD which functions as a regional planning and coordinating body along with three other areawide planning and coordinating agencies: the Chattanooga-Hamilton County Regional Planning Commission, the Tennessee State Planning Office, and the Coosa Valley Planning and Development Commission; local governments in Tennessee and Georgia that are responsible for local land use and water quality planning activities; and more than 30 local institutions that are presently involved in the collection and treatment of wastewater or provision of water supply. Table IX-2 identifies local institutions responsible for providing water supply and/or sewerage service in the CARCOG/SETDD 208 Study Area.

Following are summaries presented by county, of local management agencies, the management functions they perform, and the land use controls currently in place. For more detailed descriptions, refer to Work Element 702.2. Since all utility districts in the CARCOG/SETDD 208 Study Area only provide water supply, they are not included in the following summary tables. Refer to Table IX-2 for information concerning utility district service areas.

Marion County, Tennessee

The county contains nine local general purpose governments (eight municipalities and the county), and four utility districts. Of these institutions, two municipalities (South Pittsburgh and

TABLE IX-2
LOCAL INSTITUTIONS INVOLVED IN WASTEWATER TREATMENT AND WATER SERVICES IN THE CARCOG/SETDD 208 STUDY AREA

Local Government Agencies	Wastewater Treatment	Water Service
TENNESSEE		
Marion County		
South Pittsburgh	x	x
Monteagle	x	
Jasper		x
Whitwell		x
Kimball		x
Orme		x
New Hope Utility District		x
Griffith Utility District		x
West Valley Cooperative		x
Lone Oak Utility District (Partial)		x
Sequatchie County		
Lone Oak Utility District		x
Dunlap	x	x
Hamilton County		
Chattanooga	x	2
Signal Mountain	x	1
Red Bank	x	2
East Ridge	x	2
Collegedale	x	
Lookout Valley Utility District		1
Walden's Ridge Utility District		x
Mowbray Mountain Utility District		x
Sale Creek Utility District		x
Union Fork-Bakewell Utility District		x
Hixon Utility District		x
Eastside Utility District		1
Soddy-Daisy - Falling Water Utility District		x
Savannah Valley Utility District		x
GEORGIA		
Catoosa County		
Fort Oglethorpe	x	1
Ringgold	x	x
Catoosa County Water District		1
Dalton Water, Light and Sinking Fund Commission		x

TABLE IX-2
LOCAL INSTITUTIONS INVOLVED IN WASTEWATER TREATMENT AND WATER SERVICES IN THE CARCOG/SETDD 208 STUDY AREA (Continued)

Local Government Agencies	Wastewater Treatment	Water Service
GEORGIA		
Walker County		
Chickamauga	x	x
Walker County Water and Sewer System		1
Rossville	x	
Kensington Water Association		x
Walker County Water Authority		x
Dade County Water Authority (Partial)		x(2)
Dade County		
Dade County Water Authority		x(2)
Trenton		x

1 Purchases water from the Tennessee-America Water Company and distributes to customers.

2 Water supply distributed directly by the Tennessee-America Water Company.

Monteagle) provide wastewater treatment service and four utility districts, and five municipalities (South Pittsburgh, Jasper, Whitwell, Kimball, and Orme) operate and maintain water supply systems. Nonpoint source pollution control is addressed by Marion County, South Pittsburgh, and Jasper through zoning ordinances and subdivision regulations administered by their respective planning commissions. The Marion County Health Department regulates the installation of septic tanks and drainfields throughout the county.

Table IX-3 summarizes existing management agencies, responsibilities, and land use controls in Marion County.

Sequatchie County, Tennessee

The city of Dunlap along with Sequatchie County and the Lone Oak Utility District comprise the existing governmental entities in Sequatchie County. The city of Dunlap operates a wastewater treatment facility and water supply system which serves the incorporated area. The Lone Oak Utility District, which also services a portion of Marion County, operates a water supply system in the southern part of Sequatchie County.

Nonpoint source pollution control is indirectly addressed through subdivision regulations of Dunlap and Sequatchie County. The county also regulates the location and installation of septic tanks and drainfields in the county. Neither local government has zoning ordinances in effect. The existing management system is summarized in Table IX-4.

Hamilton County, Tennessee

Of the 11 local general purpose governments (ten cities and one county) in Hamilton County, five cities operate wastewater treatment facilities. One city, Signal Mountain, also provides water supply service. Jurisdictions operating treatment facilities are: Chattanooga, Signal Mountain, Red Bank, Collegedale, and East Ridge. The city of Chattanooga operates two plants, the remaining communities one each.

There are presently 11 public water systems in Hamilton County. Only one, the Signal Mountain water system, is municipally owned and operated. One other, the Tennessee-American Water Company, is a private company. The other nine public water providers are Utility Districts. They are: Lookout Valley, Walden's Ridge, Mowbray Mountain, Sale Creek, Union Fork-Bakewell, Soddy Daisy Falling Water, Hixon, Eastside, and Savannah Valley.

The county government administers both subdivision and zoning regulations through staff assistance from the Chattanooga-Hamilton County Planning Commission. In addition, Hamilton County regulates the installation of septic tanks and drainfields. Seven of the ten

TABLE IX-3
SUMMARY OF EXISTING WATER QUALITY MANAGEMENT SYSTEM FOR MARION COUNTY, TENNESSEE

	Plan-ning	Oper-ations	Regu-lations	Finance*	Zon-ing	Subdivision Regs.	Soil Erosion Control Ordinance	Septic Tank Regs.	201 Agency	Comments
Marion County	x		1	x	x	x		x		The Tennessee State Planning Office and CARCOG provide planning assistance and coordinate planning activities within the County. Marion County contributes an annual contribution to CARCOG for technical planning assistance.
South Pittsburg	x	x^{1-2}	x	x	x	x			x	
Jasper	x	x^2	x		x	x			x	
Whitwell		x^2							x	
Kimball		x^2								
Richard City										
Orme		x^2								
New Hope										
Monteagle		x^{1-2}		x						

*For wastewater treatment systems

x - function or ordinance exists

x^1- wastewater treatment and/or collection operations

x^2- water supply operations

1 - nonpoint source regulations only

TABLE IX-4

SUMMARY OF EXISTING WATER QUALITY MANAGEMENT SYSTEM FOR SEQUATCHIE COUNTY, TENNESSEE

	Planning	Operations	Regulations	Finance*	Zoning	Subdivision Regs.	Soil Erosion Control Ordinance	Septic Tank Regs.	201 Agency	Comments
Sequatchie Co.			1			x		x		TSPO provides planning assistance and assists with the administration of subdivision regulations. CARCOG receives annual local contributions from Sequatchie County for technical planning assistance.
City of Dunlap		x^{1-2}	x	x		x			x	

*For wastewater treatment systems

x - function or ordinance exists

x^1- wastewater treatment and/or collection operations

x^2- water supply operations

1 - nonpoint source regulations only

municipalities; Chattanooga, Signal Mountain, Soddy-Daisy, Lookout Mountain, Red Bank, Collegedale, and East Ridge have both zoning and subdivision regulations. Two municipalities, Walden and Lakesite, have only zoning regulations. The city of Ridgeside has neither subdivision nor zoning regulations. Table IX-5 summarizes the existing management system in Hamilton County.

Catoosa County, Georgia

There are two municipalities in the county, Fort Oglethorpe and Ringgold. Each operates as sewage collection and treatment system, as well as a water supply system. Three other public and one private water system provide water to various areas within Catoosa County. The Catoosa County Water and Sewer District, the Tennessee-American Water Company of Chattanooga, and the Water, Light, and Sinking Fund Commission of Dalton, Georgia are the other major water providers.

Control of nonpoint sources of pollution is administered by Fort Oglethorpe which has zoning and subdivision regulations, Ringgold which only has a zoning ordinance, and Catoosa County which regulates septic tanks and is required by state law to adopt a soil erosion and sedimentation control program.

Table IX-6 provides a summary of Catoosa County's existing water quality management system.

Walker County, Georgia

Approximately 50 percent of Walker County (that portion in the Tennessee River Drainage Basin) is included in the Chattanooga 201 wastewater facilities planning program and the CARCOG/SETDD 208 water quality management program. The city of LaFayette and its service area comprise a 201 area apart from the remainder of the county.

Three local governmental entities in the CARCOG/SETDD 208 portion of Walker County are presently involved in wastewater collection: Walker County, the city of Rossville, and the city of Chickamauga. Of these, only Chickamauga presently operates a wastewater treatment facility.

Potable water is supplied to the CARCOG/SETDD 208 portion of Walker County by six public water systems and one private water company.

Control of nonpoint source pollution is carried out by Chickamauga, Lookout Mountain, and Rossville which have zoning and subdivision ordinances, and Walker County which has subdivision regulations but no zoning ordinances. Walker County also controls septic tanks and drainfield location and installation, and is developing a soil erosion and sedimentation control program for the entire county.

TABLE IX-5
SUMMARY OF EXISTING WATER QUALITY MANAGEMENT SYSTEM FOR HAMILTON COUNTY, TENNESSEE

	Planning	Operations	Regulations	Finance*	Zoning	Subdivision Regs.	Soil Erosion Control Ordinance	Septic Tank Regs.	201 Agency	Comments
Hamilton County	0		1		x	x		x		Flows from the Soddy-Daisy, Red Bank, East Ridge and Collegedale WWTP's will eventually go to the Chattanooga Moccasin Bend treatment facility.
Chattanooga	0	x^1	x	x	x	x			x	
Collegedale	0	x^1	x	x						
East Ridge	0	x^1	x	x	x	x				
Lakesite			1		x	x				
Lookout Mountain	0		1		x	x				
Red Bank	0	x^1	x	x	x	x				
Ridgeside										
Soddy-Daisy	0		1		x	x				
Signal Mountain		x^{1-2}	x	x	x	x				
Walden	0		1		x					

*For wastewater treatment systems

0 - Planning performed by Chattanooga-Hamilton County Regional Planning Commission

x - function or ordinance exists

x^1- wastewater treatment and/or collection operations

x^2- water supply operations

1 - nonpoint source regulations only

TABLE IX-6
SUMMARY OF EXISTING WATER QUALITY MANAGEMENT SYSTEM FOR CATOOSA COUNTY, GEORGIA

	Planning	Operations	Regulations	Finance*	Zoning	Subdivision Regs.	Soil Erosion Control Ordinance	Septic Tank Regs.	201 Agency	Comments
Catoosa County	0		1				x	x		The city of Chattanooga provides water quality planning for Catoosa County through the Chattanooga 201 study.
Ft. Oglethorpe	x	x^{1-2}	x	x	x	x				
Ringgold	x	x^{1-2}	x	x	x					

*For wastewater treatment systems

0 - Provided by Coosa Valley APDC

x - function or ordinance exists

x^{1-2} - wastewater treatment and water supply operations

1 - nonpoint source regulations only.

Table IX-7 summarizes the existing management system for the CARCOG/SETDD 208 portion of Walker County.

Dade County, Georgia

There is only one wastewater collection and treatment system in Dade County. It is operated by the city of Trenton which is the county seat and the only incorporated municipality in the CARCOG/SETDD 208 Study Area of Dade County.

The control of nonpoint sources is conducted by Dade County which regulates the location and installation of septic tanks and drainfields throughout the county, and the city of Trenton has a zoning ordinance but no subdivision regulations. In addition, Dade County is required by state law to develop a soil erosion and sedimentation control program. These control and management functions are presented in Table IX-8.

3. Management System Options

The purpose of Section 208 of the Federal Water Pollution Control Act Amendments of 1972 is to encourage and facilitate the development and implementation of areawide waste treatment management plans. No plan will be implemented unless a management system is established by which various institutional and financial arrangements are identified to effectuate the provisions of the plan. The institutional and financial elements of a waste treatment management plan should answer the following basic questions:

- Which agency or agencies will be responsible for carrying out portions of the plan?
- Which agency will be responsible for continuing planning, plan coordination, and assessment?
- What procedures or processes will be utilized for agency and program coordination?
- How will the programs recommended in the plan be financed?
- Do existing laws and regulations provide an adequate legal basis for areawide water quality management?

Several alternative management approaches are identified in this plan. Each alternative attempts to satisfy the basic management requirements relating to planning, operation, regulation, and finance. The fact that alternatives are presented should not be viewed as an indication that the present water quality management system should be changed. Water quality problems in the CARCOG/SETDD 208 Study Area are being addressed and water quality conditions are improving. It is one purpose of the 208 plan, however, to determine whether the existing system is the most effective system for accomplishing further water quality improvement; or if there is a better and more economical way of managing water quality programs.

TABLE IX-7
SUMMARY OF EXISTING WATER QUALITY MANAGEMENT SYSTEM FOR WALKER COUNTY, GEORGIA (CARCOG/SETDD 208 PORTION)

	Planning	Operations	Regulations	Finance*	Zoning	Subdivision Regs.	Soil Erosion Control Ordinance	Septic Tank Regs.	201 Agency	Comments
Walker County	x	x^{1-2}	x	x		x	z	x		Areawide planning performed by CARCOG and Coosa Valley APDC.
Chickamauga	x	x^{1-2}	x	x						
Lookout Mountain	x		1		x	x				
Rossville	x	x^1	1	x	x	x				

*For wastewater treatment systems

z - Being developed

x - function or ordinance exists

x^1- wastewater treatment and/or collection operations

x^2- water supply operations

TABLE IX-8

SUMMARY OF EXISTING WATER QUALITY MANAGEMENT SYSTEM FOR DADE COUNTY, GEORGIA (CARCOG 208 PORTION)

	Plan-ning	Oper-ations	Regu-lations	Finance*	Zon-ing	Subdivision Regs.	Soil Erosion Control Ordinance	Septic Tank Regs.	201 Agency
Dade County	0		1				z	x	
Trenton	0	x^1	x	x	x	x			

*For wastewater treatment system

0 - Provided by Coosa Valley APDC and CARCOG

x - function or ordinance exists

x^1- wastewater collection and treatment

z - Being developed

The alternative management systems considered are:

- Continuation of the present management system.
- A basin-wide approach.
- Creation of a water quality management association.
- Creation of a single purpose regional wastewater management authority.
- A regional management system.

Each alternative has been evaluated based on the following six general criteria:

- Comprehensiveness
- Coordination
- Legal and Administrative Authority
- Financial
- Technical and Management Capability
- Acceptability

A discussion of these criteria and the evaluation framework is contained in Work Elements 704.1 and 803.1 "A Process for Developing and Evaluating Water Quality Management Alternatives."

A summary of each alternative management system follows. Detailed descriptions of the alternatives are contained in Work Element 704.3.

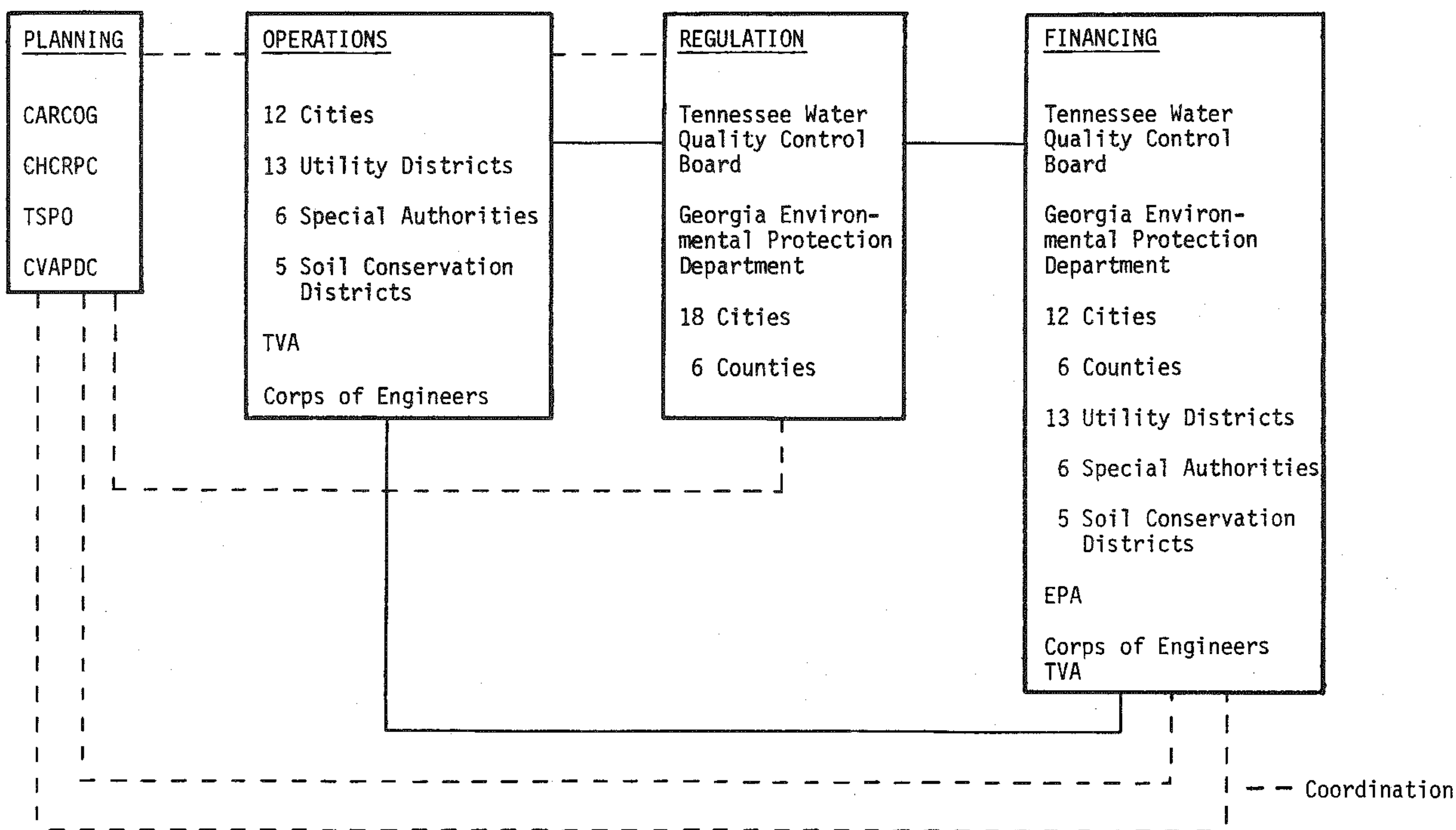
a. Continuation of the Present Management System

This system consists of the CARCOG/SETDD which functions as a regional planning and coordinating body, along with three other area-wide planning and coordinating agencies: the Chattanooga-Hamilton County Regional Planning Commission, the southeast section of the Tennessee State Planning Office, and the Coosa Valley Area Planning and Development Commission; local governments in Tennessee and Georgia that are responsible for local land use and water quality planning activities; more than thirty local institutions that are presently involved in the collection and treatment of wastewater or provision of water supply; and two state water quality regulatory agencies, the Tennessee Water Quality Control Division and the Georgia Environmental Protection Division.

