



STATE OF NORTH CAROLINA
OFFICE OF THE GOVERNOR
RALEIGH 27611

JAMES B. HUNT, JR.
GOVERNOR

Dear Concerned Citizens:

The State of North Carolina is committed to restoring the health and beauty of the Chowan River, and we need the thoughts and commitment of citizens like you to do it.

On March 9 of this year, I directed the Department of Natural Resources and Community Development to develop an Action Plan for controlling nutrient inputs to the river. The only way we can stop the algal blooms that hurt the recreational and commercial value of the rivers is to control the nutrient inputs to the river system. The Action Plan describes the steps that North Carolina and Virginia must take to control nutrients. We won't see improvements overnight, so it's all the more important that we begin at once.

Of course state and local governments still do all they can within their authority to control nutrient discharges. But we need the support of every citizen who lives in the Chowan River Basin to make the Chowan Restoration Project successful. The nutrients we must control don't come from one or two specific sources, and all sources must do their share in the clean up. Restoration may mean changes in some of our farming practices, a change in some municipal sewage treatment plants, and changes in industrial waste disposal practices. In the short run, it may seem inconvenient to take these actions. In the long run, it will benefit every citizen in the Chowan River Basin.

Please read the Action Plan and share with us your thoughtful criticism of the steps we propose to take. I hope very much that you will support this project.

Sincerely,

A large, stylized handwritten signature in black ink, appearing to read "J. B. Hunt".



State of North Carolina
 Department of Natural Resources
 and Community Development
 Raleigh 27611

JAMES B. HUNT, JR.
 GOVERNOR

September 27, 1979

HOWARD N. LEE
 SECRETARY
 TELEPHONE
 AREA CODE 919-733-4984

The Honorable James B. Hunt, Jr.
 Governor
 State of North Carolina
 Raleigh, North Carolina 27611

Dear Governor Hunt:

The Department of Natural Resources and Community Development is pleased to transmit to you our Plan of Action to restore the Chowan. Although the restoration of the river must be viewed as a long-term process, a lot has already been done, and we are continuing to take every step we can to clean it up as soon as possible. We have left no stone unturned in our search for solutions to this problem and the Department of Natural Resources and Community Development is committed to sticking with the problem until restoration occurs.

We believe you will be pleased with the progress already made in working with some of the industries and municipalities along the river. These measures, when completed, should drastically reduce the nutrient flow to the river from point sources for a restored Chowan River.

With kindest regards and best wishes, I am

Respectfully yours,

Howard N. Lee

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CHOWAN RIVER RESTORATION PROJECT

1. Summary

The Chowan River Restoration Project (CHORE) is a large-scale bi-state effort to halt algal blooms and restore the valuable and scenic lower Chowan River. The lower Chowan lies in North Carolina, but about two-thirds of the tributary area is in Virginia. North Carolina has committed to a Plan of Action to take all feasible steps to clean up sources within its borders. Both states have committed to develop a "Joint Water Quality Management Plan." Implementation of such a plan is intended to ensure acceptable water quality over the long-term. The North Carolina agency responsible for the project is the Department of Natural Resources and Community Development. In Virginia, it is the Virginia State Water Control Board.

2. Purpose

The Chowan River estuary has recently experienced nuisance algal blooms which are symptomatic of advanced eutrophication and clear evidence that excessive concentrations of nutrients are present in the river. The purpose of this Action Plan is to describe the steps that will be taken by the states of North Carolina and Virginia to reduce the levels of nutrients entering the river to the lowest practical levels. The Plan has two parts: 1) an immediate commitment by North Carolina to use the authority granted to the State Government to halt all unnecessary and excessive nutrient inputs (see 4.A. below) and, 2) a joint effort by the North Carolina-Virginia Water Management Committee to develop a long-term Water Quality Management Plan that will ensure acceptable levels of water quality permanently (see 4.B. below). The commitment set forth in this document is by the North Carolina Department of Natural Resources and Community Development. Virginia's present commitment is described in the Appendix. The name of the total project is the "Chowan River Restoration Project" (CHORE).

3. Authority and Means

The states will use all means and resources available to regulate both point and non-point discharges and to encourage good land use practices to reduce the total inflow of nutrients into the river system. Governor Hunt is on record as stating that the Chowan River is a "Top Priority" for North Carolina attention and Governor Dalton of

Virginia has assured Governor Hunt of his cooperation. As a result of Governor Hunt's March 9, 1979 meeting concerning the Chowan River, a number of other corporate, agricultural and state and local government officials are on record with their support of CHORE.

4. Elements of the Project

The basic structure of the project includes the following:

A. Immediate Action Plan

This is the immediate action component of the project. The full authority of State Government will be used to find solutions to those pollution problems which have degraded the river water quality. The specific elements of the Plan are given below. In each case, the North Carolina lead agency has been identified. It will be the responsibility of that lead agency to develop the appropriate cooperation with Virginia and the Environmental Protection Agency (EPA). Each lead agency is required to submit to the Secretary of NRCD a schedule and work plan for their individual work element by October 15. Where applicable, outcomes of the bi-state continuing Chowan planning process may modify or supersede these immediate action activities.

- (1) To work with each of the municipal or public point dischargers in the basin to reduce their nutrient inputs to the river to the minimum possible levels. Appropriate techniques such as land application of wastewater will be used wherever possible. The Appendix describes progress to date on this task.

Responsibility: Director, Division of Environmental Management

- (2) To work with each industrial or private discharger in the river basin to reduce nutrient discharges to a minimum consistent with good environmental and economic practices.

Responsibility: Director, Division of Environmental Management

- (3) In particular, work with the CF Industries' fertilizer plant at Tunis to completely eliminate the flow of nutrients from the site. CF

has retained an engineer to develop a proposal for a study on how to remedy the problem and their engineer has already met with NRCD officials.

Responsibility: Director, Division of Environmental Management

- (4) In particular, work with the Union Camp Corporation to ensure that their wastewater does not contribute to the algal blooms. North Carolina has already protested the continuation of their discharge permit as it is presently issued and intends to work toward the goal of requiring Union Camp waste disposal practices that do not adversely affect either the Chowan River or Albemarle Sound. Additional provisions to monitor nutrients were put into the reissued permit for the first time.

Responsibility: Director, Division of Environmental Management

- (5) To work with North Carolina and Virginia farmers and ensure, through voluntary programs of cooperation, that only the amount of agricultural nutrients that can readily be assimilated will be allowed to enter the river system. This program will be carried out through the Soil and Water Districts.

Responsibility: Director, Division of Soil and Water Conservation

- (6) To carefully study all other non-point runoff sources in the basin to see if any further reductions in nutrient inputs can be achieved.

Responsibility: Director, Division of Environmental Management

- (7) To assess the extent to which dry weather raw water withdrawals can be reduced, especially those that increase the probability of algal blooms and to recommend actions to mitigate these efforts.

Responsibility: Director, Division of Environmental Management

- (8) To study and implement new projects and innovative concepts that might reduce algal blooms.

Examples of such measures might be: low flow augmentation, selective dredging or experimental fishery initiatives. Only those ideas which are judged feasible and acceptable economically and environmentally would be pursued.