Under this alternative the status quo would, for the most part, be retained. Three existing local treatment facilities (Red Bank, Collegedale, and East Ridge) would possibly be consolidated into a single regional facility in Chattanooga per ongoing 201 facility planning efforts.

Planning, operations and regulatory functions, and existing financial arrangements would remain unchanged (see Figure IX-1).

FIGURE IX-1
CONTINUATION OF THE PRESENT MANAGEMENT SYSTEM



b. Basin Approach

This approach is a logical alternative for water resource management because natural boundaries (i.e., drainage basins) and not political boundaries are utilized for application of water quality programs.

This alternative provides for the recommended designation of three management agencies for the six county area. All existing agencies providing wastewater treatment functions would transfer their major interceptor and treatment functions to the three new agencies. The recommended agencies are tentatively named and described as follows:

- Sequatchie River Basin Authority - Responsibility for providing wastewater services in Marion and Sequatchie Counties, Tennessee.
- Tennessee River Basin Authority - Replace existing systems within Hamilton County, Tennessee and continue to serve those portions of Walker County, Georgia and the city of Rossville, Georgia currently served by the Chattanooga system.
- Georgia-Tennessee River Authority - To replace existing agencies in the Tennessee River drainage basin portion of Dade, Catoosa, and Walker Counties, Georgia with a single, three county authority.

Each of the three authorities would have responsibility for planning, owning, designing, financing, constructing, operating, and maintaining their own facilities.

Continuing areawide water quality planning would be a function of the CARCOG/SETDD organization.

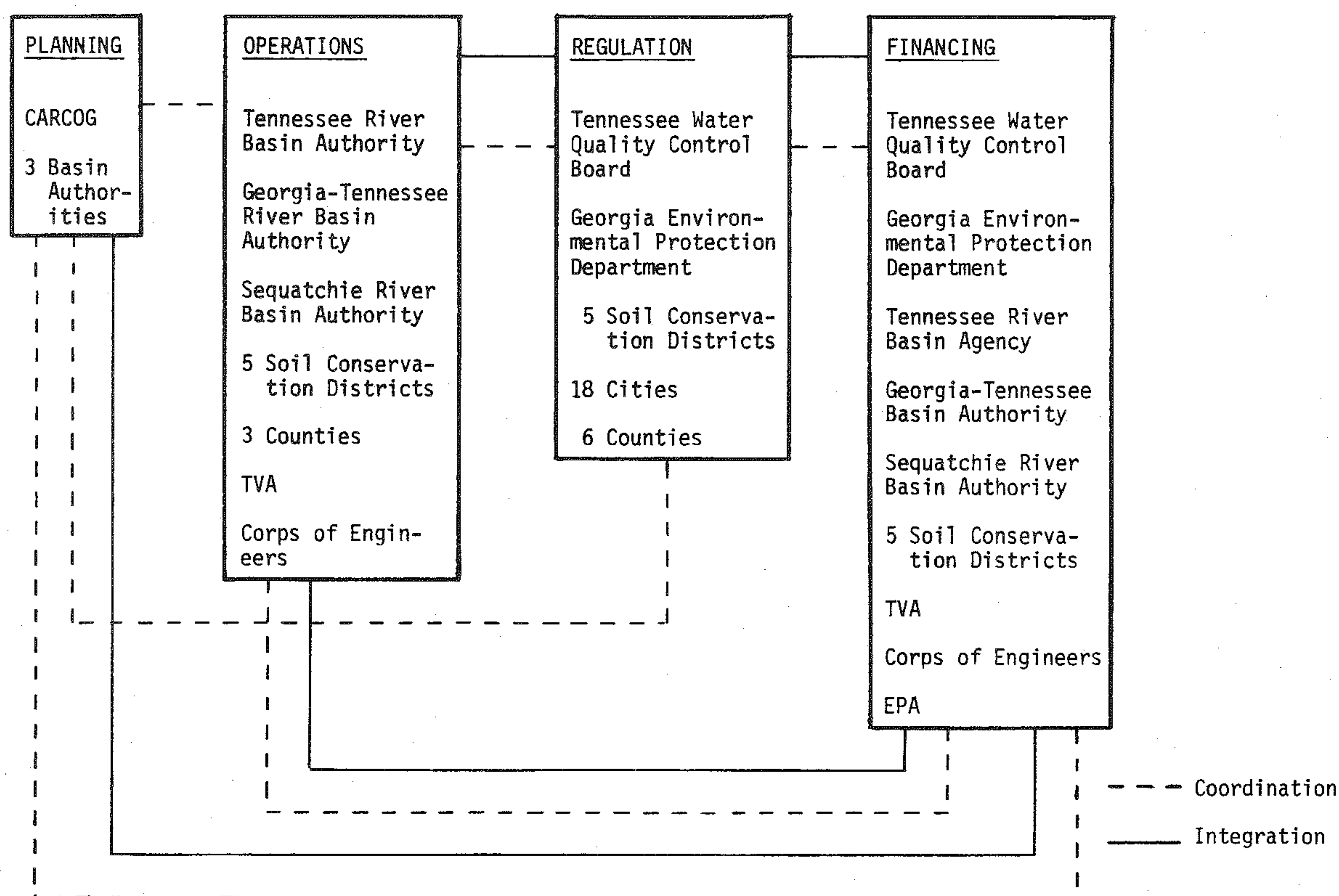
Figure IX-2 presents the basin approach alternative based on the four management responsibilities.

c. A Water Quality Management Association Approach

This approach involves the utilization of existing local management agencies and the creation of an association(s) to formally coordinate their activities. In particular, the approach calls for the formation of associations on both sides of the interstate boundary comprised of representatives of the water and wastewater treatment agencies.

Continuing areawide 208 planning and coordination would be assigned to the CARCOG/SETDD; although, the alternative provides that such planning could be the responsibility of the associations.

FIGURE IX-2
A BASIN APPROACH



Ownership and operation of the existing wastewater treatment facilities would continue through the existing fourteen water quality management agencies. The alternative suggests that the associations might provide the management vehicle to achieve some economies through joint purchasing and other activities. Facility financing would also continue to be the responsibility of the existing management agencies.

Planning, operations, regulatory and financial responsibilities, and implementing agencies for this approach are provided in Figure IX-3.

d. The Regional Wastewater Management Authority Approach

A new single agency would be created to plan, own, finance, operate, and maintain all wastewater treatment plants in the six county interstate region. Such an agency could be created only with the passage of a referendum and approval by both state legislatures.

This alternative recommends that the continuing 208 areawide water quality planning process be the responsibility of the CARCOG/SETDD. Local governments would retain responsibilities of local land use planning, collector sewer construction and maintenance, and non-point source pollution control in cooperation with the soil conservation districts. Ultimate regulatory and financial management functions would be performed by those agencies currently undertaking such functions. The Regional Management Agency (RMA) would assume some regulation and local financing responsibilities of wastewater treatment facilities. Figure IX-4 provides management agencies and functions under this alternative.

e. The Regional Management System

This system modifies the existing management system in that it establishes a Waste Management Office/Clearinghouse (Chattanooga Area Wastewater Management Coordinating Office) in order to coordinate continuing areawide water quality planning and management efforts. The Waste Management Office would utilize existing services and resources provided by one or more of the existing areawide planning agencies. Three alternatives for the housing of the Chattanooga Area Wastewater Management Coordinating Office (CAWMCO) were considered:

- Placement of CAWMCO in the CARCOG/SETDD agency.
- Placement of CAWMCO in the Chattanooga-Hamilton County Regional Planning Commission.
- Individual attention to the subareas within the region by the particular planning agency having jurisdiction (i.e., the CHCRPC for Chattanooga and Hamilton County, the Tennessee State Planning Office for Sequatchie and Marion County, and the Coosa Valley Planning and Development Commission for Catoosa, Dade, and Walker Counties). These agencies would closely coordinate their planning efforts through CAWMCO.

Figure IX-5 provides a summary of management agencies under this approach.

FIGURE IX-3
A WATER QUALITY MANAGEMENT ASSOCIATION APPROACH

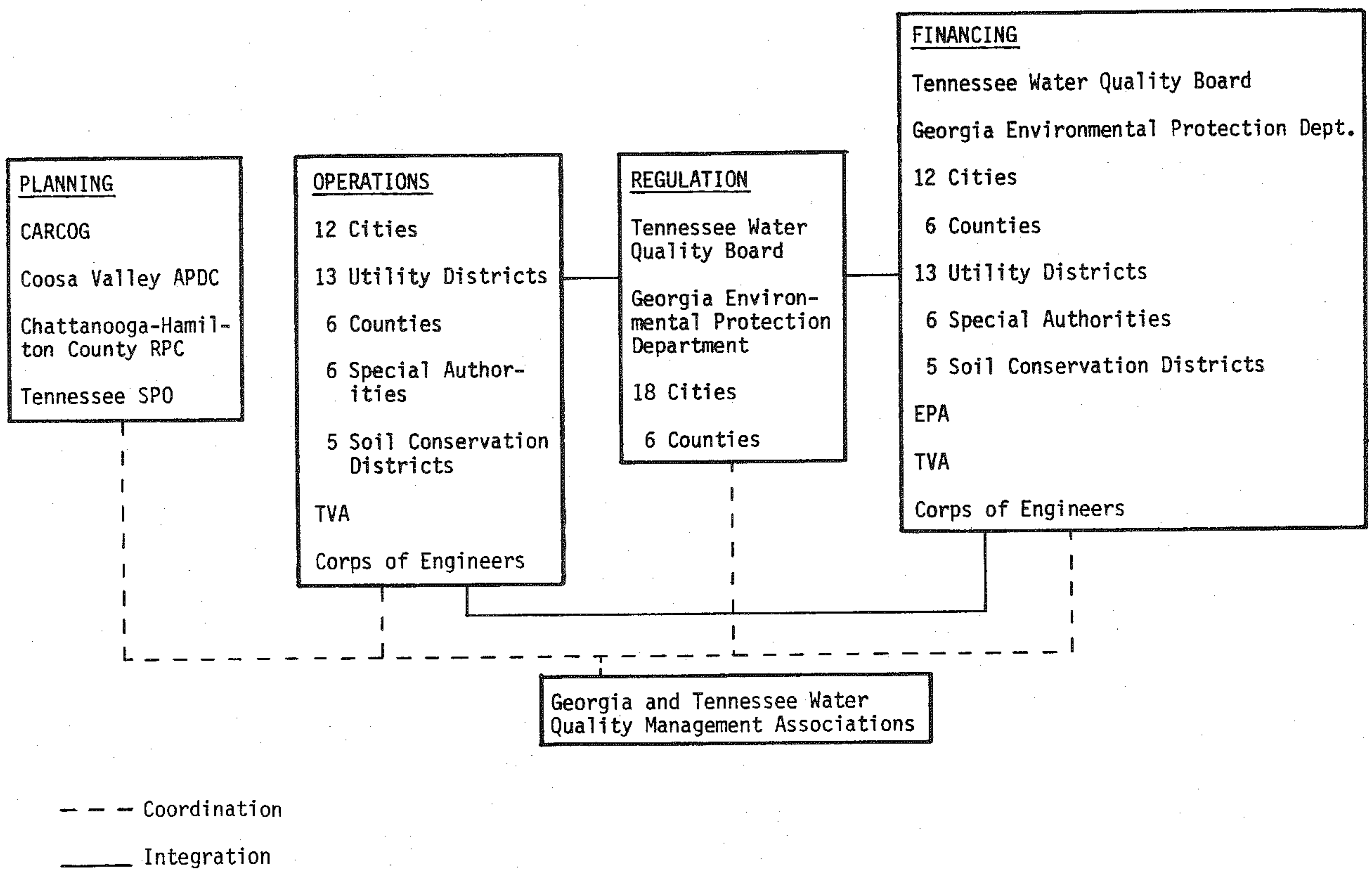


FIGURE IX-4
A SINGLE PURPOSE REGIONAL WASTEWATER MANAGEMENT AUTHORITY (RMA)

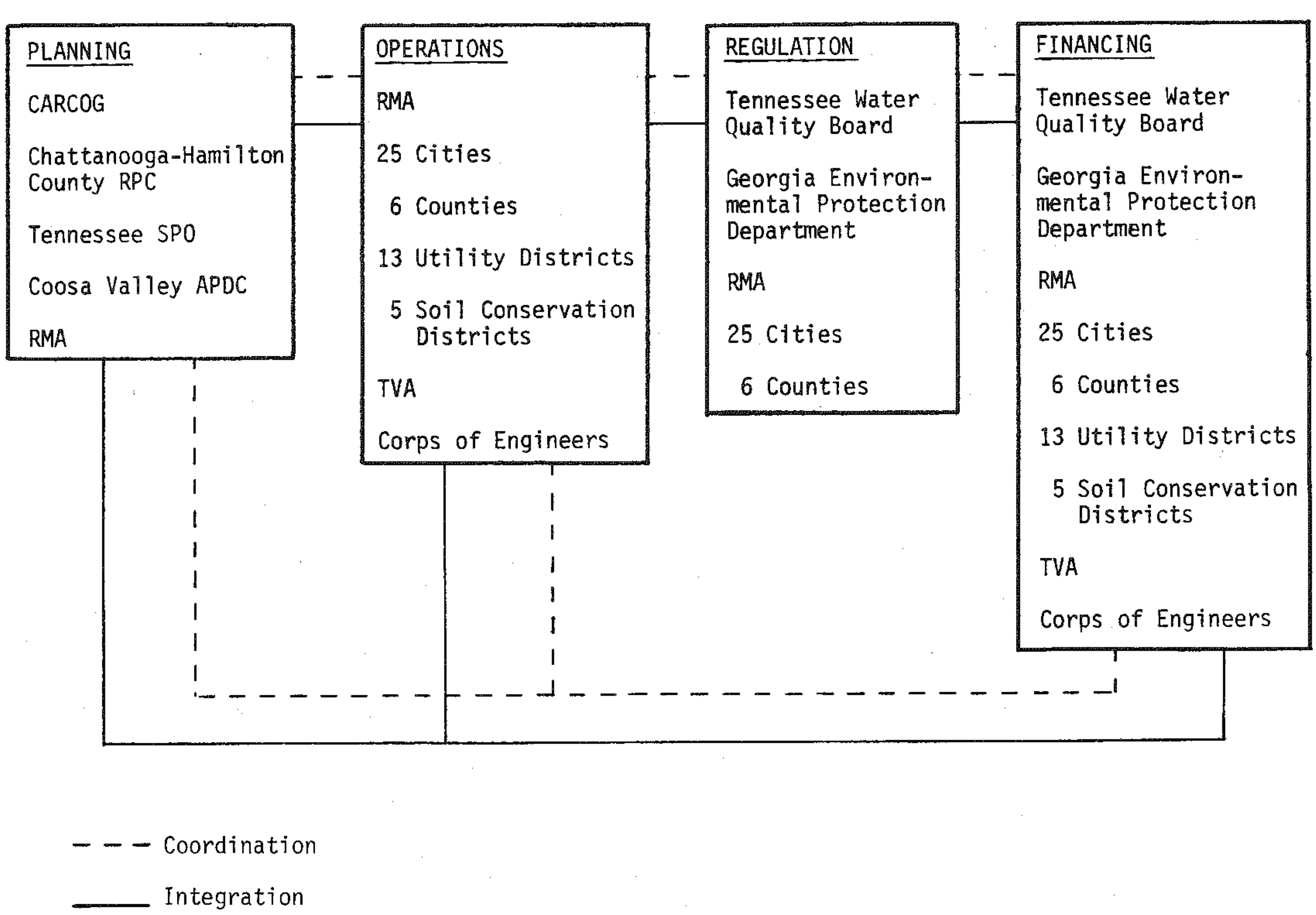
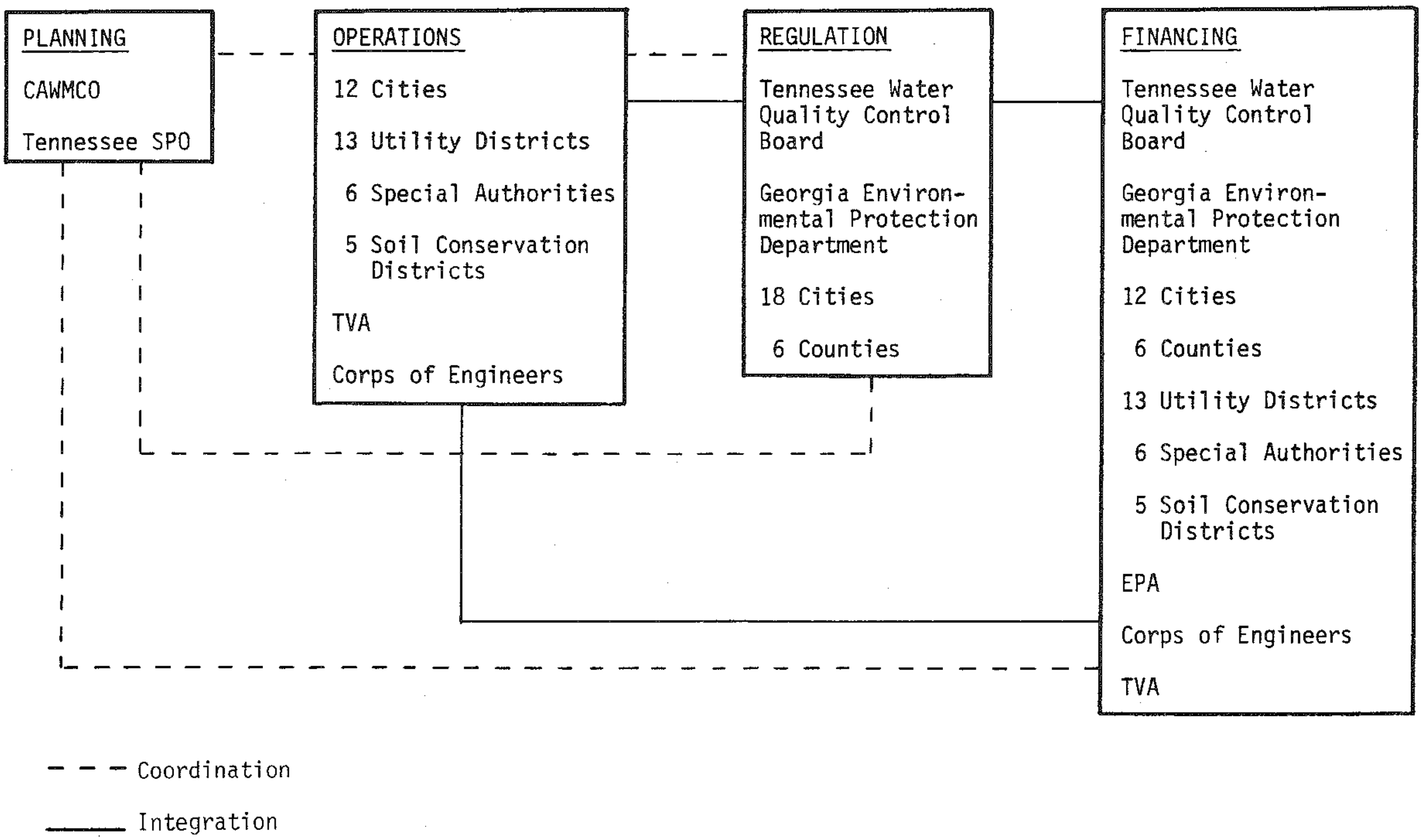


FIGURE IX-5
THE REGIONAL MANAGEMENT SYSTEM



B. NULL AREAWIDE MANAGEMENT PLAN

Under the null or "no action" alternative, institutional arrangements for the four management functions, planning, operation, regulation, and finance would generally remain the same as those identified in section A.2 of this Chapter. Arrangements for the ownership operation and maintenance of existing wastewater treatment facilities would remain the same except where approved 201 facility plans provide for other arrangements. Particular note is made of the Chattanooga 201 facility plan which recommends the closing of the Red Bank, Collegedale, and East Ridge wastewater treatment plants with flows to go to the Moccasin Bend treatment facility, the major regional wastewater treatment facility within the CARCOG/SETDD 208 Study Area. In all, thirty-seven governmental units and/or agencies would be responsible for operations. Operations pertain to the provision of wastewater treatment and collection, water supply service, flood control, and implementation of best management practices for the control of nonpoint water pollution sources.

Areawide planning would continue to be performed by the Chattanooga Area Regional Council of Governments/Southeast Tennessee Development District (CARCOG/SETDD), the Chattanooga-Hamilton County Regional Planning Commission (CHCRPC), the Tennessee State Planning Office (TSPO), and the Coosa Valley Area Planning and Development Commission (CVAPDC) with CARCOG/SETDD undertaking primary responsibility for areawide water quality planning.

Regulatory functions for point sources of water pollution would continue to be undertaken, at the state level, by the Tennessee Water Quality Control Division and the Georgia Environmental Protection Division while the U.S. EPA would retain federal regulatory authority. Eighteen cities and six counties (where applicable) would continue to regulate discharges to sewer systems and regulate urban nonpoint sources of pollution through zoning ordinances, subdivision control regulations, and septic system permit programs. Rural nonpoint source pollution abatement programs would continue to be carried out by soil (and water) conservation districts. Such programs include voluntary implementation of best management practices.

Institutional arrangements for financing water pollution controls would generally remain the same as those which currently exist.

Assuming implementation of the null alternative and no other water quality plans are implemented during the 20 year planning period, the following new management activities are likely to occur:

- Industrial Cost Recovery (ICR) charges will be implemented by wastewater treatment plant operating agencies receiving 201 grants.
- Proportionate cost user charge systems will be developed and implemented by wastewater treatment plant operating agencies receiving 201 grants.

- Additional regulation of industrial discharges to public sewer systems (i.e., revised sewer use ordinances).
- Additional state regulation of hazardous wastes disposal due to the Federal Resource Recovery Act of 1970 and the subsequent Resource Conservation and Recovery Act of 1976.
- Increased enforcement of local and new state regulations on hazardous waste transporters.
- Implementation of soil erosion and sedimentation control ordinances by Catoosa, Dade, and Walker Counties, Georgia.

C. PREFERRED AREAWIDE MANAGEMENT PLAN

The management system selected for this Plan is based on implementation of water pollution controls by existing governmental units and agencies and the private sector as applicable. Continuing areawide water quality management planning, plan coordination, and assessment are to be provided at the regional level by the 208 Policy Board and enforcement is to be provided by the Georgia Environmental Protection Division, the Tennessee Water Quality Control Division, and the U.S. EPA.

The following criteria were used in developing the management system:

- That existing ordinances and legislation be used so that implementation can be accomplished over a relatively brief period of time.
- That existing management agencies be designated unless more cost-effective arrangements can be established.
- That a new layer of planning bureaucracy not be created to implement the management system.
- That a continuing planning process be established that will meet the existing requirements of PL 92-500 and EPA; that will assist the six county area to remain eligible for EPA funding; and that will annually update the 208 areawide plan so that cost-effective measures will be utilized throughout the area to abate pollution.

Based on these criteria, a detailed management system was developed. Figure IX-6 illustrates the areawide management structure. Table IX-9 provides a listing of recommended designated management agencies with general areas of responsibility.

The narrative that follows generally describes the management system and how it is intended to function.

1. 208 Policy Board

The 208 Areawide Policy Board is to be established as a policy making, priority setting body with responsibility for the establishment and supervision of a continuing areawide water quality planning process. It will be the responsibility of the Policy Board to:

FIGURE IX-6
PREFERRED CARCOG/SETDD 208 WATER QUALITY MANAGEMENT STRUCTURE

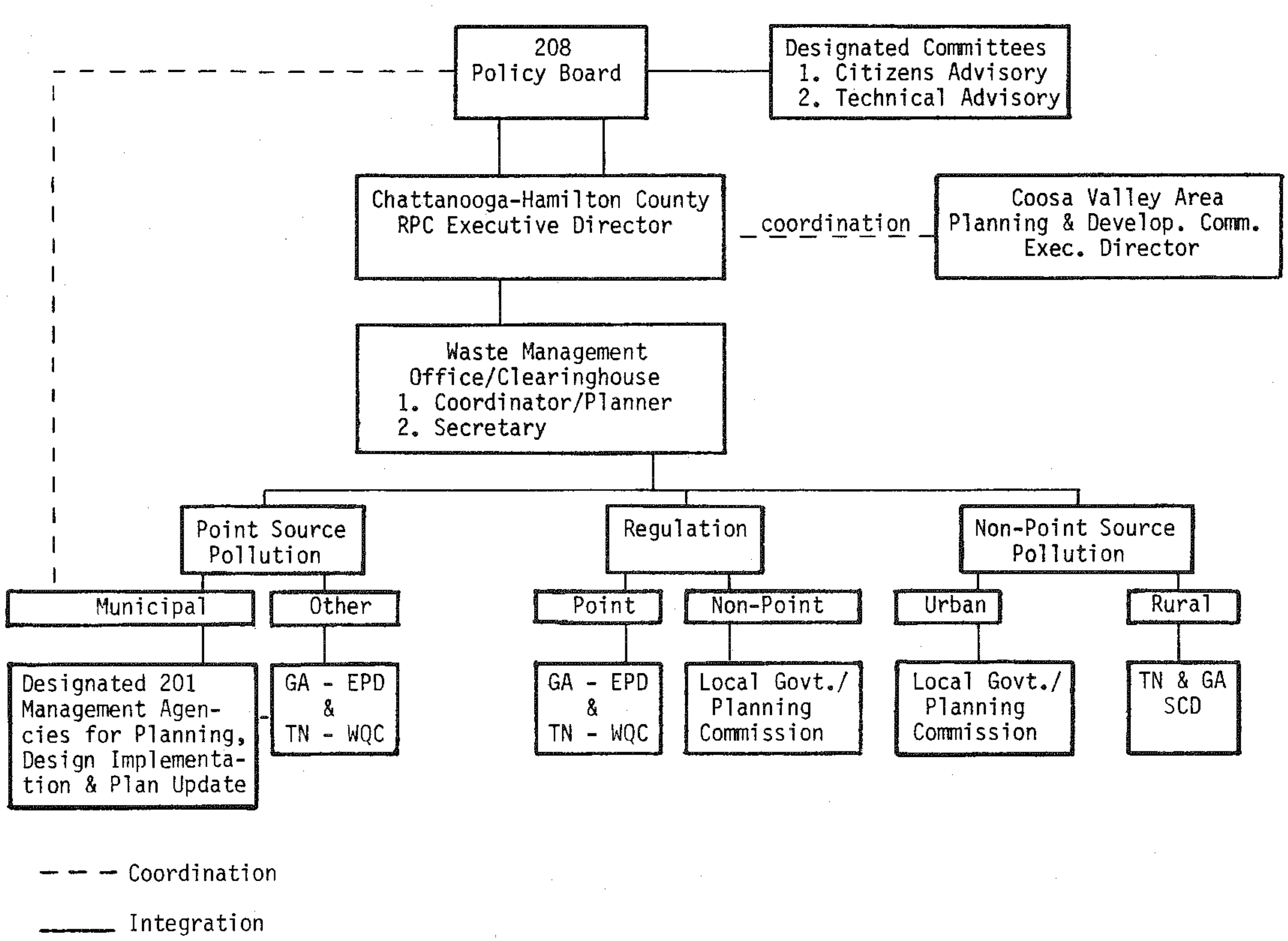


TABLE IX-9
DESIGNATED MANAGEMENT AGENCIES AND RESPONSIBILITIES

Designated Water Quality Management Agencies - Point Source	Designated Nonpoint Source Project Implementation Agencies	Designated Regulatory Agencies	Designated Planning Agencies
Class A - Wastewater Collection and Treatment System TENNESSEE Chattanooga Collegedale East Ridge Red Bank Signal Mountain South Pittsburg Dunlap	A. TENNESSEE Hamilton County Soil Conservation District Marion County Soil Conservation District Sequatchie County Soil Conservation District	A. Stream Standards, Permitting, Enforcement, Facility Grant Funds U.S. EPA Tennessee Water Quality Control Division, DPH Georgia Environmental Protection Div., DNR	A. Areawide Planning And Coordination Chattanooga Area Wastewater Management Coordination Office and 208 Policy Committee
GEORGIA Ringgold Fort Oglethorpe Chickamauga Trenton	B. GEORGIA Coosa River Water and Soil Conservation District Catoosa County Water and Soil Conservation District	B. Development Standards And Water Quality Related Planning And Land Use Policies, Controls, And Enforcement Local governments with technical assistance from Designated Planning Agencies	B. Stream Monitoring Tennessee Valley Authority
Class B - Wastewater Collection System (Only) TENNESSEE Lookout Mountain	C. All Municipal Governments In CARCOG 208 Area	C. Solid And Residual Waste Disposal Tennessee Division of Solid Waste Management and Georgia Department of Natural Resources with assistance from county Health Departments	C. Facilities Planning Local Governments D. TENNESSEE Tennessee State Planning Office (Marion and Sequatchie Counties) Chattanooga-Hamilton County Regional Planning Commission
GEORGIA Rossville Walker County Water And Sewerage Authority		D. Dredge and Fill Activities U.S. Army Corps of Engineers	E. GEORGIA Coosa Valley Area Planning and Development Commission

- Set the CAWMCO budget and assess local governments for funds to finance the budget.
- Make applications for grants through the local units of governments.
- Approve annual plan update and set priorities for implementation activities.
- Set general regulatory and management policies.
- Direct public participation.
- Approve staffing patterns and set personnel policies.
- Other activities that may be necessary and appropriate.

The Policy Board will consist of the chief elected official from each unit of government within the 208 area. An exception to this is that Chattanooga will also be represented by the Commissioner of Public Works. Voting will be on a population weighted basis with Chattanooga and the balance of unincorporated Hamilton County not to exceed 50 percent of the total vote (see Table IX-10). The Policy Board will meet quarterly or more often as appropriate.

Two designated committees, a Citizen Advisory Committee and a Technical Advisory Committee, will report directly to the Policy Board. This will provide a direct link from the continuing public participation program to the Policy Board. Each of these committees will be supported by the services of the 208 staff to the greatest extent practicable.

2. <u>Chattanooga-Hamilton County Regional Planning Commission (CHCRPC)</u>

The CHCRPC will act as the lead applicant for the 208 continuing planning program. Its offices and resources will be utilized by the 208 coordinator and secretary of CAWMCO in order to maximize efficiency. The CHCRPC will be responsible for overall plan implementation efforts, but will focus primarily on elements concerning Chattanooga and Hamilton County. The Coosa Valley Area Planning and Development Commission, by written agreement, will act as a coordinating agency with CHCRPC and focus on implementation needs of Dade, Catoosa, and Walker Counties.

3. <u>Chattanooga Area Wastewater Management Coordinating Office</u>

CAWMCO initially will be staffed by one coordinator/planner and one secretary and will be responsible to the 208 Policy Board for carrying out its policies. Administrative supervision will be provided by the executive director of the CHCRPC in concurrence with the executive director of the CVAPDC.

The functions of the CAWMCO will be to coordinate water quality related activities in the region through CHCRPC and CVAPDC, maintain awareness of water quality needs, and encourage the consideration of water quality impacts resulting from various land use developments. These purposes would be accomplished through the following operations:

TABLE IX-10
GOVERNMENTS NUMBER OF VOTES AND SHARE OF BUDGET

Government	Population*	Total Votes	Budget Fair Share**
Hamilton, Total	264,909	(71)	$ (63,225)
Chattanooga	161,978	38	38,649
Collegedale	3,600	2	860
East Ridge	23,352	6	5,577
Lakesite	689	1	164
Lookout Mtn.	1,668	2	398
Red Bank	14,677	4	3,508
Ridgeside	353	1	82
Signal Mtn.	5,739	2	1,372
Soddy-Daisy	9,554	3	2,283
Walden	1,320	1	316
Balance of County	41,979	11	10,021
Catoosa, Total	32,212	(11)	(7,686)
Ft. Oglethorpe	5,255	2	1,254
Ringgold	1,790	2	427
Balance of County	25,167	7	6,005
Dade, Total	11,741	(5)	(2,799)
Trenton	1,813	2	432
Balance of County	9,928	3	2,367
Walker, Total***	39,277	(13)	(9,378)
Chickamauga	2,204	2	526
Lookout Mtn.	1,618	1	386
Rossville	3,991	2	953
Balance of County	31,464	8	7,513
Totals:	348,139	100	$ 83,088

*Population is 1975 Estimate.
**Represents local governmental units' share of the first year Continuing Planning Process budget of $83,088 as established by the 208 Policy Board and assumes no federal matching funds.
***County population reflects only portion in 208 area.

NOTE: Vote share calculated by giving one vote to each government (20 votes) and the remaining votes (80) were assigned based on population and then calculated based on equal per capita shares. The per capita share is a bit less than $0.24.

- Update the plan annually to assure compliance with EPA grant conditions.
- Review changes in state and federal laws and regulations affecting wastewater control and provide information and technical planning assistance in order to assist local communities to comply with any such changes.
- Assist local communities in the preparation of grant applications for federal and state water pollution abatement funds.
- Maintain public participation and technical advisory programs.
- Assure consideration of water quality impacts of projects through A-95 reviews performed by CARCOG/SETDD.
- Maintain records for the Policy Board and its committees.
- Prepare budgets and assessments.
- Supervise and coordinate contractual work that might be engaged.

4. Point Source Agencies and Controls

The CARCOG/SETDD 208 Areawide Waste Treatment Management Plan recommends that the Governors of Tennessee and Georgia designate the fourteen respective local governmental bodies identified in Table IX-9 as municipal point source management agencies.

Each of the designated management agencies (DMAs) is responsible for planning, construction, operation, maintenance, financing, and general administration of its wastewater treatment and/or collection facilities. Specific municipal point source controls are contained in Chapter IV of this plan. In addition to implementing the control activities contained in Chapter IV, the DMAs will provide data and assistance to the 208 planning staff in the annual update of the Plan.