Responsibility: Director, Office of Water Resources

B. Long-Term Water Quality Management Plan Development

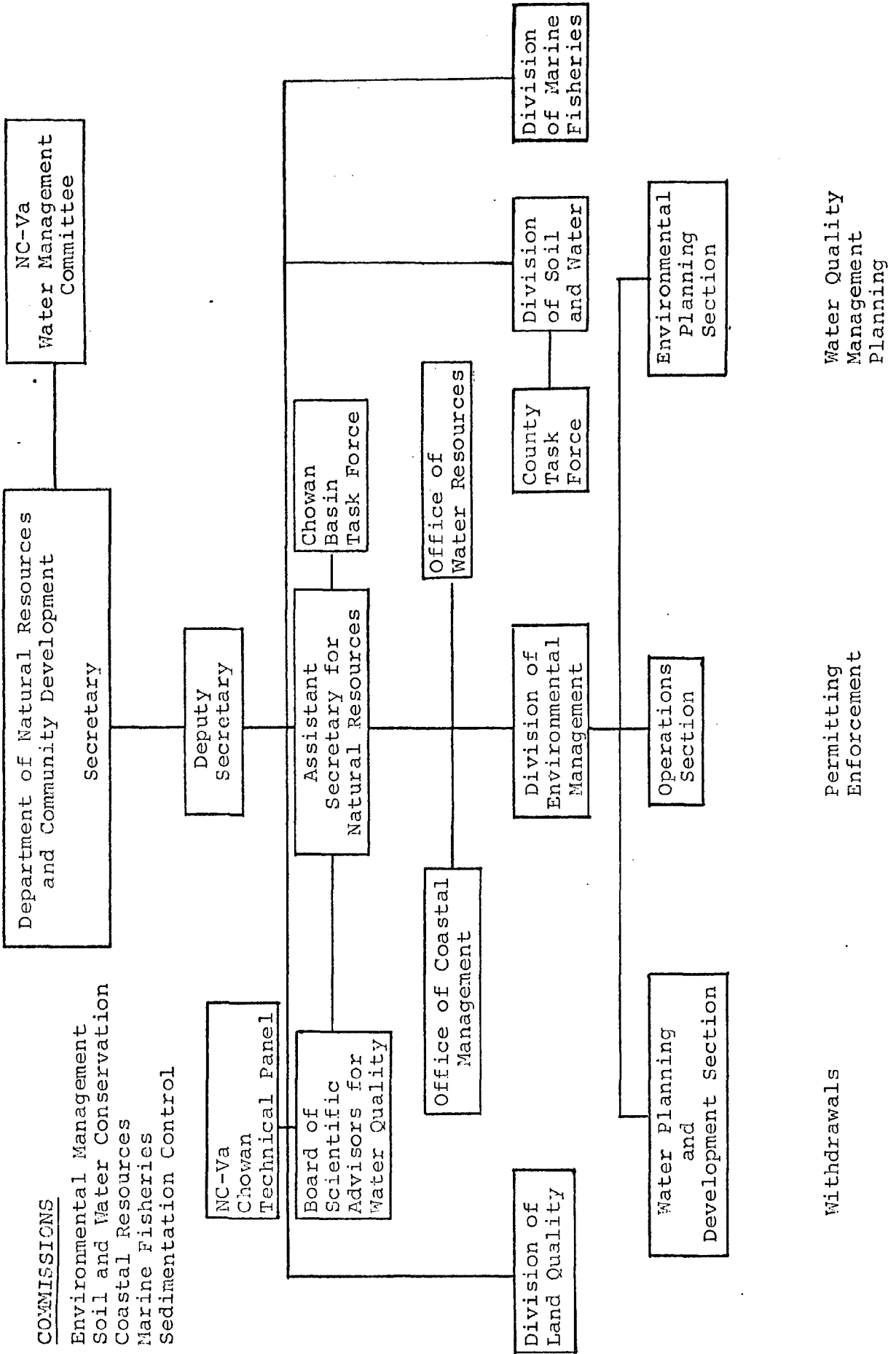
- (1) Development of the management structure for the bi-state planning process.
- (2) Development of a schedule for Management Plan Implementation.
- (3) Development of a continuing planning process to ensure follow through on the Restoration Project.
- (4) Development of monitoring and reporting systems for both the quality of the water and the progress of CHORE.

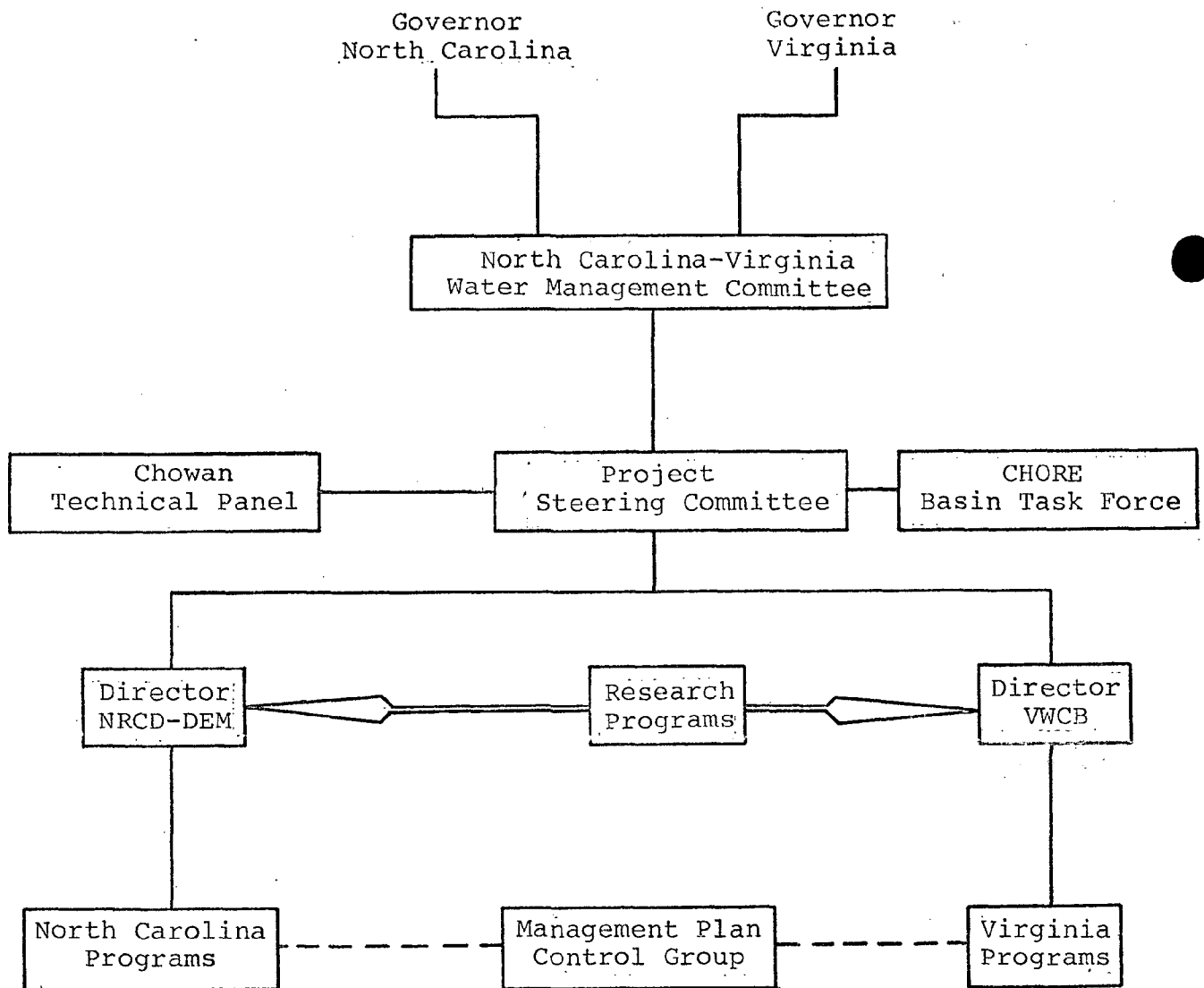
5. Management of CHORE

The responsibilities for developing the Water Quality Management Plan are as shown in Figures 1 and 2. As this is a bi-state effort, responsibilities reside with both states. Regulatory and operational authorities must reside with the appropriate boards: the Environmental Management Commission in North Carolina and the Virginia Water Control Board. For the basin Water Quality Management Plan, the states are working closely together. All bi-state activities are carried out through the North Carolina-Virginia Water Management Committee and through staff coordination by the two agencies.

The management structure for the immediate Action Plan is of particular interest. This Plan will be carried out by the North Carolina Department of Natural Resources and Community Development (NRCD). The primary responsibility is with the Secretary of NRCD working through the Deputy Secretary to the Assistant Secretary for Natural Resources who is responsible for all aspects of project operations. Six divisions of NRCD have substantial responsibilities in the project. The largest responsibility is with the Division of Environmental Management which operates regulatory and planning programs concerned with water quality. Another very important division is the

Figure 1. Responsibilities for CHORE Immediate Action Plan.





Note: This management structure applied to the bi-state project. For the N. C. Action Plan itself, the basic authority for execution is with the Governor and the Department of Natural Resources and Community Development.

Figure 2. Management Structure for Development of Water Quality Management Plan.

Soil and Water Conservation Division which is responsible for working with the Soil and Water Conservation Districts which will be instrumental in the agricultural portion of the project. Other NRCD units with substantial responsibilities include:

Division of Land Resources
Division of Marine Fisheries
Office of Water Resources
Office of Coastal Management

In addition to the Commissions shown on Figure 1, there are two advisory groups with substantial roles in the Chowan Action Plan. The Board of Scientific Advisors for Water Quality advises on scientific measures and considerations in the Chowan project. This Board is comprised of scientists and researchers with substantial expertise in water quality. The CHORE Basin Task Force is comprised of local officials with substantial expertise and interests in local matters important in execution of the project.

The administrative support for the CHORE Basin Task Force will be with the Division of Soil and Water Conservation. Administrative support for the Board of Scientific Advisors is from the Division of Environmental Management.

6. Schedule for Implementation

The basic schedule for project implementation is as shown in Figure 3.

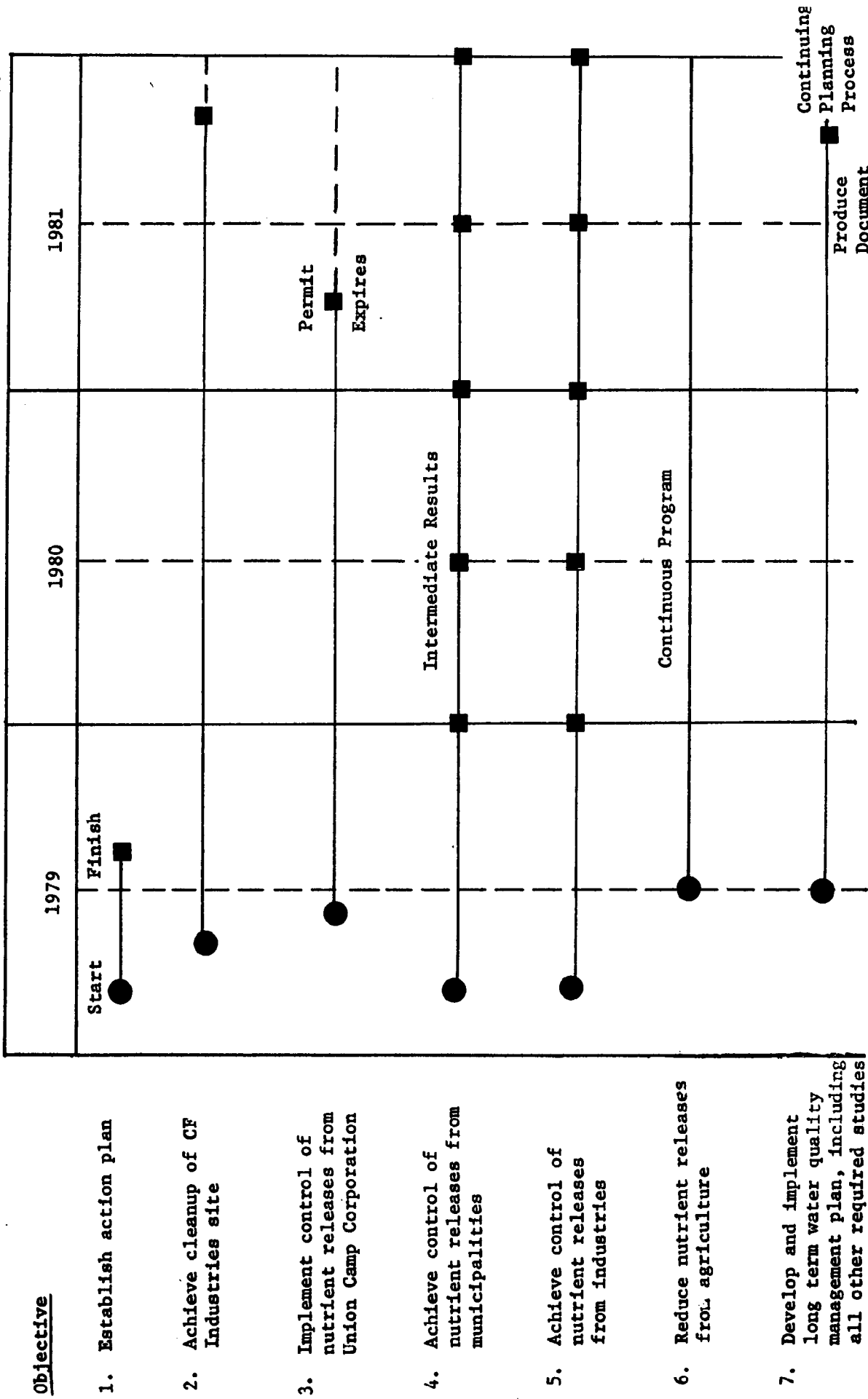
This schedule will be supplemented by time schedules developed by the immediate action lead agencies (see 4.A. above), as well as those developed in the Water Quality Management Plan.

7. Specific Management Plan Responsibilities

The two states will develop a coordinated Continuing Planning Process as an extension of outline contained

TARGET ACCOMPLISHMENTS FOR CHORE

FIGURE 3.



Objective

1. Establish action plan
2. Achieve cleanup of CF Industries site
3. Implement control of nutrient releases from Union Camp Corporation
4. Achieve control of nutrient releases from municipalities
5. Achieve control of nutrient releases from industries
6. Reduce nutrient releases from agriculture
7. Develop and implement long term water quality management plan, including all other required studies

in the Appendices. This process will outline the planning concept, complete with the allocation of resources, necessary agreements and milestone dates.

8. Reports

The CHORE Steering Committee will prepare brief quarterly and substantive annual progress reports, including in the latter all pertinent data with analysis. The Appendices of this report serve as the annual report due June 10, 1979, and summarize all the work done prior to that date. The Steering Committee will recommend to the bi-state Water Management Committee when CHORE should be considered complete.

9. Distribution of Nitrogen Inputs to Chowan

To understand the magnitude of the nutrient problem, it will be helpful to see a distribution of nitrogen input by source. Table 1 presents a very approximate listing of nutrient inputs to the Chowan from North Carolina and Virginia. These are placed in categories including non-point sources broken down into major and minor contributors.

Table 1. Annual Average Total Nitrogen Inputs to Chowan (Percent)

	<u>North Carolina</u>	<u>Virginia</u>	<u>Total</u>
Non-point Sources			
Agriculture	11	36	47
Forest and Wetlands	7	28	35
All other	1	1	2
			<hr/>
	Total		84%
Point Sources			
Municipalities	2	4	6
Industries	4	6	10
Union Camp		(5)	
CF Industries	(3)		
			<hr/>
	Total		16%
			<hr/> <hr/>
	Grand Total		100%

Source: Virginia and North Carolina 303 River Basin Plans

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MANAGEMENT PLAN CONTROL GROUP

This group would manage and coordinate the joint North Carolina-Virginia Special 208 Study should funds become available to implement the Study. Representatives would consist of staff from both states and the U. S. Environmental Protection Agency.

CHOWAN RIVER TASK FORCES

Governor Hunt envisioned the formation of a local group in each county of the Chowan River Basin to develop a Chowan Action Plan for their county. These local task forces, working with the local Soil and Water Conservation Districts, will be composed of county leaders from diverse backgrounds. They will be responsible for planning and implementing the Action Plan at the local level. The Soil and Water Conservation Commission will support the CHORE Plan by implementing the 208 Agricultural Plan in the Chowan River Basin. To coordinate the programs between counties, a regional task force will be formed from the membership of the local task forces and some regional workers. This regional task force will coordinate between the local groups and the Department of Natural Resources and Community Development to ensure consistency on the work of the local task forces. The Department of Natural Resources and Community Development will provide technical support related to Best Management Practices. The Chowan Basin Task Forces (both county and regional) will be formulated by the end of the year if possible.

APPENDIX A

PROBLEM ASSESSMENT

PROBLEM ASSESSMENT

Summary

While large growths of algae have been occurring on the Chowan River for years, heavy growths were noted in 1970 and bloom conditions developed in the summer of 1972. These conditions have continued and the summer of 1978 brought extensive algal growth once more. This condition has generated heavy local protest and much media attention. Major complaints center around the loss in recreational value caused by the algae and the reduced fishing success experienced in recent years. While the reduced commercial fishing catches have not been scientifically proven to be caused by the algae, there is no doubt that the algae has reduced the river's recreational potential and has affected recreational property values near the river. Scattered fish kills have occurred following extensive blooms of algae.

Swimming or boating in algal choked water is not attractive, and dead algae can cause odor problems. But there is more than just aesthetics associated with excessive growths of algae, particularly the blue-green species which proliferate in the Chowan. Large growths of algae can deplete the water's oxygen supply and cause fish kills. Blue-green algae are also toxic and can cause further biological problems.