Industrial discharge control will remain under the jurisdiction of the Tennessee Water Quality Control Division, the Georgia Environmental Protection Division, and ultimately the U.S. EPA for direct dischargers, and under the control of municipal operating entities for industries that discharge into municipal systems. The industrial point source areawide plan contained in Chapter V calls for the implementation of Best Practicable Treatment (BPT) by 1977, Best Available Treatment (BAT) by 1983, and Best Convention Pollutant Control Technology by 1984.

It should be noted that all of the recommended municipal point source designated management agencies must develop and implement approved industrial cost recovery and proportionate cost user charge systems in order to meet the requirements necessary for designation as outlined in PL 92-500 Section 208 (c)(2)(A-I). The CAWMCO staff will assist facility managers in developing systems to meet these requirements.

5. Nonpoint Source Agencies and Controls

Each municipal government in the CARCOG/SETDD 208 Study Area is proposed for designation as the principal management agency for its jurisdiction and is responsible for implementing the urban runoff controls contained in Chapter VI.

For rural nonpoint sources, the five soil (and water) conservation districts identified in Table IX-9 are proposed as designated management agencies. Their primary responsibilities include the implementation of the rural nonpoint source controls presented in Chapter VII. Primarily, these controls consist of best management practices for a variety of rural nonpoint sources of pollution including: agriculture, mining, landfills, construction sites, and silvicultural activities. It should be noted that prior to implementing rural runoff controls in Georgia, implementation activities must be coordinated through and approved by the Georgia Environmental Protection Division.

Residual wastes control will remain the responsibility of the Tennessee Solid Waste Management Division, DPH and the Georgia Department of Natural Resources. It is also recommended that a regional office of the Tennessee DPH, Division of Solid Waste Management be located in Chattanooga to serve the southeastern Tennessee Counties. Presently, it is difficult for local officials to meet with state officials due to the location of existing offices in Nashville and Knoxville. Controls for solid waste disposal sites are to be implemented by the owner/operator for operating sites. A voluntary industrial residuals management program will be established with the Chattanooga Manufacturer's Association providing the necessary coordination. Details of this program are provided in Chapter VIII.

6. Regulatory Agencies Designation

The CARCOG/SETDD 208 Areawide Waste Treatment Management Plan proposes the designation of the U.S. EPA, the Tennessee Water Quality Control Division, DPH and the Georgia Environmental Protection Division, DNR as point source regulatory agencies.

Nonpoint regulatory agencies are proposed to be local units of government for the most part, with the Corps of Engineers responsible for regulating dredge and fill activities through Section 404 permits.

Consideration should be given to designating the Georgia EPA as the management agency for mining and solid waste disposal activities, and the Tennessee Division of Solid Waste Disposal and the Department of Conservation for solid waste disposal and mining activities, respectively, since these agencies currently regulate these nonpoint sources of water pollution.

7. Financial Arrangements

Three major sources of funding are available to communities to implement elements of this Plan. They are federal, state, and local funds.

a. Federal Funds

Federal funds consist of the grants and loans made available through various federal agencies for defined purposes. Additionally, general revenue sharing funds are appropriated and their use is less restrictive than those from grant and loan programs. Table IX-11 presents a list of the programs and responsible agencies.

TABLE IX-11
FEDERAL GRANT AND LOAN PROGRAMS RELATED TO WATER QUALITY

Program	Administering Agency
Irrigation, Drainage, and Other Soil and Water Conservation Loans	Farmers Home Administration (FmHA) U.S. Dept. of Agriculture (USDA)
Water and Waste Disposal Systems for Rural Communities	Farmers Home Administration (FmHA) USDA
Resource Conservation & Development Loans	FmHA, USDA
Watershed Protection & Flood Prevention Loans	FmHA, USDA
Soil & Water Loans	FmHA, USDA
Agricultural Conservation Program	Agricultural Stabilization & Conservation Service (ASCS) USDA
Water Bank Program	ASCS, USDA
Watershed Protection & Flood Protection	Soil Conservation Service, USDA
Land & Water Conservation Fund Grants	Bureau of Outdoor Recreation, U.S. Dept. of Interior
Water Pollution Control--State & Local Manpower Development	EPA
Community Development Block Grant Program	Dept. of Housing & Urban Development (HUD)
Comprehensive Planning Assistance (701)	HUD
Loans to Small Businesses under P.L. 92-500	Small Business Administration
Federal Aid Highway Program	Dept. of Transportation
Construction Grant Program (Section 201, P.L. 92-500)	EPA
CETA Funds (Comprehensive Employment & Training Act)	Dept. of Labor
Public Works Grants (Public Works & Economic Development Act)	Economic Development Administration
Agricultural Cost Sharing per PL 95-217	USDA through Soil Conservation Service

General revenue sharing constitutes another potential source of federal funds for water quality control. While these funds are of sufficient magnitude and appear stable into the foreseeable future, general revenue sharing funds have, for the most part, been assimilated into local budgets to support other programs. Therefore, some measure of reprioritization of projects may be necessary if these funds are to be used to implement elements of the Plan.

b. State Funds

Financial assistance for water quality programs is provided on an extremely limited basis by both Tennessee and Georgia. The state of Tennessee currently operates a state loan program by which local communities may borrow money in order to match Federal Construction Grants. However, a community must demonstrate that it is unable to provide the local matching funds through other sources.

The state of Georgia does not operate any water quality funding programs other than the Construction Grants Program. The state does, however, provide grants in emergency situations; for instance, when a wastewater treatment facility malfunctions and endangers a public water supply.

c. Local Funds

Local units of government have several funding options at their disposal including borrowing, the levy of property taxes and, in some cases, income taxes, licensing, and permit fees, user and connection charges, and revenue generated from fines and penalties. Of these sources of funds, however, borrowing, taxing, and licensing permit and user fees constitute the only significant local sources of water pollution control funding.

d. Financing of Continuing Planning Process

The Continuing Planning Process (CPP) will utilize local funds to support the first year CPP. Participating counties are responsible for providing these funds in proportion to their share of total population (see Table IX-10). In turn, the counties may assess the cities, based on population, to meet this obligation. If any government elects not to participate financially in the CPP, the 208 Policy Board shall have the option of denying that government all voting privileges and reapportioning its votes to the remaining governments. Additionally, continuing planning funds will be sought from EPA for partial financing of the CPP. If these funds are received, each government's share will be reduced accordingly. EPA continuing planning grants are on a 75-25 percent match basis (i.e., 75 percent of the CPP would be funded by EPA with local governments contributing the other 25 percent).

D. CONTINUING PLANNING PROCESS

As indicated in Section C of this chapter, the 208 Policy Board shall be responsible, among other things, for the annual review and revision of the Plan through CAWMCO. This function is an important one as it will provide the CARCOG/SETDD 208 Study Area with periodic analyses of water quality in the region and the status of Plan implementation.

The 208 Policy Board has already established an $83,088 budget for the first year's continuing planning program; a priority activity of which will be the refinement of any conditionally approved elements of this Plan. Other activities encompassed within the CPP are listed in Table IX-12. These are specific tasks to be considered by the 208 Policy Board and CAWMCO for the plan review and revision function. These tasks should be considered as general guidelines and should be amended or modified, as necessary, by the 208 Policy Board in order to ensure an effective annual review and revision of the Areawide Waste Treatment Management Plan.

Recommended tasks presented are those to be performed annually and those to be performed approximately every five years. This scheduling allows for a continuing general assessment of the Plan and Plan implementation, and of significant areawide trends affecting water quality on a continuing basis while restricting detailed reevaluation to a less frequent interval. The CPP tasks (see Table IX-12) have been grouped by functional activity with their respective frequency intervals noted.

This list of tasks identifies the major activities associated with the review and update of the Plan. Emphasis on a particular task may vary from year to year, depending upon many factors.

The cost of the continuing planning process will primarily be that of a small full time staff (one coordinator/planner and one secretary). The cost of the first year CPP has been set at approximately $83,000. The cost of the major review that should occur every five years, however, cannot be estimated at this time and will depend upon the level of effort that the 208 Policy Board determines necessary to complete the plan revision.

1. Special Continuing Planning Projects

In addition to the plan review and revision function, it is recommended that CAWMCO perform and/or coordinate the following major tasks if funding becomes available to further the evaluation of the 208 area's water quality problems and to further the development of cost-effective solutions.

a. Eutrophication Studies

Continue monitoring eutrophication rates of the Nickajack and Chickamauga Reservoirs in order to determine the need for additional

TABLE IX-12
CONTINUING PLANNING PROCESS TASKS

Tasks	Frequency
1. Land Use	
a. Evaluate the impacts of major land use changes on public sewerage capabilities and non-structural control needs.	Annual
b. Maintain file of approved changes in land use plans, zoning ordinances and other pertinent land use regulations impacting water quality.	Annual
c. Review and assess water quality implications of regional land use trends and propose alternatives and/or controls.	5 years
d. Document significant land use changes and analyze for water quality impact.	5 years
e. Review population and employment projections.	Annual
2. Environmental Assessment	
a. Assess impacts of plan implementation on environmental conditions.	5 years
3. Water Quality	
a. Maintain inventory of existing water quality data.	Annual
b. Maintain inventory of point source dischargers, permit limitations and effluent characteristics.	Annual
c. Maintain inventory of nonpoint sources and characterize to the extent feasible (SCD's responsibility).	Annual
d. Maintain inventory of data on flow conditions (especially low flows) in the area's rivers and streams.	Annual
e. Project and evaluate existing and future wastewater flows and loads.	5 years
4. Technical Components of Plan	
a. Maintain inventory of sewer system evaluation surveys (SSES) and rehabilitation projects and results.	Annual
b. Maintain inventory of the progress of other projects under the Construction Grants Program.	Annual
c. Determine effect of projects completed under the Construction Grants Program on wastewater flows and loads.	Annual

TABLE IX-12
CONTINUING PLANNING PROCESS TASKS (Continued)

Tasks	Frequency
4. Technical Components of Plan	
d. Adjust construction priorities as necessary and review States' Priority listings.	Annual
e. Coordinate technical data with water quality and land use changes and make appropriate computer simulations to assess impacts of changes.	5 years
f. Assess and make necessary changes in the computer model input parameters, assumptions and coefficients.	5 years
g. Modify appropriate sections of the technical plan based upon the changes in technical data, water quality information and land use development trends.	5 years
5. Management Components of Plan	
a. Review management goals and assess progress toward achieving those goals.	Annual
b. Review development practices and effectiveness of regulatory authorities for the control of water pollution.	Annual
c. Review and assess implementation progress of priority projects and adjust priority schedule as necessary.	Annual
d. Review legal, financial and political ramifications of plan implementation.	Annual
e. Review legislation or intergovernmental agreements necessary for implementation of the plan and assess need for new or additional action.	Annual
f. Review staffing and budget requirements for continued implementation and coordination of the Plan.	Annual
6. Public Participation	
a. Acquire input from local governmental units documenting their concerns, problems and prospects regarding plan implementation.	Annual
b. Involve Citized Advisory and Technical Advisory Committees and interested publics in the review and revision of the Plan.	Annual
c. Prepare report documenting plan assessment and proposed changes, distribute to participating governments, TDPH, GEPD and U.S. EPA and other appropriate entities and hold public hearings for review and comment.	Annual

nutrient removal facilities at municipal wastewater treatment plants in the CARCOG/SETDD 208 Study Area.

b. Water Intakes

The following three projects relate to drinking water intakes:

- Develop an inventory of potential industrial spill sites having impact on water intakes.
- Coordinate the development of a voluntary Spill Prevention Control and Countermeasure Plan (SPCC) for each potential industrial spill site which may adversely affect water quality in the area of drinking water intakes. A SPCC Plan is a contingency plan designed to minimize environmental and public health damage resulting from industrial spills.
- Adopt an industrial growth policy which would preclude the potential for future industrial spills.

c. Urban Runoff Projects

The following projects relate to urban runoff:

- Construct disinfection facilities at the points of combined sewer overflows in high priority combined sewer problem areas as a demonstration project to determine the effectiveness and benefits to be derived from this type of control measure.
- Install a swirl concentrator in a high priority combined sewer problem area as a demonstration project to determine the effectiveness and benefits to be derived from this type of control measure.
- Implement a demonstration street sweeping program and evaluate its effectiveness in reducing the pollutional load from urban runoff.
- Assist local units of government to develop soil erosion and sedimentation control ordinances relative to costruction activities.
- Evaluate in-line storage capacity of existing storm sewer systems for abatement and control of urban runoff related pollution as a means to more cost-effectively treat urban runoff.

d. Rural Runoff

- Review and coordinate rural nonpoint source reduction demonstration programs with the Soil Conservation Service and local soil (and water) conservation districts.
- Conduct an extensive public information and education program pertaining to rural nonpoint source best management practices and the 208 nonpoint source control plan throughout the six county 208 area.

- Provide additional technical assistance to further define and demonstrate effective methods of on-site sewage disposal in the Chattanooga area in cooperation with county and state health departments.
- Conduct additional investigation and evaluation of potential groundwater pollution resulting from above and below ground disposal of solid waste.
- Monitor water quality and model rural runoff priority areas to determine effectiveness of rural runoff controls and to assess plan implementation.

e. Industrial Wastewater Treatment

Perform a cost-effective evaluation for the development of regional industrial wastewater treatment facilities with respect to the attainment of "Best Available" and "Best Conventional Treatment" by industries in the CARCOG/SETDD 208 Study Area on an individual basis.

f. Residuals

Initiate a regional sludge disposal program to determine the most cost-effective and environmentally sound means of municipal sludge disposal.

2. Continuing Planning Process Summary

In summary, the component of the continuing planning process and the annual review and update that will eventually lead to its success or failure is coordination. The coordination role will be filled by the 208 Policy Board through the Chattanooga Area Wastewater Management Coordinating Office (CAWMCO) and is one of both providing assistance to local governments in plan implementation, and one of overseeing implementation efforts of local governmental units to ensure that the agreed upon areawide plan is being adhered to. These coordination activities encompass all of the previously described tasks. The overall goal of the coordination function is to maintain consistency in local plan implementation efforts through open discussion arriving at mutual agreement concerning the course of action to be taken.

E. SUMMARY AND COMMENTS

This Chapter has outlined the federal management system requirements, the existing management system of the CARCOG/SETDD 208 Study Area, the alternative management systems considered, and finally, the management system for the implementation of this Areawide Waste Treatment Management Plan. To review the preferred system briefly:

- Existing point source control agencies, essentially, local municipal wastewater system owners, the Tennessee Water Quality Control Division, the Georgia Environmental Protection Division, and the U.S. EPA are proposed for designation by the governors of Tennessee and Georgia to control point sources within the framework of federal and state law and this Plan.

- All local governmental units of the CARCOG/SETDD 208 Study Area are proposed for designation by the governors to control nonpoint source controls within the areas of their jurisdiction. The U.S. Army Corps of Engineers will retain regulatory authority over dredge and fill activities.

- A 208 Policy Board with two advisory committees and a waste management coordination office is established and proposed for designation by the governors to carry out continuing areawide water quality planning, plan assessment and coordination, to provide assistance to local units and regional planning agencies in Plan implementation, and to undertake continued public participation efforts and other functions as necessary.

- Generalized funding sources for implementation of the controls described in the plan are presented.

- Recommended tasks for the Plan review and revision function are also presented.

This management system responds to the requirements of the law and to the water quality needs of the CARCOG/SETDD 208 Study Area. It can be implemented within the existing legal framework and it is politically acceptable since this management system is based on existing institutional arrangements with which area governments are familiar.

It should be noted here that Marion and Sequatchie Counties have requested to withdraw from the CARCOG/SETDD continuing water quality management planning area following plan completion. It should also be emphasized that these two counties have fully participated in the development of this plan, and water pollution controls for these two counties contained herein remain applicable. However, continued areawide water quality management planning activities for Marion and Sequatchie Counties will become the responsibility of the Tennessee Division of Water Quality Control through its continuing planning program.

CHAPTER X - PUBLIC PARTICIPATION

X
PUBLIC PARTICIPATION

A. REQUIREMENTS OF PUBLIC LAW 92-500

In Public Law 92-500, Congress set forth a comprehensive requirement for public participation in all programs established under the Act. Section 101(e) of PL 92-500 contains the declaration of congressional intent on this matter.

> "Public participation in the development, revision and enforcement of any regulation, standard, effluent limitation, plan, or program established by the Administrator or any State under this Act shall be provided for, encouraged, and assisted by the Administrator and the States. The Administrator, in cooperation with the States, shall develop and publish regulations specifying minimum guidelines for public participation in such processes."

B. APPROACH

The CARCOG/SETDD 208 study public participation program was designed to interest, inform and involve as many sectors of the public as possible in the planning process. This is reflected in the objectives established for the program:

- Inform and educate the citizenry of the planning area about the origin, structure and purpose of the planning program.
- Secure citizen input to assist the planning staff and the Policy Board in the development of the CARCOG/SETDD Areawide Waste Treatment Management Plan.

Two general approaches were utilized during the course of the planning process to accomplish these objectives: Public Information and Public Participation.

1. Public Information

Public Information efforts included:

- Establishing an information flow system.
- Distributing a "public awareness" brochure.
- Provision of an audio-visual presentation entitled "208: Toward Clean Water for the Chattanooga Metropolitan Area.
- Providing a 208 Speakers Bureau.

- The distribution of "Waste Management News," a quarterly newsletter.

- Information releases to the news media.

- Promoting news coverage of public meetings through advanced notification of the media.

Information System

A staff member of the CARCOG/SETDD Waste Management Planning office was designated as the public participation coordinator and assumed the responsibilities of maintaining communications between various citizen groups and project staff, maintaining contact with the press, and generally coordinating the flow of 208 information to the public.

Brochure

A brochure was prepared and was widely distributed during the initial planning process. Its intended purpose was to heighten citizen awareness of local water quality problems and to inform the general public that an agency and a program exist to formulate a plan to manage those same problems. The brochure also invited concerned citizens to participate in the decision making process.

A-V Presentation/Speakers Bureau

The audio-visual presentation was utilized in conjunction with the speakers bureau. Letters were sent to nearly 300 civic, business, environmental and social groups inviting them to utilize the speakers bureau and the slide-tape presentation. Response to this effort was quite favorable in that twenty-six presentations were made from February, 1977 through June, 1977. At each meeting, 208 planning staff presented the slide-tape presentation which discusses various sources of water pollution, pollution controls, and the water management planning process, after which staff answered questions concerning the program. Table X-1 provides a list of group presentations held along with the date and number of persons in attendance.

Newsletter

The project staff published five quarterly newsletters during the planning period. These newsletters contained information on major developments in the planning program, and were distributed to approximately 300 area residents included in CARCOG/SETDD mailing lists. In addition, articles related to the 208 program were included in the regular monthly newsletters of CARCOG/SETDD and CVAPDC.

Media Program

The media program consisted of press releases distributed in advance of meetings of the Policy Board, the Citizens Advisory Committee and the

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TABLE X-1: SPEAKERS BUREAU PRESENTATIONS

Date	Group	Attendance
2/1/77	Holly Hills Garden Club	15
2/15/77	Chattanooga Homebuilders Association	75
2/18/77	Mocassin Bend Girl Scout Leaders	9
2/22/77	WMP Citizens Advisory Committee	17
2/23/77	H. L. Barger Sixth-graders	100
2/24/77	Chattanooga-Hamilton County Regional Planning Commission	10
3/3/77	Brainerd Optimists Club	30
3/9/77	Sierra Club	25
3/17/77	Sertoma	25
3/17/77	Contractors Specification Institute	10
3/21/77	Chattanooga Engineers Club	90
3/22/77	UT-C Environmental Class	10
3/22/77	UT-C Geography Class	30
4/1/77	Concord Hill Garden Club	9
4/5/77	Northshore Forest Garden Club	14
4/13/77	Chattanooga Jaycees	25
4/20/77	Senior Neighbors	15
5/5/77	Engineers Task Force	14
5/6/77	UT-C Class	37
5/11/77	Signal Mountain	30
5/11/77	Community Services Group	15
5/26/77	Signal Mountain League of Women Voters	3
5/26/77	League of Women Voters	6
6/7/77	East Side Senior Citizens	42
6/9/77	East Ridge Senior Citizens	15
6/20/77	Dodson Avenue Neighborhood Center Senior Citizens	75

Technical Advisory Committee; public service announcements distributed to radio and television stations to promote public hearings; advance contact with reporters to encourage coverage of meetings, and close cooperation with reporters covering program development, including the distribution of written background materials. As a result of these activities, at least twenty stories directly concerning the Waste Management Program appeared in the area press, most of them in the two Chattanooga dailies. In addition, Policy Board meetings were covered by local television stations on three occasions, and WTVC-TV produced and aired a 30-second public service announcement on the final round of public hearings. That announcement also was made available on video tape to two other commercial television stations in Chattanooga. Written public service announcements were mailed to area radio stations.

2. Public Participation

Public Participation efforts included:

- Establishing an areawide Citizens Advisory Committee.
- Distributing public opinion questionnaires.
- Holding Public Hearings.

Citizens Advisory Committee

A 30 member Citizens Advisory Committee (CAC) was organized rather late in the planning process due to administrative difficulties concerning the public participation contract arrangements. However, once organized, the CAC did provide some valuable input.

A balanced and broad cross section of the public was represented on the CAC due to the efforts of the staff to solicit representation from the following types of organizations:

- Civic
- Education
- Journalism/Communications
- Agricultural
- Commercial
- Industrial
- Health/Medical
- Social Service
- Labor
- Environmental
- Minority

Geographical balance was achieved by reserving 15 seats for representatives from Chattanooga-Hamilton County and 3 seats each for the remaining five counties.

The initial meeting of the committee was held on January 17, 1977. Subsequent meetings were held on February 22, May 17, May 24, and June 23, 1977.

From the beginning, the Committee was told that it would not be asked to take votes or issue formal resolutions until the members of the Committee felt the need to do so. Although some sentiment eventually developed for issue-by-issue recommendations adopted by Committee votes, this never occurred. Most of the members attending the meetings apparently felt it best to respond individually, rather than collectively, to the information presented to them.

The first three meetings of the Advisory Committee were largely informational in nature. Members of the staff and project consultants presented various aspects of their work and gave the Committee some background on the nature of the water quality problem in the Chattanooga area, the requirements of PL 92-500, and the alternatives under consideration by the staff.

The meetings of May 17 and May 24 saw exhaustive discussions of the management system issue. Some members of the Committee expressed the opinion that the management system should be their chief concern, inasmuch as they did not feel qualified to comment intelligently on technical aspects of the program.

Most of the discussion on the management system centered on the composition of the Policy Board. The members of the Committee appeared to feel strongly that the final plan should contain guarantees of continued citizen participation in the decision-making process, and some suggested arrangements for selecting citizens for membership on the Policy Board. Others expressed the view that the Policy Board should consist entirely of elected officials, who have been chosen by their constituents to make policy decisions affecting their communities. Even so, sentiment was virtually unanimous that some form of continued citizen participation be included in the final plan.

Consequently, the Citizen Participation section of the recommended plan includes a provision retaining the present Citizens Advisory Committee to be consulted by the Policy Board prior to the making of program decisions.

The meeting of June 23 was presented with the draft plan. This meeting produced the suggestion that the Waste Management Agency should be combined with the Chattanooga-Hamilton County Air Quality County Board, in effect establishing a regional environmental protection agency. Several variations of such an arrangement were discussed, but no formal recommendation was agreed on.

Public Opinion Questionnaire

Public opinion questionnaires were another means utilized to facilitate public input. These were distributed at presentations made by the speakers bureau. The objective of the questionnaire was to provide a very general picture of citizen's attitudes toward:

- Growth issues
- Environmental problems
- Relative importance of water quality issues
- Existing water quality in the 208 area
- The level of government at which pollution control activities should take place

The results of this effort clearly indicate that water pollution is recognized as a significant problem by the general public; furthermore, respondents tended to agree that water quality concerns should be considered in the formulation of future development policies and that local government should play a major role in any program of pollution control. The following is a summary of public response to selected questions:

- Do you feel that growth is good for the community?

  65% responded yes   33% responsed no
  Of those who responded yes, 75% of them said that growth should only be allowed if there would be no increase in the amount of water pollution generated.

- Do you feel that the quality of our area's waters has improved?

  26% responded yes   36% responded no
  38% felt there was no change
  The majority of respondents felt that the reason that the water quality had improved was due to state and federal efforts.

- Do you feel that the quality of the area's waters has declined, why do you think this has occurred?

  Industrial sources were cited as the major contributor with municipal treatment facilities and garbage dumping activities as secondary sources.

- How serious do you think the water pollution problem is for our area?

  46% severe   31% moderate   23% not a problem

- In your opinion what level of government should carry out a water pollution control program for the Chattanooga area?

  21% federal   32% state   41% local

- What aspect of the community do you feel needs the most attention?

  Air pollution was cited as the first aspect, followed by water pollution, public apathy, and general community services and facilities.

Public Hearings and Policy Board Meetings

Six Public Hearings were held during the course of the Water Quality Management Project. Despite the efforts of project staff to stimulate interest in these hearings, turnout was uniformly poor and very little public input took place. Following is a schedule of public hearings.

PUBLIC HEARINGS

	Date
Presentation of problem definition phase of the project. Held in Ft. Oglethorpe.	5/18/76
Presentation of Problem definition phase of the project. Held in Chattanooga.	5/19/76
Presentation of the four alternative management concepts. Held in Dunlap.	3/22/77
Presentation of the four alternative management concepts. Held in Chattanooga.	3/24/77
Presentation of the four alternative management concepts. Held in Ft. Oglethorpe.	3/25/77
Presentation of the Preliminary Draft Plan. Held in Chattanooga.	6/02/77
Presentation of the Preliminary Draft Plan. Held in Fort Oglethorpe.	6/03/77

In addition to the public hearings, nine Policy Board meetings were held. These meetings were open to the public and were widely advertised through newspapers, newsletters and radio public service announcements. The following summarizes the topics discussed at these meetings.

POLICY BOARD MEETINGS

Subject	Date
The purpose of the meeting was to explain how the program would be coordinated with ongoing cognate programs in the region.	8/21/75
Held to select consultants. Heard CSAC recommendation and staff recommendation. Approved staff recommendation.	2/18/76
Problem Definition, Program Priorities, Work Program to review resolution to proceed with contract and agreement negotation.	5/17/76
Presented Budget Status, Citizen Participation Plan, Work Program Briefing (Progress), Media Program, General Program Briefing.	10/18/76
Purpose: To present alternative Management concepts. Members of CAC were in attendance.	3/29/77

POLICY BOARD MEETINGS

Subject	Date
Total Plan presented.	7/7/77
Management System was discussed.	7/19/77
Set preliminary budget for Management Systems.	7/14/77
To approve Final Draft Plan.	9/21/77

Minutes of the public hearings and the Policy Board meetings are contained in the Annual and Semi-Annual reports submitted to EPA, GEPD, and TDWQC.

C. CONTINUING PUBLIC PARTICIPATION

The continuing public participation and information program will be effected through the following mechanisms:

- Library depositories
- News releases to the media
- Continuation of the Speakers Bureau
- Publications - Newsletters and Updated Water Quality Management Reports
- A Citizens Advisory Committee
- A Technical Advisory Committee
- Public Hearings

1. Library Depositories

Plans, projections, maps and other informational materials developed during the continuing planning program will be made available to interested citizens through the establishment (by CAWMCO) of depositories in the major public libraries of the area, including:

- Chattanooga Bicentennial Library
- John Storrs Fletcher Library, University of Tennessee at Chattanooga
- Orena Humphrey Public Library, Whitwell
- Cherokee Regional Library, LaFayette
- Chickamauga Public Library
- Dade County Public Library, Trenton
- Rossville Public Library

2. News Releases

The Chattanooga Area Waste Management Coordination Office (CAWMCO) will continue to inform print and broadcast news media well in advance of scheduled Policy Board Meetings, Advisory Committee Meetings, public hearings and special events to insure news coverage. Media representatives will also continue to receive pertinent background materials from the CAWMCO.

3. Speakers Bureau

CAWMCO will continue the operation of the Speakers Bureau. Audio-visual presentations similar to that used during the initial planning effort will also be utilized.

4. Publications

The CAWMCO will issue a quarterly newsletter for distribution to elected officials, related public agencies, the press, the Policy Board, Advisory Committee Members, business and industrial concerns, schools and colleges, and any member of the general public who wishes to be placed on the mailing list. Initially, the mailing list will include approximately 500 addresses drawn from lists secured from other agencies. The newsletter shall cover a broad range of topics related to the activities of CAWMCO, with the purpose of giving readers understanding of the program's role within the framework of local, state and federal efforts toward improving water quality. In addition to the newsletter, the CAWMCO will produce reports concerning updates and revisions to the CARCOG/SETDD Areawide Waste Treatment Management Plan.

5. Citizens Advisory Committee

The proposed management system calls for the continuation of the present Citizens Advisory Committee. This committee will be directly responsible to the Policy Board for reviewing and recommending revisions to the areawide waste treatment management plan. Other functions of the CAC shall be to:

- Review and comment on continuing planning program work activities.
- Recommend activities to the Policy Board to be undertaken by CAWMCO.
- Review and assess Plan implementation.
- Review and assess the continuing public participation program.

6. Technical Advisory Committee

The proposed management system calls for the continuation of the Technical Advisory Committee. However, the focus and intent of this committee will be changed somewhat from that during the initial planning process since during that time the TAC was not considered a portion of the public participation program. The original TAC largely consisted of federal and state agency representatives and served, mainly, to review technical components of the plan. Under the proposed plan, the TAC would become a means of public participation by expanding its membership to include the following technical interests:

- Conservation and environment
- Business and industry
- Mining
- Forestry
- Health department and drainage control personnel
- Wastewater treatment plant operators

Representation on the TAC would also be solicited from the following public agencies:

- U.S. EPA
- Soil Conservation Service
- U.S. Department of Agriculture
- Tennessee Division of Water Quality Control, DPH
- Georgia Environmental Protection Division, DNR
- Tennessee State Planning Office, Southeastern District
- Chattanooga Area Regional Council of Governments
- Chattanooga-Hamilton County Region Planning Commission
- Coosa Valley Area Planning and Development Commission
- Tennessee Valley Authority

The functions of the TAC would also be expanded. These shall be to:

- Review technical outputs of the CAWMCO.
- Provide a formal avenue for technical input to the continuing planning process.
- Review and assess implementation of technical components of the plan.
- Recommend revisions to technical plan components.
- Assist local governments implement portions of the plan by providing technical advice.
- Provide input to the Policy Board concerning all technical aspects of the continuing planning program.

7. Public Hearings

Public hearings will be held in order to further provide opportunity for public review and comment on proposed changes to the Plan. Identical hearings shall be held in Chattanooga and Fort Oglethorpe to provide maximum opportunity for citizen participation. It is also recommended that the Advisory Committees and the Policy Board, as well as CAWMCO staff participate in the conduct of the hearings.

In conclusion, the key to any public participation program is two-way communication. The continuing public participation program, outlined above, adequately provides for this; however, the success of this program will ultimately depend upon the determination and concerted efforts with which the CAWMCO, Policy Board and the Advisory Committees carry out their assigned tasks.

CHAPTER XI
SUMMARY OF THE PROPOSED PLAN FOR THE CARCOG/SETDD 208 STUDY AREA

XI

SUMMARY OF THE PROPOSED PLAN FOR THE CARCOG/SETDD 208 STUDY AREA

A. INTRODUCTION

To provide for comprehensive planning to meet regional water quality needs, the Congress of the United States, through its legislative process, has mandated the creation of regional planning commissions and the subsequent formulation of areawide waste treatment management plans. In response to these mandates, the Chattanooga Area Regional Council of Governments/Southeastern Tennessee Development District (CARCOG/SETDD) received a federal grant on June 5, 1975 for the development of a regional water quality management plan. This Plan, designated as the CARCOG/SETDD 208 Areawide Waste Treatment Management Plan, was prepared pursuant to the requirements of Section 208 of the 1972 Federal Water Pollution Control Act Amendments (Public Law 92-500). Through Section 208, Congress intended that water quality mangement planning be carried out on an areawide basis and that it investigate, evaluate, and prepare a comprehensive plan to control all sources of water pollution for a 20 year planning period. This proposed plan for the Chattanooga area is summarized herein.

B. PURPOSE AND GOALS OF THE PLAN

The purpose of the CARCOG/SETDD 208 Areawide Waste Treatment Management Plan is to provide an ongoing procedure for the implementation of pollution abatement measures to meet the nation's 1983 water quality goals. These goals seek the effectuation of water quality controls to achieve stream conditions suitable for the protection of fish and wildlife and the recreational use of the water. In conjunction with these national goals, a major portion of the proposed plan is devoted to ensuring the fishability and swimmability of all waters, where attainable, in the Chattanooga regional area by July 1, 1983. Other major goals of the 208 planning process are:

- The elimination of pollutive discharges to all navigable waters by 1985.
- The application of best conventional pollutant control technology for conventional (oxygen demanding) pollutants and best available technology for the removal of toxic and non-conventional pollutants from all industrial sources by July 1, 1984.

Achievement of these goals will result in significant water quality improvements for the CARCOG/SETDD 208 Study Area and compliance with the provisions of Public Laws 92-500 and 95-217.

With the above major goals in mind, this plan has addressed sixteen (16) planning elements required by the Section 208 regulations, 40 CFR 131, November 28, 1975, Section 131.11 (a)(p). These planning elements include:

- Establish planning boundaries.
- Perform a water quality assessment and propose water quality segment classifications for area streams.
- Compile discharger, demographic, and land use inventories and projections.
- Perform a nonpoint source assessment.
- Review water quality standards.
- Develop total maximum daily loads of pollutants.
- Review or propose point source load allocations.
- Identify municipal waste treatment system needs.
- Evaluate industrial waste treatment system needs.
- State nonpoint source control needs.
- Outline residual wastes and land disposal needs.
- Assess urban and industrial stormwater treatment system needs.
- Project target abatement dates.
- Establish regulatory programs.
- Identify management agencies.
- Perform an environmental, social, and economic impact assessment of the proposed plan.

These planning elements were designed to provide the necessary evaluations and inputs for the development of a comprehensive water quality management plan. The responsibility for performing the planning elements related to the development of total maximum daily loads of pollutants and point source waste load allocations was not delegated to the CARCOG/SETDD, and these elements are, therefore, not discussed herein. The planning process through which the other planning elements were accomplished is described below.

C. PLANNING PROCESS

On October 10, 1974, the CARCOG/SETDD was designated as the water quality management planning agency for the Tennessee counties of Hamilton, Marion, and Sequatchie, and the Georgia counties of Catoosa, Dade, and Walker. The receipt of a $949,000 grant in 1975 initiated a planning process that has continued for over two years. This planning process involved a start-up period and ten broad work element areas which facilitated the development of the final CARCOG/SETDD 208 Areawide Waste Treatment Management Plan. These work elements and their outputs are discussed below.

The start-up period of the planning process achieved the selection of the consultants, review of the river basin plans, definition of areawide water quality problems, and establishment of two advisory committees. These two committees, the Technical Advisory Committee (TAC), and the Citizens Advisory Committee (CAC) served to review, comment, and make recommendations on the technical and management aspects of the plan. The CAC was composed of local representatives of civic, commercial, industrial, social science, and environmental organizations, while the TAC consisted of federal and state officials. Both these committees made their recommendations directly to the Policy Board, a group of local officials having the ultimate decision-making responsibility in the 208 process. Both the TAC and the CAC will continue to operate as a part of the public participation phase of the program.