An outbreak of red sore disease, a bacterial infection of fish, is reaching epidemic proportions this year in the Chowan River-Albemarle Sound drainage system. The disease has been linked to deteriorating water quality in the sound and river and some commercial fish catches have up to 100 percent contamination. While the direct link has not yet been made between the algal blooms and the disease, which can be fatal to fish and cause disease and death in man, it is probably that steps taken to eliminate the blooms will also help protect the commercial fishing industry from red sore disease outbreak.

Previous Studies

Nitrogen is the nutrient most often mentioned when discussing the restoration of the Chowan River, but it is important to note that phosphorus also plays a critical role in the nutrient balance. Increases of nitrogen in the river have promoted the growth of algae to the point that in some portions of the river, phosphorus can be the limiting nutrient. This is important because four of the five species of algal blooms can "fix" nitrogen from the air, therefore, phosphorus may prove to be an important link in the restoration project. Much of the work described below, however, focuses on nitrogen.

Water quality monitoring in the 1960's showed that the Chowan had levels of inorganic nitrogen approaching the amount necessary for blooms to occur. During 1972 and succeeding

years, detailed studies have found that more than enough nutrients exist in the river to support severe algal blooms. A 1972 study by the North Carolina Division of Environmental Management recommended that several detailed studies be funded to provide more information on the problems in the Chowan River.

As a result of the 1972 report, several research studies were funded to investigate different aspects of the water quality problem in the river. This study effort, which received financial support from the U. S. Environmental Protection Agency, the U. S. Department of the Interior and the states of North Carolina and Virginia took place over a one-year period, 1974-1975. This was called the Chowan River Project.

The study of the Chowan River involved six coordinated project components as follows:

1. The U. S. Geological Survey (USGS) developed a hydrologic model using tide, wind and temperature information along with upstream gaged flows. This model will be essential for use in making nutrient transport estimates and to facilitate development of water quality models.
2. An intensive sampling program of the river was made by the North Carolina Office of Water and Air Resources, under the direction of Mr. Grover Cook. This sampling effort turned out to be too limited to provide sufficient data for modeling efforts and, in particular, was insufficient because the sampling was not done during a bloom year. This data will be extremely useful for later model verification work.
3. The role of aquatic macrophytes in controlling water quality was studied under the direction of Drs. Brinson and Davis at East Carolina University. They found that aquatic macrophytes were unlikely to affect the water quality of the Chowan River because of the restricted area of the shallow littoral in the river and, thus, low growth of rooted aquatics.
4. The recycling of nitrogen in the river was studied by Drs. Stanley and Hobbie, N. C. State University. They found that nitrogen was recycled rapidly in the Chowan and that much of the nitrogen to sustain summer algal blooms comes from nitrogen that is

recycled from the river and its bottom sediments. This means that if point source discharges of organic matter and nutrients settle out on the river bottom, even if discharged only in the winter, they may provide nutrients to sustain summer blooms of algae.

5. The phytoplankton response to water quality was studied under the direction of Dr. Witherspoon, N. C. State University. This study characterized the patterns of algal growth in the Chowan and identified the major bloom-causing species in the river. Dr. Witherspoon and others monitored algal growth from 1974 to 1977 and noted that algal biomass increased each year. They noted that the sluggish lower river was where most of the growth took place because of the long residence time of nutrients and algae. The investigation also documented that algal blooms would occur following rainfall after the river stage decreased. In addition, it was found that algae, washed down from upstream areas with runoff, could proliferate to bloom proportions in the lower river. This indicated that nutrients in surface runoff as well as algae from upstream areas may be contributing to the problem.
6. Mathematical modeling of the Upper and Lower Chowan was performed under the direction of Dr. Contractor, Virginia Polytechnic Institute and Drs. Galler and Amein, N. C. State University, respectively. These models were to use the information developed in the first five components of the study. Dr. Contractor's report has not yet been received by DEM and, in any case, does not address the bloom portion of the Chowan. The model as developed by Drs. Galler and Amein has provided a basic modeling tool to be worked with; however, it has several severe limitations due to lack of a sufficient data base and gaps of knowledge in the processes of the Chowan which need further study. These gaps of knowledge include interaction with the sediments and nitrogen fixation. The model also does not predict algal nuisance or bloom conditions, but rather average conditions in the river.

Other researchers investigating water quality in the Coastal Plain have found that greater amounts of nutrients were transported in channelized streams than in natural streams (Kuenzler, *et al.*, 1977). They concluded that natural streams and swamps in eastern North Carolina cleanse the water of nutrients and, therefore, would deliver less nutrients to estuaries than would channelized streams.

Very high amounts of nitrogen have been monitored in ditches below agricultural land in eastern North Carolina (Gambrell, et al., 1974) and sampling undertaken by the Statewide 208 Study has found very high levels of nutrients in streams draining agricultural areas in the Coastal Plain. Gilliam, et al., (1978) have reported results of recent research near Kinston and Plymouth that used the control of water table height in ditches to stop some of the nutrients from reaching streams. They state "There is no question that a significant reduction in nitrate-nitrogen entering the surface water could be achieved using the methods described herein." However, the researchers are not sure whether this would mean that less nitrogen would reach estuaries. It appears clear from the existing data that less nitrogen would reach streams in the Coastal Plain if less tile drainage, less intensive ditching and less ditch maintenance or channel improvements were undertaken.

Preliminary Summary of Division of Environmental Management Data

The emphasis of the current and proposed monitoring on the Chowan is on determining the sources and fate of nutrients entering the Chowan and the biological response of the river to nutrient loadings. Major emphasis of data evaluation has centered on nitrogen since this nutrient has been implicated as the limiting nutrient for algal growth in the Chowan and thus the nutrient to be most tightly controlled. More emphasis will probably be directed towards phosphorus in future data analysis as its role in the eutrophication process in the Chowan may not have been sufficiently emphasized in the past.

A. Estimated Nutrient Loadings

An inventory of nitrogen loadings to the Chowan watershed from both point and non-point sources has been developed and is summarized in Table 1. Further refinements on loadings of nitrogen from specific land uses and refinements in land use characterization of the basin will be developed as the monitoring and study efforts continue.

The nitrogen loadings for the Virginia portion of the Chowan Basin were developed from information in the Virginia 303 Plan (June 1976) for this basin. In this Plan, the magnitude of non-point source pollution was estimated in terms of pollutant area-yield rates for specific land use types which were judged to be reasonable values for the Chowan River Basin. Further loadings

were attributed to farm animal populations in the basin. The area-yield rates were compared (by Virginia) to values reported in recent technical literature and found to be reasonable and were also found to be compatible when evaluated against the results of a combined point source/non-point source computer model being developed at the Virginia Polytechnic Institute for the Chowan Basin. The non-point source pollution area yield rates used were as follows:

<u>Land Use Type</u>	<u>Total Nitrogen as N (lbs/acre/yr)</u>
Urban	6
Agricultural	6
Forest/Marsh	2

The point source industrial and municipal loadings of nitrogen from Virginia were also developed from information in the 303 Plan.

For the purpose of approximating contributing non-point sources of nitrogen in the North Carolina portion of the basin, the Virginia methodology was adopted. This was done after review of the available technical literature which supported the kinds of yields which were used and for purposes of being consistent for comparison of North Carolina and Virginia contributions. Land uses and animal populations were abstracted from the North Carolina 303 Plan for this basin. Point source loadings for North Carolina were calculated from recent data on average flows and nutrient concentrations for North Carolina dischargers. Direct precipitation figures were estimated after review of several data sources on rainfall nutrient concentrations in this area.

Actual nutrient loading delivered to the estuary from the headwaters and major tributaries of the Chowan will be developed on a seasonal and annual basis as the monitoring program continues and flow data becomes available through USGS. These input data will be invaluable for future modeling work on the river.

B. Water Quality Data

Water quality data has been gathered along the river on a weekly basis since September 1978. Data has been collected on nutrients and various physical and chemical parameters in the river. This data has been compiled in the Quarterly Reports on the investigation.

The tidal nature of the river and the complexity of the biological-nutrient processes in the river makes interpretation of this data difficult outside of the confines of a water quality modeling effort. The concentrations of available nutrients necessary to trigger algal blooms in the estuary has not been determined. This is because flushing times, temperature, light penetration and other factors also impact algal growth. Also, some nutrient sources and sinks have not been adequately investigated for the Chowan system such as interaction with the sediments and nitrogen fixation by blue-green algae. It is hoped that the data being gathered in this study, along with further research, will allow for development of a usable predictive model for algal growth in the Chowan which can be used for management purposes.