Completion of the start-up phase of the planning process led to the initiation of the early work elements. These work elements assembled and reviewed existing demographic, environmental, and land use data, and used these data to develop land use options. Once this was accomplished, a group of six work elements was designed to analyze existing and future conditions in order to aid in the formulation of control options for the reduction of pollution from various sources. These options were outlined for the following sources:

- Point Sources
- Urban Runoff
- Rural Runoff
- Solid Waste and Residuals

Additionally, controls relating to two other areas, regional water quality and management, were also formulated. Upon development of these controls, the final work elements of the planning process were begun. This phase of the 208 mechanism is concerned with the refinement and formation of the plan from the previously formulated control options, as well as the implementation and public participation aspects of the final plan. The end product of this process, the CARCOG/SETDD 208 Areawide Waste Treatment Management Plan, has three distinct facets (the Point Source Plan, the Nonpoint Source Plan, and the Management Plan), all of which are summarized below.

D. PROPOSED POINT SOURCE PLAN

The pollution abatement mechanisms delineated by the proposed plan as being point source controls include those programs, policies, or construction activities required to reduce water pollution attributable to wastewater treatment facilities and industrial discharges. Included in these pollutant mitigating actions are any necessary modifications to existing systems or the establishment of new controls. The proposed Point Source Plan has been divided into two components to address the control of pollution from different types of point sources. These are:

- The Municipal Point Source Plan.
- The Industrial Point Source Plan.

The development of particular control measures for each category of point sources assures the establishment of a water quality improvement program that is specific in its recommendations, and at the same time, comprehensive in nature. Each of these plans for the CARCOG/SETDD 208 Study Area is described below.

1. Municipal Point Source Plan

The Municipal Point Source Plan assumes the operation of the following wastewater control mechanisms:

- Any wastewater treatment plant (WWTP) currently under construction.
- Any WWTP, although only in the proposal stage, which will probably be constructed during the planning period.
- Any program or policy to control point source pollution (including 201 plans) that is currently being implemented or which will be implemented during the planning period.

This plan also assumes compliance with the National Pollutant Discharge Elimination System (NPDES permits), 303(e) River Basin Plans, and the Construction Grants Program (where construction will occur). The point source controls to be enacted by the plan are described below.

Under the Municipal Point Source Plan (see Figure XI-1), the existing Moccasin Bend wastewater treatment facility would be expanded and upgraded to treat regional flows from the present Brainerd, East Ridge, Red Bank, Soddy-Daisy, Collegedale, and Fort Oglethorpe service areas. Interceptor sewers would be constructed to transmit these flows to the regional facility. The plan also calls for the expansion and improvement of the existing Trenton and Chickamauga facilities and the construction of several new wastewater treatment plants. These include a Ringgold facility, a 0.78 MGD secondary biological plant at Jasper, and a 0.30 MGD biological facility at Whitwell. The 201 Facilities Plans for Signal Mountain and Dunlap have not as yet made any final recommendations concerning these treatment facilities, so the Municipal Point Source Plan assumes various options for these plants. The possible controls considered for the Signal Mountain facility include the expansion and upgrading of the existing treatment plant, or the regionalization of this plant into the Moccasin Bend facility. The control options possible for the Dunlap area are either the expansion and upgrading of the present plant, or the construction of a new aerated lagoon or trickling filter facility. At this time, the plan makes no final recommendations for actions to either of these treatment plants; however, the continuing planning process will further address the selection of point source controls for these facilities.

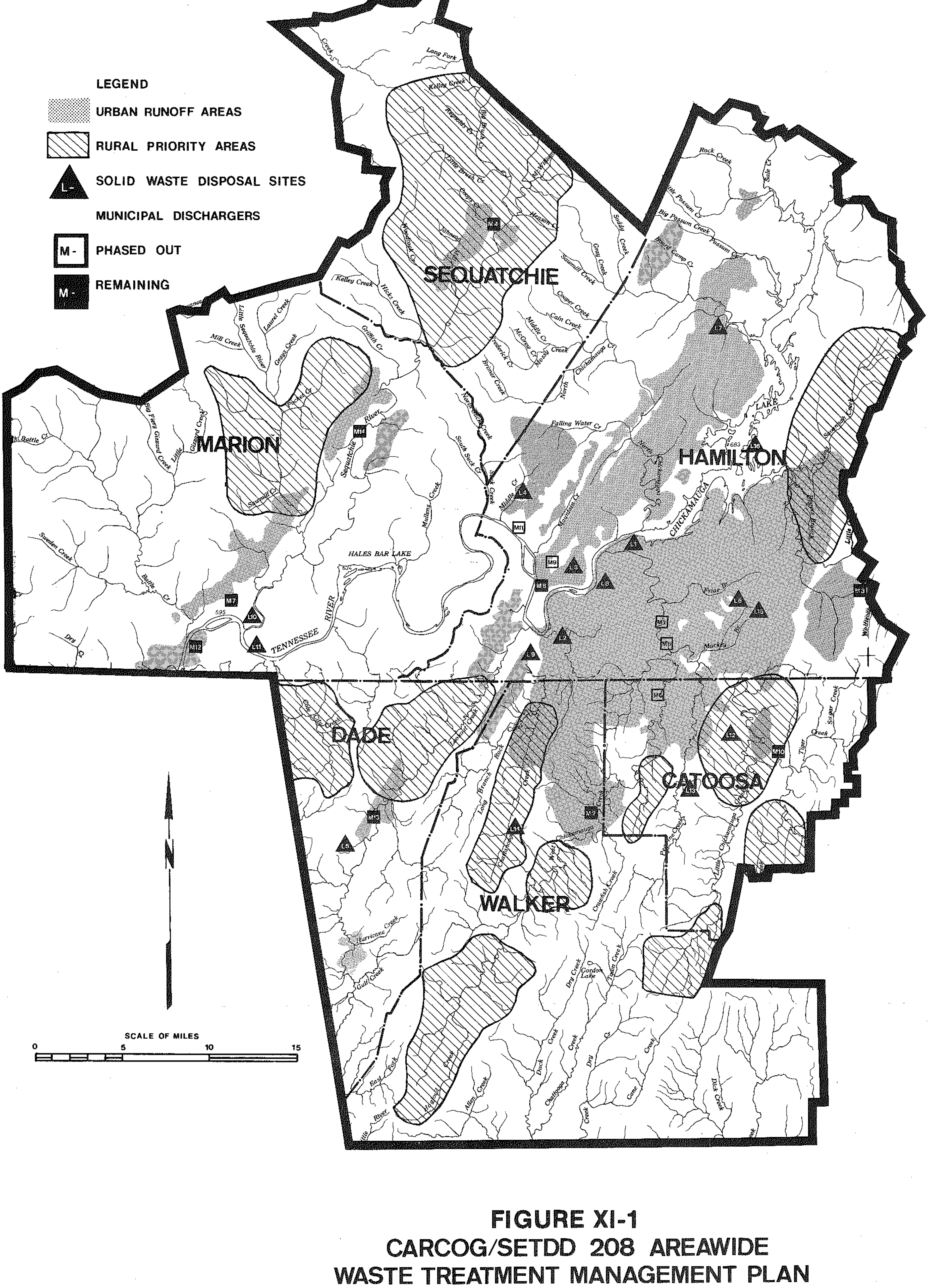

FIGURE XI-1
CARCOG/SETDD 208 AREAWIDE
WASTE TREATMENT MANAGEMENT PLAN

- The Urban Runoff Plan
- The Rural Runoff Plan
- The Residual Wastes Plan

The areas effected by these three plans are illustrated on Figure XI-1. The Urban Runoff Plan prescribes both structural and nonstructural measures for quality and quantity control of runoff, while the Rural Runoff Plan recommends management techniques in several areas. The Residual Wastes Plan consists of a series of recommendations for regulation of solid waste disposal sites and treatment of industrial sludges. Implementation of these plans will result in the establishment of viable pollution control techniques tailored to both the individual community and regional needs. The provisions of these plans are summarized below.

1. Urban Runoff Plan

Under the Urban Runoff Plan, six control practices (four voluntary nonstructural and two structural) have been developed for the reduction of pollution attributable to urban stormwater. The first of these, enactment of a comprehensive erosion and sediment control ordinance, would serve to decrease the amount of sediment in urban runoff by establishing guidelines for the control of erosion from construction sites, denuded lands, and drainage channels. The second nonstructural recommendation of the plan is to perform an industry-by-industry investigation to determine if industrial sources of runoff should be considered as point sources, or if pretreatment of such runoff should be required. The plan also calls for the establishment of a parking ordinance mandating the removal of cars from curbside prior to street sweeping. This measure would serve to dramatically reduce the pollutants carried by stormwater runoff since curbside areas contribute large amounts of contaminants to such flows. The fourth nonstructural control to be prescribed by the plan is the strict enforcement of anti-litter laws and ordinances. This control measure will help upgrade water quality, improve aesthetics, and ultimately reduce cleanup costs. The two structrual controls for the mitigation of urban runoff that are recommended by the plan are presented as Priority I and Priority II items. Priority I items entail the installation of disinfection facilities at combined sewer overflow points on the Tennessee River. Priority II items consist of the construction of disinfection facilities and swirl concentrator/regulator chambers at points of combined sewer overflows on Chattanooga Creek. It should be noted that implementation of nonstructural controls is on a voluntary basis and that the application of structural controls is contingent upon federal funding. It should also be noted that although the urban runoff control options were developed specifically for the modeled combined sewer areas of the city of Chattanooga, they are also applicable to other urban areas within the study area as indicated in Figure XI-1.

2. Rural Runoff Plan

The Rural Runoff Plan prescribes the voluntary use of Best Management Practices (BMPs) in four areas to provide abatement of rural nonpoint source pollution. Rural areas to be controlled include: hydrologic modifications, agriculture, forestry, and mining. The recommended hydrologic modifications for protection of watercourses from erosion and sedimentation include grade stabilization, critical area planting, use of debris basins, streambank protection, use of fences and borders for livestock exclusion, and alternative cropping systems. The agricultural controls that were suggested to minimize sedimentation and the discharge of animal wastes to receiving streams consist of using land capability classifications to determine the suitability of soils for cropland use; the formation of runoff, erosion, and drainage controls; and the development of collection, storage, and treatment facilities. Additional agricultural controls include construction of ponds, diversions, field borders, fences, absorption areas, and designation of protected areas. Improved forestry measures, such as woodland seeding, site preparation, proper road construction, and upgraded harvesting techniques, are recommended to reduce sheet and rill erosion and sustain tree cover. Secondary controls consist of tree planting, livestock exclusion, conscientious pesticide use, and construction of firebreaks and fences. The reduction of soil loss, amount of toxic effluents, and sediment damage, as well as site reclamation and water quality maintenance are the goals of the recommended mining controls. These controls include: critical area planting, grade stabilization, land smoothing, subsurface drains, and use of diversions and debris basins.

3. Residual Wastes Plan

The Residual Wastes Plan provides for the management of solid waste disposal sites (see Figure XI-1) and industrial sludge disposal systems. In formulating the disposal site component of the plan, sixteen landfills were cited as problem areas and improved control techniques were developed to mitigate pollution from these sources. The recommended controls include: the covering, grading, and seeding of filled portion of the sites; the use of drainage modifications to eliminate leachate from the sites; improvements in operating procedures; the use of vegetative cover for erosion control; and improved litter control through the use of fences. The plan also prescribes improved siting procedures, upgraded enforcement of solid waste disposal laws, and enactment of soils cover regulations.

The industrial sludge component of the Residual Wastes Plan calls for the establishment of a coordinating committee to provide a management system for regulating industrial disposal techniques. This committee (the Industrial Residuals Management Committee) will serve to develop the promotional programs and planning mechanisms necessary to furnish optimum treatment schemes for industrial disposal. Special attention will be given to source reduction methods and possible reuse of wastes in other industrial processes. Ultimate disposal techniques to be considered include pyrolysis, sanitary and chemical landfilling, incineration, and chemical processing.

4. Cost of Nonpoint Source Plan

The costs developed for the Nonpoint Source Plan include a total cost figure for the residual waste component, an estimation of the expenditure required for implementation of the structural controls to regulate urban runoff, and various phased costs for the Rural Runoff

Plan. The total cost of the Residual Wastes Plan was projected to be $403,000, while the structural controls, both disinfection facilities and swirl concentrators, to be implemented under the Urban Runoff Plan were estimated to cost $1,563,000. No costs were developed for nonstructural controls since these will vary from location to location and costs must be site specific. The Rural Runoff Plan has a projected total cost (present worth) of $14,602,000 with this cost being broken down as follows:

- $342,000 per year for two years (1979, 1980) to initiate the program.
- $4,375,000 total expenditure from 1981 to 1985 to implement controls in areas with documented problems (priority areas).
- $9,544,000 total expenditure from 1986 to 2000 for implementation of controls in the remainder of the 208 area.

The total estimated cost (present worth) for these components of the Nonpoint Source Plan can be seen to total $16,568,000.

F. AREAWIDE MANAGEMENT PLAN

The proposed management systems builds on and maximizes the efficiency of the existing water quality management system by strengthening the coordination between the various agencies responsible for implementing water pollution controls.

A 208 Areawide Policy Board, composed of the chief elected official from each unit of government plus the Chattanooga Commissioner of Public Works, is established as a policy making, priority setting body responsible for supervising continuing areawide water quality planning. The proposed management system also establishes the Chattanooga Area Waste Management Coordinating Office (CAWMCO) to carry out the directives of the 208 Policy Board. The primary functions of the CAWMCO will be to coordinate water quality related activities in the region through the Chattanooga-Hamilton County Regional Planning Commission and the Coosa Valley Area Planning and Development Commission, maintain awareness of water quality needs, and encourage the consideration of water quality impacts resulting from various land use developments.

1. Point Source Management

Under the proposed plan, the fourteen local governmental bodies owning wastewater collection and/or treatment facilities are responsible for implementing the municipal point source controls contained in the plan. Additionally, these entities will provide data and assistance to the CAWMCO staff for the annual update of the plan. Regulation and oversight is to be provided by the Tennessee Water Quality Control Division and the Georgia Environmental Protection Division.

Industrial discharge control will remain under the jurisdiction of the Tennessee Water Quality Control Division, the Georgia Environmental Protection Division, and ultimately the U.S. EPA for direct dischargers, and under the control of municipal operating entities for industries that discharge into municipal systems.

2. Nonpoint Source Management

The proposed management system for nonpoint sources calls for municipal governments in the CARCOG/SETDD 208 Study Area to be responsible for implementing the urban runoff controls contained herein.

For rural nonpoint sources, it is proposed that the local soil (and water) conservation districts be responsible for implementing (in cooperation with land owners) best management practices.

Regulation of nonpoint sources, under the proposed plan, is to be largely the responsibility of local units of government with the U.S. Army Corps of Engineers regulating dredge and fill operations.

3. Continuing Areawide Water Quality Planning

The continuing planning program (CPP) will be the responsibility of the 208 Policy Board through the CAWMCO. It is recommended that the CPP include two general areas of programming including: the annual review and update of the plan, and special continuing planning projects.

The annual review and update function is an important one as it will provide a periodic analyses of water quality in the region and the status of plan implementation. Furthermore, this function will ensure that the waste treatment management plan addresses the current water quality problems and needs of the 208 study area.

Special continuing planning projects will be performed to further the evaluation of the 208 area's water quality problems and to further the development of cost-effective solutions. These special projects which follow include tasks relative to the following water quality problems and issues:

- Eutrophication rates of the Nickajack and Chickamauga Reservoirs.
- The impacts of industrial spills on drinking water intakes and measures to mitigate environmental and public health damages associated with such spills.
- Combined sewer overflow and construction site runoff controls for urban areas.
- Best management practices for the control of rural nonpoint sources of water pollution.

- Evaluate the cost-effectiveness of providing regional industrial wastewater treatment facilities that will meet federal requirements for treating industrial wastewater.

- Initiate a regional sludge disposal program to determine the most cost-effective and environmentally sound means of municipal sludge disposal.

G. ENVIRONMENTAL ASSESSMENT OF THE PROPOSED PLAN

1. Introduction

One of the concluding steps in the 208 planning process is an environmental assessment of the impacts anticipated to occur with plan implementation. This Environmental Assessment (prepared as a separate document) provides a summary description of the existing environmental conditions within the CARCOG/SETDD 208 Study Area, describes the areawide waste treatment management plan alternative (the Null Alternative) and the proposed plan, as well as provides a thorough discussion of the expected environmental, economic, and social impacts of the plan. In order to provide a complete overview to the proposed CARCOG/SETDD 208 Areawide Waste Treatment Management Plan, a summary of these impacts contained in the Environmental Assessment is presented below.

2. Environmental, Economic, and Social Impacts

Water Quality Impacts

Impacts of Point Source Controls: Generally, the proposed plan was developed assuming compliance with 201 NPDES effluent limitations and applicable year 2000 waste load allocations for municipal and private waste treatment facilities, as well as best conventional pollutant control technology (BCT) and best available technology (BAT) for industries. It is therefore anticipated that a significant improvement of current water quality conditions will occur over the twenty year planning period with the implementation of the proposed plan, eventually resulting in the elimination of present stream water quality violations. Additionally, six municipal wastewater treatment plants are to be eliminated through regionalization. The phasing out of these plants and the subsequent discontinuation of their discharges will effect an improvement in the water quality of the respective receiving streams.