Preliminary analysis of the data has revealed some findings. During the summer 1978 bloom period, a pattern of high total nitrogen and, in particular, total organic nitrogen was found in the bloom area from Holiday Island south to Edenton Bay. This is due to the relatively large amounts of nutrients tied up in the algal cells. Nitrate nitrogen ($\text{NO}_3\text{-N}$) and ammonia nitrogen ($\text{NH}_3\text{-N}$) values were consistently lower in this reach than in the reaches above Holiday Island.

Much of the sampling effort has centered on possible nitrogen input from the CF Industries (CFI) properties. A pattern of higher levels of total organic nitrogen and total inorganic nitrogen downstream from CFI were noted on most, but not all, sampling runs. The increase in nitrogen concentration was most noticeable during low stream flow periods and was not noticeable during high flow periods. Preliminary estimates indicated that between 500 to 2000 lbs./day of nitrogen enter the Chowan River in the vicinity of CFI.

The winter sampling on the river and its tributaries showed a typical pattern of much higher loads of nitrogen to the river during the winter high flow period than during the summer low flow period. This was due not only to higher flows, but also higher nitrogen concentrations, particularly inorganic nitrogen. The effect of the winter Union Camp discharge on the river nitrogen loadings was quite noticeable. This winter influx of nutrients may be particularly important if settling of some of these nutrients occurs in the winter period and recycling of nutrients back into the water column occurs during the critical spring and summer growth period.

Water quality data is also being collected on the major tributaries of the river on a bi-weekly basis to provide data on inputs to the river system.

C. Biological Quality Data

The 1978 bloom on the Chowan lasted from late June to early November. The typical pattern of growth of algae during these months showed good species diversity and lower biomass above the bloom area (above Hiliday Island) and a dominance of 1 to 3 taxa and high growth of algae in the bloom area. The predominant species found in the bloom growth area were of the blue-green type. Five major species of cyanophyceae were found to be the cause of the visual blooms in the Chowan: three species of *Anabaena*, one of *Mycrocystis* and one of *Aphanizomenon*. The particular phytoplankton species present in the river are important since algae have different nutrient and physiological needs and some species can fix their own nitrogen from atmospheric sources.

Growth was definitely in nuisance proportions during the 1978 bloom. The DEM is proposing a chlorophyll a water quality standard of 40 ug/l for estuaries, and chlorophyll concentrations far exceeded this value during the 1978 bloom.

References

- Gambrell, et al., 1977. N. C. W. R. R. I.
Report No. 93.
- Gilliam, et al., 1978. N. C. W. R. R. I.
Report No. 128.
- Kuenzler, et al., 1977. N. C. W. R. R. I.
Report No. 127.

Table 1. Estimate of Annual Nitrogen Inputs to the Chowan River Basin

	Land Area (10 ⁴ acres)	% of Total Area	Lbs. N per ac. per yr.	10 ⁵ lbs N per yr.	% of Total N
<u>North Carolina</u>					
Agriculture	20.2	6.8	-		11.4
Runoff			6	12.1	(8.8)
Animal Waste	-	-	-	3.6	(2.6)
Forest & Wetlands	47.1	15.7	2	9.4	6.9
Urban Runoff	1.4	0.5	6	0.8	0.6
Point	-	-	-		5.5
Industrial	-	-	-	5.1*	(3.7)
Mun. & other Domestic	-	-	-	2.5	(1.8)
Direct Precipitation	2.8	0.9	7.8	2.2	1.6
Total	71.5	23.9		35.7	26.1
<u>Virginia</u>					
Agriculture	36.8	12.3	-		36.2
Runoff			6	22.1	(16.2)
Animal Waste	-	-	-	27.4	(20.0)
Forest & Wetlands	189.5	63.3	2	37.9	27.7
Urban Runoff	1.4	0.5	6	0.8	0.6
Point	-	-	-		9.5
Industrial	-	-	-	7.6	(5.6)
Mun. & other Domestic	-	-	-	5.3	(3.9)
Total	227.7	76.1		101.1	73.9
<u>Total</u>					
Agriculture	57.0	19.1			47.6
Runoff			6	34.2	(25.0)
Animal Waste	-	-	-	31.0	(22.6)
Forest & Wetlands	236.6	79.0	2	47.3	34.6
Urban Runoff	2.8	1.0	6	1.6	1.2
Point	-	-	-		15
Industrial	-	-	-	12.7*	(9.4)
Mun. & other Domestic	-	-	-	7.8	(5.8)
Direct Precipitation	2.8	0.9	7.8	2.2	1.6
Total for Chowan Basin	299.2	100		136.8	100

* Including CF's 4.4 (1200 lbs/day)

Table 2. General Characteristics of the
Chowan River Basin

Basin drainage area:

Piedmont Plateau of Virginia (rolling hills)	2,000 square miles
Coastal Plain	3,000 square miles
Main River length	50 miles
Rainfall (annual)	45 inches
Runoff from Chowan River Basin (annual)	12 inches
	or .9 cfs/mi ² of drainage
1970 population (approximate)	
Virginia	171,600
North Carolina	88,400
Total	260,000
1970 rural population (80% of total)	206,000
1% decline in population since 1960	

TABLE 3 - WASTEWATER DISCHARGERS
OF THE CHOWAN RIVER BASIN

A. VIRGINIA DISCHARGERS

MEHERRIN RIVER BASIN
Domestic Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
1	Town of Alberta	Brunswick	Roses Creek
2	Town of Lawrenceville	Brunswick	Roses Creek
3	City of Emporia	Greenville	Falling Run
4	Town of Victoria (West)	Luenburg	Couches Creek
5	Town of Chase City (#2)	Mecklenburg	unt. Finneywood Creek
6	Town of South Hill (#2)	Mecklenburg	Mountain Creek
7	Town of South Hill (#3)	Mecklenburg	Taylor Creek
8	Town of LaCrosse (#1)	Mecklenburg	Little Genito Creek
9	Town of Boykins	Southampton	Tarrara Creek
10	Brunswick Jr. High School and Totaro Elem. School	Brunswick	unt. Roses Creek
11	Brunswick Academy	Brunswick	Sandy Branch
12	Sturgeon Elem. School	Brunswick	unt. Flatrock Branch
13	Meherrin-Powellton Elem. School	Brunswick	unt. Greentown Branch
14	Edmunds Trailer Court	Brunswick	unt. Allen Creek
15	Southside Community College	Charlotte	unt. Gills Creek
16	Hicksford Elem. School	Greenville	Falling Run

Map
Key
No.

<u>No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
17	Zion Elen. School	Greensville	unt. Falling Run
18	Belco Motel and Restaurant	Greensville	unt. Falling Run
19	Ramada Inn	Greensville	Fontaine Creek
20	Artie Pickford Residence	Greensville	Mill Swamp
21	Robert Hicks Residence	Greensville	unt. Mill Swamp
22	Virginia Rest Stop (I-95)	Greensville	unt. Beaverpond Creek
23	Gizzards Sunoco	Greensville	unt. Falling Run
24	Wilson Trailer Court	Greensville	Caney Branch
25	B. A. Moore's Trailer Park	Greensville	unt. Falling Run
26	Boykins Elen. School	Southampton	unt. Tarrara Creek

MEHERRIN RIVER BASIN
Industrial Dischargers:

Map
Key
No.

<u>No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
1	Vulcan Materials (001)	Brunswick	Robinson Creek
2	Vulcan Materials (002)	Brunswick	Robinson Creek
3	Lawrenceville Water Treatment Plant	Brunswick	Great Creek
4	Jenny System Mayfield Carwash	Brunswick	Great Creek
5	Virginia Dye Corp.	Greensville	Meherrin River
6	Trego Stone Corp.	Greensville	Fontaine Creek
7	Weldon Mills	Greensville	Meherrin River
8	Georgia Pacific	Greensville	Metcalf Creek
9	Emporia Water Treatment Plant	Greensville	Meherrin River
10	Victoria Industrial Development Authority (Salt Holding Pond)	Lunenburg	Couches Creek

MEHERRIN RIVER BASIN (Continued)
Industrial Dischargers:

Map Key No.	Facility Name	County	Receiving Water
11	Victoria Industrial Development Authority (Aerated Lagoon)	Lunenburg	Couches Creek
12	Kenbridge Water Treatment Plant	Lunenburg	Flat Rock Creek
13	South Hill Water Treatment Plant	Mecklenburg	Crooked Creek

NOTTOWAY RIVER BASIN
Domestic Dischargers:

Map Key No.	Facility Name	County	Receiving Water
1	Town of McKenny	Dinwiddie	unt. Buckskin Creek
2	Town of Jarratt	Greensville	Hickory Swamp
3	Town of Victoria (East)	Lunenburg	unt. Big Hounds
4	Town of Kenbridge	Lunenburg	Seays Creek
5	Red Oak E.S.	Brunswick	unt. Waqua Creek
6	Eastside E.S.	Dinwiddie	Rocky Branch
7	Nottoway Motel and Restaurant	Brunswick	Nottoway River
8	Humble Oil Co. 712	Brunswick	Nottoway River
9	Dinwiddie Co. Jr. High School	Dinwiddie	unt. Little Cattail Creek
10	Dinwiddie Co. High School	Dinwiddie	unt. Chamberlains Bed Creek
11	Silmurts Motel	Dinwiddie	Smith Creek
12	Georgian Rathskeller	Dinwiddie	unt. Hatcher Run
13	Green Acres Trailer Court and Motel	Dinwiddie	Hatcher Run

NOTTOWAY RIVER BASIN (Continued)
 Domestic Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
14	I-85 Rest Stop	Dinwiddie	unt. Gravelly Run
15	Harrison's Trailer Park	Dinwiddie	Picture Branch
16	Holiday Inn Trav-L- Campgrounds	Dinwiddie	Hatcher Run
17	Stuckey's	Dinwiddie	Little Cattail Creek
18	Belfield E.S.	Greensville	unt. Maclins Creek
19	Reste' Motel	Greensville	Otterdam Swamp
20	Emporia Motel and Restaurant (Quality Inn)	Greensville	Otterdam Swamp
21	Emporia Truck Stop	Greensville	unt. Three Creek
22	Deering Exxon	Greensville	unt. Three Creek
23	Burkeville Inter- Mediate School	Nottoway	nt. Mallorys Creek
24	Fort Pickett	Nottoway	unt. Hurricane Branch
25	Piedmont State Hosp.	Nottoway	unt. Lazaretto Creek
26	Holiday Inn South	Prince George	Unt. Jones Hole Swamp
27	Clairmont Motel	Prince George	Jones Hole Swamp
28	Bollingbrook Inn Motel and Allstate MHP	Prince George	unt. Jones Hole Swamp
29	Busby Sunoco Station	Prince George	Jones Hole Swamp
30	Hill's Trailer Park	Prince George	unt. Jones Hole Swamp
31	Southampton High School	Southampton	unt. Mill Swamp
32	Southampton Jr. High School	Southampton	unt. Nottoway River
33	Courtland E.S.	Southampton	unt. Flag Run

NOTTOWAY RIVER BASIN (Continued)
Domestic Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
34	Capron E.S.	Southampton	Buckhorn Swamp
35	Hunterdale E.S.	Southampton	unt. Nottoway Swamp
36	Southampton State Correctional Farm	Southampton	Three Creek
37	Convict Camp No. 20	Southampton	Hornet Swamp
38	Central H.S. and E.S.	Sussex	Anderson Branch
39	Colonial Motel and Jarratt Motel	Sussex	Spring Creek
40	Davis Restaurant	Sussex	Stony Creek
41	Sussex Courthouse	Sussex	unt. Thweatt Branch

NOTTOWAY RIVER BASIN
Industrial Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
1	Lone Star Industries	Brunswick	unt. Nottoway River
2	Dinwiddie Laundromat	Dinwiddie	Stony Creek
3	Victoria Water Treatment Plant	Lunenburg	Little Hounds Creek
4	Burkeville Veneer	Nottoway	unt. Mallorys Creek
5	Crewe Water Treatment Plant	Nottoway	Lazaretto Creek
6	Fort Pickett Water Treatment Plant	Nottoway	Hurricane Creek
7	Hercules, Inc.	Southampton	Wills Gut
8	Hercules, Inc.	Soluhampton	Nottoway River

NOPTOWAY RIVER BASIN (Continued)
Industrial Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
9	H. P. Beale and Sons	Southampton	unt. Mill Run
10	Southampton State Correctional Farm	Southampton	Three Creek
11	Johns-Manville Corp. (002)	Greensville	Hickory Swamp
12	Johns-Manville Corp. (001)	Greensville	Chetocric Swamp

BLACKWATER RIVER BASIN
Domestic Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
1	South Plains Sub-Division (City of Petersburg)	Petersburg City	unt. Second Swamp
2	Berkeley Manor (City of Petersburg)	Petersburg City	Blackwater Swamp
3	City of Franklin	Southampton	Blackwater River
4	Edgehill Subdivision	Southampton	unt. Blackwater River
5	Town of Waverly	Sussex	Spring Branch
6	Town of Wakefield	Sussex	Wildcat Swamp
7	Zuni Presb. School	Isle of Wight	unt. Blackwater River
8	Field Correctional Unit 3	Isle of Wight	unt. Corrowaugh Swamp
9	South E.S.	Prince George	unt. Second Swamp
10	Walton E.S.	Prince George	unt. Blackwater Swamp
11	Richard Bland College	Prince George	unt. Second Swamp
12	Harrison E.S.	Prince George	unt. Blackwater Swamp

BLACKWATER RIVER BASIN (Continued)
Domestic Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
13	Beazley E.S.	Prince George	unt. Blackwater Swamp
14	Prince George H.S. and Country Aire MHP	Prince George	Blackwater Swamp
15	Prince George Jr. H.S.	Prince George	Second Swamp
16	Quality Inn/Steven Kent Motel	Prince George	unt. Second Swamp
17	IaSalle Motel	Prince George	unt. Second Swamp
18	Ellwyn Motel	Prince George	unt. Second Swamp
19	Phillips 66	Prince George	Groundwater
20	Prince George Texaco	Prince George	unt. Warwick Swamp
21	Petersburg Jail Farm	Prince George	unt. Second Swamp
22	Bennies M.H.P., Inc.	Prince George	unt. North Fork Blackwater Swamp
23	Mannings M.H.P.	Prince George	Blackwater Swamp
24	Whispering Pines Trailer Court	Prince George	unt. Blackwater Swamp
25	Battlefield Park Exxon No. 2	Prince George	Groundwater
26	Berlin-Ivor E.S.	Southampton	unt. Seacock Swamp
27	Brookside Trailer Park	Southampton	unt. Blackwater River
28	Jones Primary School	Suffolk	Spiney Swamp
29	Surry County H.S.	Surry	Hazel Swamp
30	L. P. Jackson Combined School	Surry	unt. Blackwater River

BLACKWATER RIVER BASIN
Industrial Dischargers:

<u>Map Key No.</u>	<u>Facility Name</u>	<u>County</u>	<u>Receiving Water</u>
1	Union Camp Bleached Paper and Board Division	Isle of Wight	Blackwater River
2	Union Camp Building Products Division	Isle of Wight	Blackwater River
3	Master Tank and Welding Co.	Prince George	unt. Second Swamp
4	R. M. Felts Packing Co.	Southampton	unt. of Seacock Swamp
5	St. Regis Paper Co.	Southampton	unt. of Blackwater River
6	Union Camp Bleached Paper and Board Division	Suffolk City	Blackwater River
7	Masonite Corp.	Sussex	Spring Branch
8	Masonite Corp.	Sussex	Spring Branch
9	Spurlock Corp.	Sussex	Spring Branch
10	Spurlock Corp.	Sussex	Spring Branch