Some adverse effects will be encountered with the implementation of the selected plan since the construction of four new municipal wastewater treatment plants (Ringgold, Dunlap, Jasper, and Whitwell facilities) is recommended where currently none exists. The disposal of effluents to their respective receiving streams (South Chickamauga Creek, Tennessee River, Coops Creek, and Sequatchie River) will effect a slight degradation of water quality in the immediate vicinity of the new discharges. This detrimental impact is counterbalanced, however, by the fact that the construction of these facilities and associated sewer lines will enable sewer service to be provided to areas presently on septic systems, thus, lessening the potential contamination of groundwater supplies from septic tank wastewater. Furthermore, the treatment levels recommended in the selected plan will be adequate to meet water quality standards. Some short-term detrimental impacts may also occur under the proposed plan due to the recommended construction activities associated with the building of the new facilities and the expansion of the other treatment plants.

Impacts of Nonpoint Source Controls: Many nonpoint source controls concerning urban and rural runoff, as well as residual waste disposal are proposed under the preferred plan. These control measures should effect a reduction of stormwater pollution from the washoff of urban dust and dirt, and water pollution from landfills. In addition, the utilization of Best Management Practices (BMP) and the enactment and subsequent enforcement of a comprehensive erosion and sedimentation control ordinance, as recommended under the selected plan, should produce a reduction in the sediment loadings to the 208 area receiving waters. It should be noted that the proposed BMPs are strictly voluntary in nature. Therefore, the level of public participation and cooperation will determine the degree of success of these controls on improving the region's water quality.

Air Quality Impact

Due to the region's climatology, topography, and industrial development, the urban areas within the study area experience elevated levels of pollutants. High levels of total suspended particulates are particularly a problem within the Chattanooga area. Little or no relief from these air quality problems is anticipated as a result of implementing the proposed plan. Assuming that wastewater treatment facilities are operating properly and efficiently, noxious odors from these sources should be controlled. The proposed expansion of treatment and collection systems could generate a localized problem with fugitive dust depending upon soil conditions and weather during construction; however, these adverse conditions would only be temporary. Thus, it becomes evident that, at best, the effectuation of the proposed plan will maintain the status quo with regard to the air quality of the CARCOG/SETDD 208 Study Area.

Impacts on Land Use

The CARCOG/SETDD 208 Areawide Waste Treatment Management Plan is anticipated to have a minimal impact on future land use development since the plan does not require, but rather only recommends the implementation of land use controls. Included within the proposed controls is the effectuation of the CARCOG/SETDD Regional Development Plan. This plan provides a series of regional development policies that serve as general guidelines for local and public officials in making decisions regarding development strategies. Also inherent within the proposed plan is the recommendation that local governments continue to perform their own planning and zoning efforts. If this regional plan is implemented and local governments continue to develop and implement land use controls, the land use component of the selected plan should have a positive impact on future water quality, as well as development.

As required by EPA, the 201 Facilities Plans, which have been incorporated within the 208 study, have made provisions for the additional wastewater treatment capacity anticipated during the twenty year planning period. However, these 201 studies are primarily concerned with meeting existing water quality and community needs and are not intended as a mechanism to regulate or guide growth. It is for these reasons that the 208 plan is anticipated to have little impact on land use.

Aside from the impacts on land use development described above, the adverse impacts of the 208 areawide waste treatment plan will consist primarily of disruptions of daily activities and other problems associated with sewer construction through developed areas. It should be emphasized, however, that these construction activities will cause only a temporary disruption of land uses. Additionally, the proposed construction of new wastewater treatment plants and the expansion of existing facilities will entail the permanent commitment of a very small portion of the 208 study area's land resources. These adverse impacts will be greatly overshadowed, however, by the overall benefits received by implementing the proposed 208 plan.

Biological Impacts

Due to the expansion and upgrading of treatment plants, the elimination of six municipal plants and the utilization of the proposed rural and urban nonpoint source controls, the implementation of the selected plan should provide a substantial improvement in water quality in the CARCOG/SETDD 208 streams, subsequently creating a more favorable environment for aquatic life. The proposed plan will, however, have some adverse impacts on the aquatic flora and fauna since four new municipal wastewater treatment plants are proposed for construction where presently none exist. The disposal of effluents to the respective receiving streams will effect a slight degradation of water quality and aquatic life within the immediate vicinity of the point source discharges. As stated previously, the recommended treatment levels will, however, be adequate to meet water quality standards.

Impact on Environmentally Sensitive Areas

The following paragraphs provide a concise description of the impact of the proposed 208 areawide plan on seven areas considered to be environmentally sensitive. These include:

- Sources of potable water
- Wetlands
- Floodplains
- Erosion
- Steeply sloped lands
- Endangered and threatened species
- Archaeological and historical sites

Water Resources: Presently, the Chattanooga area experiences occasional problems with the public water supply due to undesirable tastes and odors. Assuming the implementation of the controls ordered by the Tennessee Department of Public Health, these problems should be rectified. Furthermore, with the effectuation of the 208 plan, the improved effluent from municipal and industrial dischargers should effect an improvement in water quality which, in turn, should have a beneficial impact on the quality of potable water supplies.

Wetlands: Although no documentation regarding the region's wetlands was available, Executive Order 11990 states that the Nation's wetlands should be protected. If wetlands are encountered during the implementation of the structural components of the plan, appropriate mitigative measures should be taken to protect these areas.

Floodplains: The selected plan sets forth no new provisions for the protection of the region's floodplains from future development. The plan does, however, support the CARCOG/SETDD Regional Development Plan - 2000. This plan provides a general framework for land use development in the floodplains.

Erosion: The implementation of the proposed rural runoff controls, as well as the enactment and enforcement of the erosion and sedimentation control ordinance should mitigate pollution due to erosion. Since the rural runoff controls are voluntary in nature, the degree of success of this portion of the program is dependent upon the level of public participation and cooperation.

Steeply Sloped Lands: The selected plan sets forth no new provisions for the protection of the region's steeply sloped lands from future development. As stated above, the 208 plan does, however, support the regional development plan. This plan discourages the development of steep slopes.

Endangered and Threatened Species: The potential exists that endangered and threatened species inhabit the proposed construction sites within the 208 study area. Additionally, the discharge from the new wastewater treatment plants could adversely impact the protected aquatic organisms. Precautions, such as field reconnaissance of the construction sites, should be taken to ensure that none of the rare/endangered plant and animal species exist within the area of concern.

Archaeological and Historic Sites: The proposed plan will have a potentially adverse impact on the archaeological and historic resources within the study area, since construction activities are recommended by the plan. The extent of this detrimental impact cannot be fully assessed due to the fact that many of the region's archaeological resources may still be undiscovered. It is EPA's policy to perform a field reconnaissance prior to construction of proposed facilities to determine whether or not significant archaeological or historic resources would be impacted.

Economic Impact

The estimated present worth costs to implement the various components of the recommended plan are summarized below.

- Municipal Point Source Plan - $375,869,119.
- Industrial Point Source Plan - $82,386,250. (This cost was developed prior to the enactment of the Clean Water Act of 1977; however, these cost figures provide a general indication of the expense of this component of the plan.)
- Residual Wastes Plan (cost for only the solid waste disposal controls) - $403,100.
- Urban Runoff Plan (cost for only the structural controls) - $1,563,000.
- Rural Runoff Plan - $14,602,000.

Additional costs will also result from the implementation of the recommended controls of industrial residuals and the nonstructural urban runoff controls.

The impact of the 208 plan on other components of the economy, such as employment, housing, industrial growth, agricultural activities, income, and others is not expected to be significant. These aspects of the economic impact of the 208 plan can be summarized as follows:

- Employment will be impacted directly by the expansion of wastewater treatment facilities, the abandonment of six municipal plants, and the effectuation of both urban and rural runoff controls. Employment shifts and possibly some loss of jobs will occur with the employees of the eliminated plants. Jobs will be created by the planning design, construction operation, and maintenance of the new Ringgold, Jasper, Dunlap, and Whitwell facilities, while the proposed expansion of the existing municipal facilities may provide further employment opportunities in the construction and operation of the plants. Employment may be beneficially affected by the required upgrading of treatment levels of industrial wastes. In addition, there may be spin-off benefits for manufacturing, supply, and distribution sectors of the economy from the proposed construction activities. Finally, employment may be impacted as a result of available waste treatment capacities at the area's wastewater treatment plants. With these capacities, employment opportunities may be created by the addition of jobs in various local economies in the study area.

It does not necessarily follow, of course, that such will happen; but, the potential is there. Conversely, however, without adequate wastewater treatment capacity, at least certain types of economic activities and employment opportunities may be constrained.

- Housing supply and location will not significantly be affected, if at all, by the plan. However, new housing costs may increase somewhat if the proposed erosion and sedimentation control ordinance is enacted. These increased costs may vary considerably depending upon location and the measures required to control erosion resulting from construction activities.

- The required compliance of industries to meet BCT for conventional pollutants and BAT for toxic substances will result in an increase in operating costs for the industries without an increase in production. Such increases in production costs are normally passed onto the consumer in the form of price hikes. Furthermore, the higher production costs may become an economic burden for the smaller industries.

- The voluntary implementation of Best Management Practices on agricultural lands should have a net positive impact on agricultural productivity, and hence, farm income.

- Aggregate income levels in the 208 study area should not be directly affected by the plan. Indirect affects are too speculative in nature to attempt to project.

- Due to the nature of the 208 plan, any adverse impacts resulting from high debt retirement or operation and maintenance costs are impossible to evaluate. By necessity, such impacts must be covered at the community level by the 201 Facility Plans.

<u>Social Impact</u>

Under the proposed management system, the 208 Policy Board will undertake general management functions including supervision and coordination of continuous planning efforts, the recommendation of municipal wastewater management priorities, and other point source control priorities. In addition, the 208 Policy Board with the assistance of the Soil Conservation Districts will be responsible for establishing nonpoint source control priorities. The lead 201 agencies will undertake the operation and maintenance of all municipal wastewater facilities and the Chattanooga Area Wastewater Management Coordinating Office (CAWMCO) would perform continuous planning functions.

The major strengths of this system are that it builds on the existing management framework in the two ways outlined below:

- Plan implementation remains primarily with local governments.
- Plan coordination and continuous planning occurs on an area-wide level.

Additionally, the 208 Policy Board is responsive to the needs of local citizens since it is composed of the chief elected officials from each local governmental unit. The system's major weaknesses lie in the areas of plan implementation. It is not clear how the 208 Policy Board will be able to adequately assume plan implementation through essentially voluntary measures.

Public participation will be an integral part of the implementation of the CARCOG/SETDD 208 Areawide Waste Treatment Management Plan. The 208 Policy Board with the assistance of the Chattanooga Area Waste Management Coordination Office (CAWMCO) will manage the public participation program by providing on-going education and training to the public regarding the controls for environmental pollution. Additionally, the management plan recommends a revision of the existing Technical Advisory Committee (TAC) so that this committee may function in the public participation process by expanding its membership to include the following technical interests:

- Conservation and environment
- Business and industry
- Mining
- Forestry
- Health department and drainage control personnel
- Wastewater treatment plant operators

Thus, the proposed plan is designated to generate more public interest by maintaining the maximum amount of individual community identity.

These impacts of plan implementation, presented here to complete the overview of the 208 planning process, effectively demonstrate the success of the plan in achieving its stated goals, i.e., the fishability and swimability of the region's waters by 1983. The overall impact is one of improving the water quality of the CARCOG/SETDD 208 Study Area streams to a measurable extent within the 20 year planning period. This improvement will result from the application of the various point and nonpoint source controls prescribed by the plan. The continuing management phase of the plan will provide for public input and periodic revision of the technical content of the plan to provide for any additional controls deemed necessary. Through these actions, the proposed CARCOG/SETDD 208 Areawide Waste Treatment Management Plan will serve as a mechanism for the improvement of environmental quality that is not only responsive to the region's needs, but also comprehensive in scope.

APPENDIX A

STATE OF TENNESSEE DISCHARGER PERMITS

NPDES FACILITIES IN CHATTANOOGA 208 AREA

NPDES NUMBER	NAME / COUNTY		ISSUE DATE	EXPIRE DATE	SIC CODE	MAJR IND	TYPE OWNR			
TN0002798	ALCO CHEM CHATTANOOGA / HAMILTON	SO CHICKAMAUG CR	740426	790601	2869		PRI	P O BOX 5141	CHATTANOOGA	TN 37406
TN0029840	ALLEN COAL MINE 3&4 / HAMILTON	ALLEY GULF BR	770923	821024	1211		PRI	400 PARAGON DRIVE	RED BANK	TN 37415
TN0026760	AM CYANAMID CO / HAMILTON	TENNESSEE RV	751205	810109	2819		PRI	P. O. BOX 4025	CHATTANOOGA	TN 37405
TN0002577	AM OIL ASPH TERM CHATTANOOGA / HAMILTON	TENNESSEE RV	730907	781007	5171		PRI	P O BOX 4128	CHATTANOOGA	TN 37405
TN0029700	BIG FORK MINING #1 MINE / MARION	SO SUCK CR	770923	821024	1211		PRI	P. O. BOX 3471	OAK RIDGE	TN 37830
TN0005282	BLUE SPRINGS TROUT FARM JASPER / MARION	BLUE SPRINGS	750630	800814	0279		PRI	RT 2 BOX 72	JASPER	TN 37347
TN0002267	C F IND-CHATT NITROGEN COMPLEX / HAMILTON	FRIAR BR	740426	790601	2813	M	PRI	BOX 87	HARRISON	TN 37341
TN0031542	CALDWELL & SEALS COAL-#1 / MARION	MILL CR TRIB			1211		PRI	900 MOUNTAIN CR. ROAD, APT. N179	CHATTANOOGA	TN 37405
TN0003557	CENTRAL SOYA CHATTANOOGA / HAMILTON	TENNESSEE RV	740211	790213	5153	M	PRI	JUDO RD	CHATTANOOGA	TN 37406
TN0024228	CHATTANOGA-BRAINERD WTP / HAMILTON	SO CHICKAMAUGA CR	770701	820630	4952	M	PUB	CITY HALL	CHATTANOOGA	TN 37402
TN0024210	CHATTANOGA-MOCCASIN BEND WTP / HAMILTON	TENNESSEE RV	770520	820630	4952	M	PUB	CITY HALL	CHATTANOOGA	TN 37402
TN0023116	CHATTANOOGA STATE AREA VOC TEC / HAMILTON	TENNESSEE RV	741230	800129	8249		STA	4401 AMNICOLA HWY.	CHATTANOOGA	TN 37406
TN0002780	CHATTEM DRUG & CHEM / HAMILTON	CHATTANOOGA CR	740426	790601	2834	M	PRI	1715 WEST 38TH ST	CHATTANOOGA	TN 37409
TN0022438	CITIES SERVICE OIL CO-CHATTANO / HAMILTON	FRYARS BR	741224	800210	5171		PRI	4233 JERSEY PIKE	CHATTANOOGA	TN 37416
TN0028002	COLLEGEDALE STP / HAMILTON	WOLFTEVER CR	751216	810130	4952		PUB	BOX 416	COLLEGEDALE	TN 37315
TN0003514	COMBUSTION ENGINEERING / HAMILTON	TENNESSEE RV	731109	780930	3443		PRI	911 WEST MAIN ST	CHATTANOOGA	TN 37402

NPDES FACILITIES IN CHATTANOOGA 208 AREA

NPDES NUMBER	COUNTY NAME		ISSUE DATE	EXPIRE DATE	SIC CODE	MAJR IND	TYPE OWNR			
TN0002542	CONALCO CONDUCTORS HAMILTON	TENNESSEE RV	731109	780930	3357		PRI	P O BOX 6039	CHATTANOOGA	TN 37401
TN0001481	CUTTER LABORATORIES HAMILTON	TENNESSEE RV	740211	790213	2833	M	PRI	1800 CRUTCHFIELD ST	CHATTANOGA	TN 37406
TN0040002	DAYTON MINING-MINE #2 HAMILTON	SOUTH SUCK CR			1211		PRI	9524 DAISY-DALLAS ROAD	DAISY	TN 37319
TN0040011	DAYTON MINING-MINE #3 HAMILTON	SAWMILL CR			1211		PRI	9524 DAISY-DALLAS ROAD	DAISY	TN 37319
TN0040029	DAYTON MINING-MINE #4 HAMILTON	SODDY CR			1211		PRI	9524 DAISY-DALLAS ROAD	DAISY	TN 37319
TN0040037	DAYTON MINING-MINE #5 HAMILTON	BIG POSSUM CR			1211		PRI	9524 DAISY-DALLAS ROAD	DAISY	TN 37319
TN0005711	DESOTO-AMNICOLA PLT CHATTA HAMILTON	SO CHICKAMAUGA CR	731228	780930	3645		PRI	P O BOX 5038	CHATTANOOGA	TN 37406
TN0002836	DIAMOND SHAMROCK CHATT HAMILTON	CITIGO CR	740426	790601	2821		PRI	P O BOX 29	CHATTANOOGA	TN 37401
TN0004707	DIXIE SAND GRAVEL CHATTANOOGA HAMILTON	TENNESSEE RV			1442	M	PRI	515 RIVER ST	CHATTANOOGA	TN 37402
TN0002453	DIXIE YARNS LUPTON CITY HAMILTON	NICKAJACK LAKE	731231	781231	2281		PRI		LUPTON CITY	TN 37351
TN0002844	DU PONT CHATTANOOGA HAMILTON	TENNESSEE RV	731231	781231	2821	M	PRI	P O BOX 71	CHATTANOOGA	TN 37401
TN0021946	DUNLAP WTP SEQUATCHIE	COOPS CR	740125	790107	4952		PUB	P O BOX 546	DUNLAP	TN 37327
TN0030970	EARL PATTON COAL-MINE 31 SEQUATCHIE	KELLEY CR	771028	821128	1211		PRI	P. O. BOX 498	BRENTWOOD	TN 37027
TN0023884	EAST RIDGE STP HAMILTON	SPRING CR	740625	790630	4952	M	PUB	1501 TOMBRAS AVE	EAST RIDGE	TN 37412
TN0028533	EXXON CO U S A HAMILTON	TENNESSEE RV	761105	820120	5171		PRI	4834 BONNEY OAKS DR.	TANOOGA	TN 37416
TN0003492	GAF CORP CHATTANOOGA HAMILTON	FRIAR BR	740426	790601	2822	M	PRI	P O BOX 6037	ANOOGA	TN 37401

NPDES FACILITIES IN CHATTANOOGA 208 AREA

NPDES NUMBER	NAME / COUNTY	ISSUE DATE	EXPIRE DATE	SIC CODE	MAJR IND	TYPE OWNR				
TN0028410	GRUNDY MINING-GRAY'S CR #21 MARION	770923	821024	1211	M	PRI	GRAY'S CR	BETSY PACK DR., P. O. BOX 878	JASPER	TN 37347
TN0030961	GRUNDY MINING-MINE 30 SEQUATCHIE	771028	821128	1211		PRI	KELLEY CR	P. O. BOX 498	BRENTWOOD	TN 37027
TN0026735	HAMILTON CO-HIXSON HI SCH HAMILTON	751229	810129	4952		BPP	NO CHICKAMAUGA CR	MIDDLE VALLEY RD	CHATTANOOGA	TN 37343
TN0026743	HAMILTON CO-HIXSON JR HI SCH HAMILTON	750630	800814	4952		BPP	CHICKAMAUGA CR	5401 SCHOOL DR	CHATTANOOGA	TN 37343
TN0026701	HAMILTON CO-MIDDLE BROWN JR & HAMILTON	751229	810129	4952		BPP	CHICKAMAUGA RESERVOIR	HIGHWAY#58	HARRISON	TN 37341
TN0026751	HAMILTON CO-NURSING HOME HAMILTON	750630	800814	4952		BPP	FRAIR BR	2626 WALKER RD	CHATTANOOGA	TN 37421
TN0026719	HAMILTON CO-OOLTEWAH ELEM SCH HAMILTON	750630	800814	4952		BPP	LITTLE WOLFTEVER CR	HIGHWAY 11 & 64	OOLTEWAH	TN 37363
TN0026727	HAMILTON CO-VALLEY VIEW ELEM HAMILTON	750630	800814	4952		BPP	TENNESSEE RV	701 BROWNS FERRY RD	CHATTANOOGA	TN 37419
TN0004936	HILLS HOSIERY MILL DAISY HAMILTON			2252		PRI	OPEN DRAIN DTCH	P O BOX 68	DAISY	TN 37319
TN0002208	HIXSON SEWAGE-NORTHGATE MALL HAMILTON	740211	790213	5311	M	PRI	NORTH CHICKAMAUGA CR TRIB	535 CHESTNUT ST	CHATTANOOGA	TN 37402
TN0031437	JESSIE SHIPLEY COAL-WHITWELL MARION			1211		PRI	LAUREL CR	ROUTE 3, BOX 266	WHITWELL	TN 37397
TN0004766	JIFFY CAR WASH CHATTANOOGA HAMILTON	740308	781231	7542		PRI	STRINGERS BR	4402 DAYTON BLVD	CHATTANOOGA	TN 37415
TN0004588	L&N RR WAUHATCHIE YARD HAMILTON	731120	780930	4013	M	PRI	BLACK CR	P O BOX 1749	CHATTANOOGA	TN 37401
TN0004618	LORET RESORT VILLA CHATTANOOGA HAMILTON	731231	781231	5812		PRI	TENNESSEE RV	35 W MAIN ST	CHATTANOOGA	TN 37408
TN0022829	LORET RESORT VILLA-HARRISON HAMILTON	741230	800129	4952		PRI	TENNESSEE RV	NORTH HWY 58	HARRISON	TN 37341
TN0030325	LUTEX CHEM CORP HAMILTON			2821		PRI	SO CHICKAMAUGA CR	6153 AIRWAYS BOULEVARD	CHATTANOOGA	TN 37421

NPDES FACILITIES IN CHATTANOOGA 208 AREA

NPDES NUMBER	NAME / COUNTY	ISSUE DATE	EXPIRE DATE	SIC CODE	MAJR IND	TYPE OWNR	RECEIVING WATER	ADDRESS	CITY	STATE ZIP
TN0028398	MARION COAL CO #29 / MARION	770923	821024	1211		PRI	GRAY'S CR	P. O. BOX 583	TRACY CITY	TN 37387
TN0029513	MCDOWELL DEVELOPMENT CORP / HAMILTON	770722	820822	2841	M	PRI	LOOKOUT CR	P. O. BOX 1665	CHATTANOOGA	TN 37401
TN0003204	MCKEE BAKING CO / HAMILTON	741127	800113	2052	M	PRI	WOLFTEVER CR	P O BOX 750	COLLEGEDALE	TN 37315
TN0001635	MEAD CORP-CHATTANOOGA COKE/CHM / HAMILTON	740426	790601	3312	M	PRI	CHATTANOOGA CR	4800 CENTRAL AVE	CHATTANOOGA	TN 37410
TN0030902	MISSOURI PORTLAND-CHATTANOOGA / HAMILTON	780131	830301	3241		PRI	TENNESSEE RV	7711 CARONDELET AVENUE	ST. LOUIS	MO 63105
TN0031062	MURPHY MTN MINING #1 / MARION	780224	830328	1211		PRI	RUNNING WATER CR-POPE CR	P. O. BOX 226	SIGNAL MOUNTAIN	TN 37377
TN0002861	POLYSAR LATEX / HAMILTON	741127	800113	2822		PRI	TENNESSEE RV	3805 AMNICOLA HIGHWAY	CHATTANOOGA	TN 37406
TN0028339	RAY-SER DYEING CO / HAMILTON	751219	810126	2269		PRI	NO CITICO CR	1807 ELMENDORF ST.	CHATTANOOGA	TN 37406
TN0020516	RED BANK WTP / HAMILTON	770701	820630	4952	M	PUB	TENNESSEE RV	3117 DAYTON BLVD.	CHATTANOOGA	TN 37415
TN0002828	REILLY TAR & CHEM CHATTANOOGA / HAMILTON	740426	790601	2865		PRI	CHATTANOOGA CR	1510 MARKET SQUARE CENTER	INDIANAPOLIS	IN 46204
TN0001902	ROCKWELL INTERNATIONAL / HAMILTON	740426	790601	3431	M	PRI	CHATTANOOGA CR	33RD ST & ALTON PARK BLVD	CHATTANOOGA	TN 37401
TN0003603	ROPER CORP CHATTANOOGA / HAMILTON	740211	790213	3631		PRI	TENNESSEE RV	MANUFACTURERS RD	CHATTANOOGA	TN 37405
TN0029327	SAVANNAH VALLEY UTIL DIST WTP / HAMILTON	760629	810729	4941		PRI	LONG SAVANNAH CR	ROUTE 1	OOLTEWAH	TN 37363
TN0004031	SELOX AIR SEPARATION PL HIXSON / HAMILTON	731231	781231	2813		PRI	TENNESSEE RV	ACCESS RD	HIXSON	TN 37343
TN0029459	SEQUATCHIE VALLEY COAL DUNLAP / SEQUATCHIE	770923	821024	1211		PRI	UNKNOWN	P. O. BOX 69	CHATTANOOGA	TN 37401
TN0030171	SEQUOYAH NUCLEAR PLT / HAMILTON	770202	820319	4952		FED	TENNESSEE RV	268 401 BUILDING	CHATTANOOGA	TN 37401

NPDES FACILITIES IN CHATTANOOGA 208 AREA

NPDES NUMBER	FACILITY / COUNTY NAME	ISSUE DATE	EXPIRE DATE	SIC CODE	MAJR IND	TYPE OWNR	RECEIVING STREAM	ADDRESS	CITY	STATE ZIP
TN0001562	SHELL OIL CHATTANOOGA / HAMILTON	740830	791021	5171		PRI	FRIAR BR	P O BOX 4	TYNER	TN 37392
TN0031186	SHU-TER MINING-#1-DUNLAP / SEQUATCHIE	771228	830130	1211		PRI	MANSFIELD BR-DRY CR	P. O. BOX 846	CROSSVILLE	TN 38555
TN0021211	SIGNAL MOUNTAIN STP / HAMILTON	770520	820630	4952		PUB	NICKAJACK RESERVOIR	P. O. BOX 53	SIGNAL MOUNTAIN	TN 37377
TN0001821	SIGNAL MTN CEMENT DIV CHATT / MARION	740211	790213	3295		PRI	TENNESSEE RV	1300 AMERICAN NATIONAL BANK BL	CHATTANOOGA	TN 37402
TN0001830	SIGNAL MTN CEMENT DIV CHATT / HAMILTON	731231	781231	3241	M	PRI	TENNESSEE RV	1300 AMERICAN NATIONAL BANK BL	CHATTANOOGA	TN 37402
TN0022969	SIGNAL PLAZA-SIGNAL MTN / HAMILTON	750321	800504	6512		PRI	SHOAL CR	1210 TAFT HWY.	SIGNAL MOUNTAIN	TN 37377
TN0030716	SO ENERGY RESOURCES MINE 2 & 6 / SEQUATCHIE	771028	821128	1211	M	PRI	DRY CR-BIG HE CR	2200 FIRST AMERICAN CENTER	NASHVILLE	TN 37238
TN0024295	SO PITTSBURG-WTP / MARION	741022	791231	4952	M	PUB	TENNESSEE RV	P O BOX 408	SOUTH PITTSBURG	TN 37380
TN0002071	SO RAILWAY CHATTA DIESEL SHOP / HAMILTON	740923	780930	4011		PRI	CITICO CR	P O BOX 11046	CHATTANOOGA	TN 37401
TN0028380	SO WOOD PIEDMONT-CHATTANOOGA / HAMILTON	760629	810729	2491	M	PRI	CHATTANOOGA CR	PO BOX 5447	SPARTANBURG	SC 29304
TN0004341	SODDY DAISY WATER TREATMENT PL / HAMILTON	740110	781231	4941		PRI	SODDY LAKE	POST OFFICE BOX 175	SODDY DAISY	TN 37319
TN0040045	STANDARD MARION COAL-MINE #1&2 / MARION			1211		PRI	ALLEY GULF	633 CHESNUT STREET, SUITE 2020	CHATTANOOGA	TN 37450
TN0022764	STONE MAN CHATTANOOGA / HAMILTON	741127	791127	1422		PRI	LOOKOUT CR	3908B TENNESSEE AVE	CHATTANOOGA	TN 37409
TN0031259	SYCAMORE MINING-BIG RIDGE MINE / MARION	780127	830227	1211		PRI	NORFOLK PRYOR COVE BR	P. O. BOX 8103	CHATTANOOGA	TN 37411
TN0022241	TEXACO MANUFACTURER ROAD-CHATT / HAMILTON	740830	791021	5171		PRI	TENNESSEE RV	MANUFACTURER ROAD	CHATTANOOGA	TN 37405
TN0028509	TN CONSOLIDATED COAL(NO DCHG) / MARION	770923	821024	1211	M	PRI	GRAVES CR	BETSY PACK DR., P. O. BOX 878	JASPER	TN 37347

NPDES FACILITIES IN CHATTANOOGA 208 AREA

NPDES NUMBER	NAME / COUNTY	RECEIVING WATER	ISSUE DATE	EXPIRE DATE	SIC CODE	MAJR IND	TYPE OWNR	ADDRESS	CITY	STATE ZIP
TN0030295	TN DEPT OF TRANS I-24 WEL STA / HAMILTON	LOOKOUT CREEK	761227	820127	4952		STA	505 FESSLERS LANE	NASHVILLE	TN 37210
TN0027626	TN DOT SAFETY REST AREA 10E & / MARION	TENNESSE RV	750630	800814	4952		STA	HIGHWAY BUILDING	NASHVILLE	TN 37219
TN0001511	TN METALLURGICAL JASPER / MARION	GUNTERSVILLE RS	731228	780930	3339	M	PRI	P O BOX 366	JASPER	TN 37347
TN0002518	TN-AM WATER CO (INACTIVE) / HAMILTON	TENNESSEE RV	740110	781231	4941	M	PRI	126 EAST TENTH STREET	CHATTANOOGA	TN 37401
TN0021024	TVA RACCOON MTN STP NO 1 RV MI / MARION	TENNESSEE RV	731205	781231	4952		FED	F E GARTRELL 268-401 BLDG	CHATTANOOGA	TN 37401
TN0021032	TVA RACCOON MTN STP NO 2 RV MI / MARION	TENNESSEE RV	731205	781231	4952		FED	F E GARTRELL 268-401 BLDG	CHATTANOOGA	TN 37401
TN0020397	TVA RACCOON MTN STP NO 3 RV MI / MARION	TENNESSEE RV	731205	781231	4952		FED	F E GARTRELL 268 401 BLDG	CHATTANOOGA	TN 37401
TN0021059	TVA SEQUOYAH NUCL PROJ NO 1 RV / HAMILTON	TENNESSEE RV	731205	781231	4952		FED	F E GARTRELL 268-401 BLDG	CHATTANOOGA	TN 37401
TN0021041	TVA SEQUOYAH NUCL PROJ NO 2 RV / HAMILTON	TENNESSEE RV	731205	781231	4952		FED	F E GARTRELL 268 401 BLDG	CHATTANOOGA	TN 37401
TN0020150	TVA SEQUOYAH NUCL PROJ NO 3 RV / HAMILTON	TENNESSEE RV	731205	781231	4952		FED	F E GARTRELL 268 401 BLDG	CHATTANOOGA	TN 37401
TN0023485	TVA SEQUOYAH NUCLEAR PLT STP / HAMILTON	TENNESSEE RV	740715	790731	4952		FED	268-401 BLDG	CHATTANOOGA	TN 37401
TN0027413	TVA-CHICKAMAUGA HYDRO / HAMILTON	TENNESSEE RV	750630	800814	4911		FED	268 401 BLDG.	CHATTANOOGA	TN 37401
TN0027472	TVA-NICKAJACK HYDRO / MARION	TENNESSEE RV	750630	800814	4911		FED	268 401 BLDG.	CHATTANOOGA	TN 37401
TN0020290	TVA-POWER SERVICE CENTER / HAMILTON	TENNESSEE RV	740131	790331	4911		FED	F E GARTRELL 268 401 BLDG	CHATTANOOGA	TN 37401
TN0031631	TVA-RACCOON MTN STORAGE PROJ / MARION	NICKAJACK RESERVOIR			4931		FED	268 401-BUILDING	CHATTANOOGA	TN 37401
TN0026450	TVA-SEQUOYAH NUCLEAR / HAMILTON	TENNESSEE RV			4911	M	FED	268 401 BLDG	CHATTANOOGA	TN 37401

78/04/11 P. C. S. QUICK LOOK REPORT

NPDES FACILITIES IN CHATTANOOGA 208 AREA

NPDES NUMBER	NAME / COUNTY NAME	RECEIVING STREAM	ISSUE DATE	EXPIRE DATE	SIC CODE	MAJR IND	TYPE OWNR	ADDRESS	CITY	STATE ZIP
TN0002429	U S PIPE & FOUNDRY CHATTANOO HAMILTON	TENNESSEE RV	731231	781231	3321	M	PRI	POST OFFICE BOX 311	CHATTANOOGA	TN 37401
TN0003808	U S PIPE & FOUNDRY SOIL DIV HAMILTON	TENNESSEE RV	731231	781231	3321	M	PRI	P O BOX 6129	CHATTANOOGA	TN 37401
TN0002313	USA VOLUNTEER ARMY AMMO PLT HAMILTON	TENNESSEE RV	740426	790430	9711	M	FED	P O BOX 1748	CHATTANOOGA	TN 37401
TN0030589	USAR CENTER-CHATTANOOGA HAMILTON	STORM DRAIN-TN RV	770608	820701	4952		FED	HDQTRS 101ST AIRBORNE DIV.	FORT CAMPBELL	KY 42223
TN0025895	VELSICOL CHEM CORP CHATTANOOGA HAMILTON	CHATTANOOGA CR			2865	M	PRI	4902 CENTRAL AVE	CHATTANOOGA	TN 37410
TN0028436	VIRGINIA MINING CO #18 MARION	GRAY'S CR	770923	821024	1211	M	PRI	BETSY PACK DR., P. O. BOX 878	JASPER	TN 37347
TN0003077	VULCAN MAT'L CHATTANOOGA HAMILTON	SO CHICKAMAUG CR	740211	790213	3295	M	PRI	SHALLOWFORD RD	CHATTANOOGA	TN 37411
TN0027669	VULCAN MATERIALS-BATTLE CR MARION	BATTLE CR	750630	800814	1422		PRI	BOX 357	S. PITTSBURG	TN 37380
TN0028291	W L JACKSON MFG(INACTIVE) HAMILTON	CHATTANOOGA CR	751205	770101	3639		PRI			
TN0001660	W R GRACE S PITTSBURG MARION	TENNESSEE RV	741230	800213	2819		PRI	P O BOX 436	SOUTH PITTSBURG	TN 37380
TN0026336	WALDEN RIDGE COAL-ROCKY RV SEQUATCHIE	ROCKY RV-DRY CR	770923	821024	1211		PRI		DUNLAP	TN
TN0002437	WHELAND FOUNDRY CHATTANOOGA HAMILTON	CHATTANOOGA CR	740628	791010	3322	M	PRI		CHATTANOOGA	TN 37402
TN0005517	WHITWELL WATER PLT WHITWELL MARION	SEQUATCHIE RV	740110	781231	4941		PRI	110 SPRING AVE	WHITWELL	TN 37397

TOTAL NUMBER OF QUICK LOOK LINES IS 00110