unt. - unnamed tributary

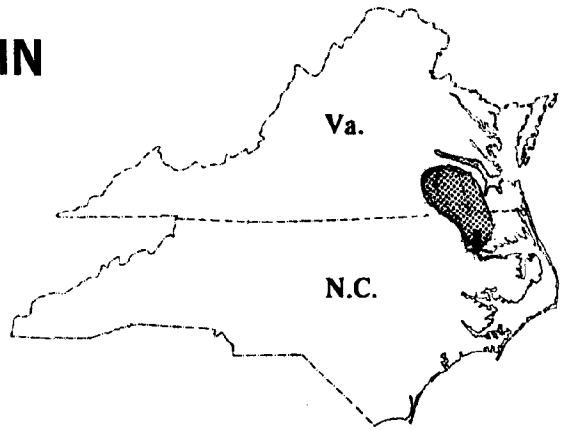
B. NORTH CAROLINA DISCHARGERS

Map Key NO.	Facility	County	Receiving Water	Type Waste
1	Roanoke Housing Project	Northampton	Beaverpond Creek	Domestic
2	Seaboard	Northampton	Ivy Creek	Domestic
3	Eastside Elementary School	Northampton	Ramsey Creek	Domestic
4	Northampton High School	Northampton	Wildcat Swamp	Domestic
5	Severn	Northampton	Meherrin River	Domestic
6	Conway	Northampton	unt. Kirby Creek	Domestic
7	Georgia-Pacific, Inc.	Northampton	Paddy's Delight Creek	Industrial
8	Woodland	Northampton	unt. Urahaw Swamp	Domestic
9	Murfreesboro	Hertford	Meherrin River	Domestic
10	Riverview Elementary School	Hertford	unt. Meherrin River	Domestic
11	Oulander	Hertford	Fort Branch	Domestic
12	S. Oulander Elementary School	Bertie	Fort Branch	Domestic
13	Ahoskie	Hertford	Ahoskie Creek Swamp	Domestic
14	Alamanc Knitting Mills	Hertford	unt. Ahoskie Creek Swamp	Industrial
15	Winton	Hertford	Chowan River	Domestic
16	C. F. Industries	Hertford	unt. Chowan River	Industrial
17	C. G. White Ele. School	Bertie	unt. Barbecue Swamp	Domestic
18	Harrellsville	Hertford	unt. Wiccacon River	Domestic
19	W. Colerain Ele. School	Bertie	unt. Chinkapin Swamp	Domestic
20	Colerain	Bertie	unt. Chowan River	Domestic
21	Perry-Wynns Fish Co.	Bertie	Chowan River	Industrial
22	John P. Law Ele. School	Bertie	unt. Black Walnut Swamp	Domestic
23	Gates County High School	Gates	unt. Bennett Creek	Domestic
24	Gates County Community Center	Gates	Bennett Creek	Domestic
25	N.C. Dept. of Correction and Central Jr. Hi. School	Gates	unt. Bennett Creek	Domestic
26	Gatesville Ele. School	Gates	Bennett Creek	Domestic
27	Sunbury Primary School	Gates	unt. Raynor Swamp	Domestic
28	T.S. Cooper Ele. School	Gates	unt. Raynor Swamp	Domestic
29	Chowan County Hi. School	Chowan	Indian Creek	Domestic
30	White Oak School	Chowan	unt. Chowan River	Domestic
31	United Piece Dyeworks	Chowan	Chowan River	Industrial
32	Chowan County Water System	Chowan	unt. Rockyhock Creek	Industrial
33	Edenton Water Treatment Plant	Chowan	unt. Chowan River	Industrial
34	Edenton Cotton Mills	Chowan	Queen Annie Creek	Industrial
35	Edenton	Chowan	Chowan River	Domestic

unt. - unnamed tributary

CHOWAN RIVER BASIN

FIGURE 1

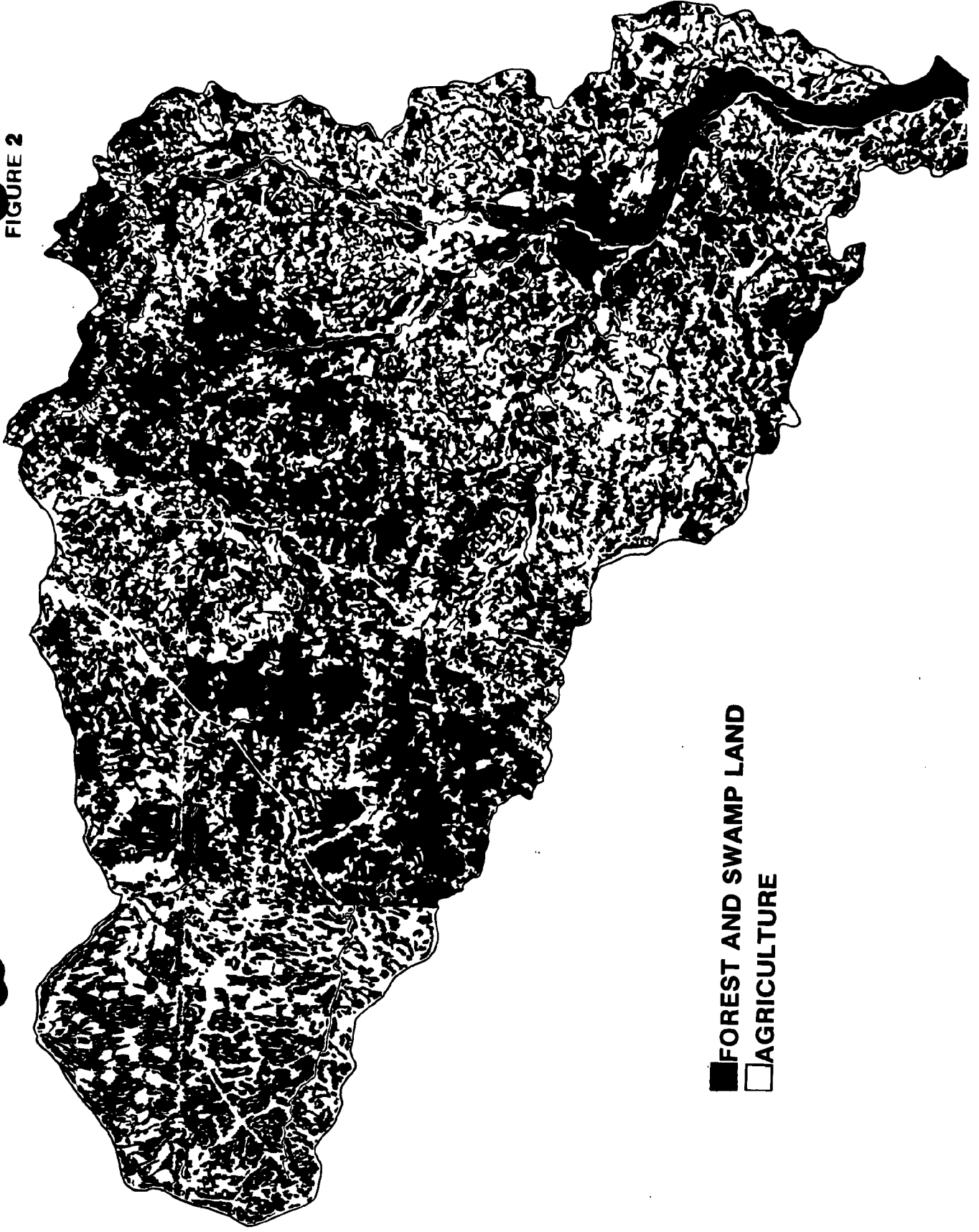


LOCATION MAP



GENERALIZED LAND USAGE

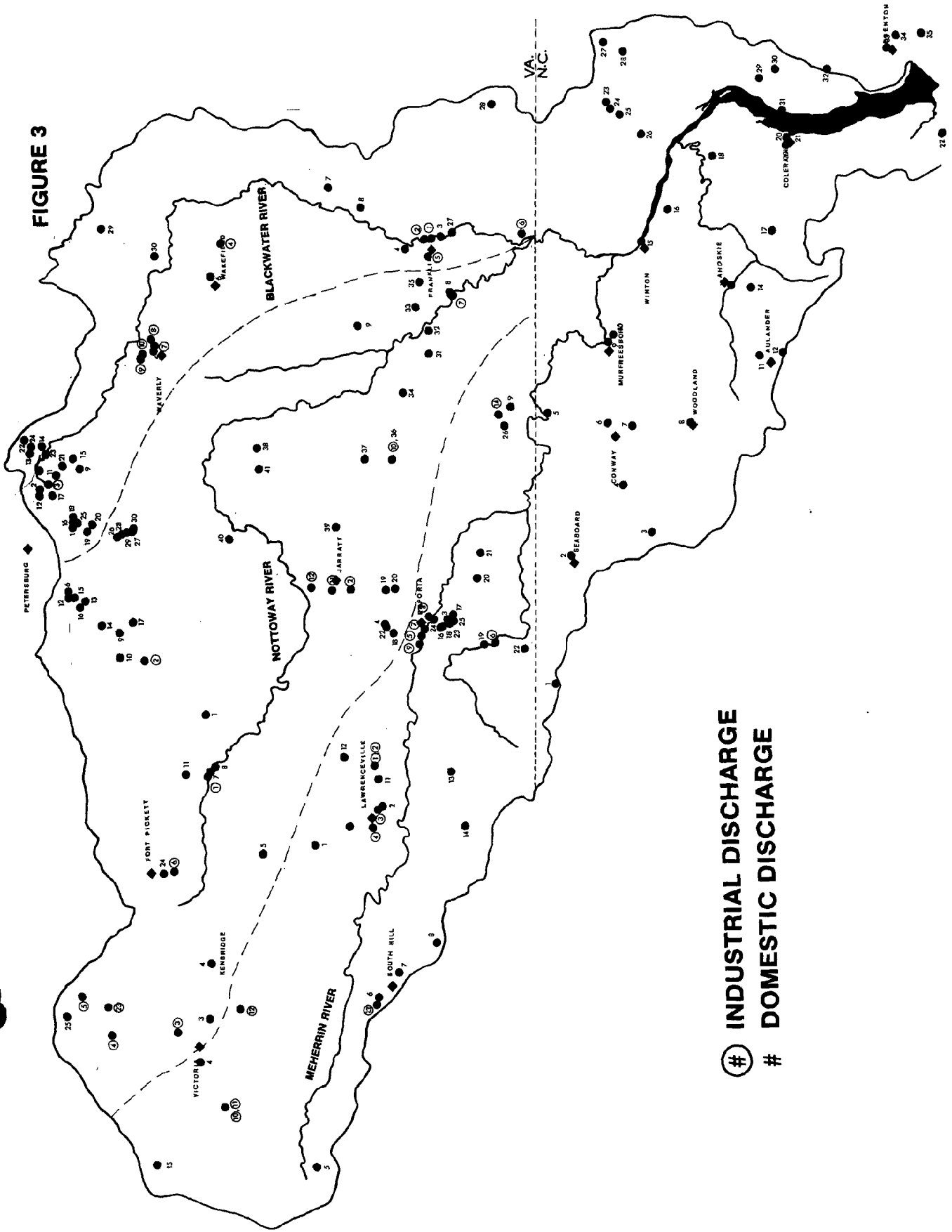
FIGURE 2



■ FOREST AND SWAMP LAND
□ AGRICULTURE

DISTRIBUTION OF POINT SOURCE

FIGURE 3



(#) INDUSTRIAL DISCHARGE
 # DOMESTIC DISCHARGE

APPENDIX B

NORTH CAROLINA ACTIVITIES
AND
COMMITMENTS

NORTH CAROLINA ACTIVITIES AND COMMITMENTS

Monitoring Strategy

The water quality monitoring program currently underway in the Chowan River is the single most critical activity being performed. It is essential to an understanding of how the river responds to various conditions and to the development of a sound management strategy. Three full-time scientists are assigned to this restoration project and are stationed in Edenton. Dr. Robert Holman is the head of this team, and may be reached at (919) 482-7556. The current and proposed monitoring plan calls for the following actions:

- A. Approximately 25 stations on the Chowan River are sampled weekly by boat. Figure 1 shows the locations of the sampling stations, and Table 1 gives station descriptions and parametric coverage. These samples will provide a data base for river conditions during the sampling period and can be combined with flow data for development of water quality models of algal growth and nutrient dynamics in the Chowan. Continuous automatic samples of the river are being taken in the vicinity of C. F. Industries (CFI).
- B. Approximately 20 stations on tributaries to the Chowan River are sampled bi-weekly from bridges. Figure 2 shows the locations of these stations and Table 2 gives station descriptions and parametric coverage. These stations will give nutrient loading data for tributaries which will be useful for model inputs. These loading data can also be used along with land use data and point source data to determine important nutrient source areas.
- C. Weekly samples of the Union Camp effluent are taken when the industry is discharging and bi-weekly samples are taken of United Piece and Dye effluent. Further monitoring of point sources will be needed on a regular basis to obtain accurate estimates of individual point source contributions.
- D. Sediment samples are taken on a monthly basis at five stations for nutrient analysis in an effort to show geographical and seasonal variations in nutrient concentrations in the sediment. This sampling scheme may not be sufficient to determine nutrient inputs from the sediment. It is anticipated that a sediment interaction research study in the Chowan, to be managed through the WRRI, could answer the sediment question (assuming it is funded).

- E. Some air sampling has taken place in the vicinity of CFI to preliminarily study air inputs of nutrients to the Chowan from CFI's emissions. Some loading of nitrogen was seen in this area and further air sampling and modeling work has been planned to study this possibly significant source.
- F. Groundwater studies have been ongoing at the CFI site. Wells have been installed in the swamp below their property and surface and subsurface concentrations of nitrogen in the swamp have been determined. Hydraulic profiles have been determined by shooting elevations of water levels in the wells. A report is pending on an estimate of groundwater inputs of nutrients from CFI property.
- G. Agricultural BMP's recommended in the 208 Plan are² being implemented on four small watersheds (1-5 mi² area) within the Chowan River Basin as part of a study being carried out by NCSU researchers. Nutrient production from these watersheds will be compared with that from a forested watershed as well as with previous estimates of nutrient production. These previous estimates, made before BMP implementation, were developed from monitoring done for a two-year period in two of the watersheds by researchers from NCSU. This study will provide much needed information relative to the effectiveness of recommended BMP's in reducing nutrients from agriculture.
- H. Tides and temperature are being continuously monitored at five stations along the river by USGS to use in determining accurate flow patterns in the river. This information will be useful in future water quality modeling.
- I. Algal kinetics and nutrient requirements are being studied through a contract with Dr. Witherspoon at NCSU. He is focusing his work on the five major bloom species in the Chowan. The NCSU laboratory is also performing much of the nutrient analysis and all phytoplankton analysis for the Chowan study. The Division of Environmental Management is currently establishing a laboratory in Edenton to ensure the availability of sample analysis and analytical capabilities for both biological and chemical samples. The same analytical methods developed and utilized by Dr. Witherspoon are being used.

Nutrient Sensitive Water Classification

Until the adoption of the Nutrient Sensitive Water Classification, the Division of Environmental Management (DEM) did not have the authority to limit nutrient inputs into the surface waters of the State. At the January 11, 1979, meeting of the Environmental Management Commission (EMC), the DEM staff presented a proposed action plan to limit nutrient releases to the Chowan River Basin. In response to this proposal, along with various other input, the EMC adopted a resolution authorizing the Director of DEM to initiate rule-making procedures for developing "a regulation to limit nutrient discharges into the streams and tributaries to streams experiencing or which are likely to experience excessive growth(s) of microscopic and macroscopic vegetation."

Following the direction provided in the January 11 EMC Resolution, DEM staff, Enforcement staff and the Attorney General's Office staff began to formulate specific regulatory authority to address nutrients in the aquatic environment. The result of this effort is the concept nutrient sensitive waters. The rule was formulated to utilize the statutory authority in G. S. 143-214.1 for developing surface water classifications aimed at protecting the water for its best usage.

The Nutrient Sensitive Water (NSW) regulation was considered at public hearings in Winton, North Carolina on March 13, 1979 and in Raleigh, North Carolina on March 15, 1979. The staff brought the regulation before the EMC at their May 10, 1979 meeting. At that time, the EMC adopted the NSW regulation. Briefly, 15 NCAC 2B. 0214, Nutrient Sensitive Waters, allows the EMC to classify, in addition to existing classifications, any waters which "are experiencing or are subject to excessive growths of microscopic or macroscopic vegetation" as nutrient sensitive. Excessive growths are defined as "... growths which the Commission in its discretion finds to substantially impair the use of the water for its best usage as determined by the classification applied to such waters." Excessive growths, then, are more than scientific measurements alone. The total impact of excessive aquatic vegetation must be considered. The NSW regulation prohibits the increase of nutrient concentrations in waters so classified.

A copy of the adopted regulation is shown in Addendum 1.

At the May 10, 1979 EMC meeting, the Commission utilized their emergency powers to classify the Chowan River as nutrient sensitive for 120 days. On June 21, 1979, a public hearing was held in Winton, North Carolina to consider whether the NSW classification of the Chowan should be made permanent.

Point Source Nutrient Control Options

- A. Municipalities: Since the EMC has adopted the NSW classification of the Chowan as permanent, at least two nutrient control options exist:
1. Under the NPDES permitting system, all point source dischargers into NSW may be required to control nutrient inputs. Thus, a municipality's NPDES permit could contain nutrient limitations. However, two conditions will prevent the immediate realization of any benefits this control option might have. First, nutrient limitations will be placed in a discharger's permit upon reissuance. Because permit reissuance is normally on a five year basis, nutrient effluent limitations may not become effective for up to five years. Second, even if a permit with nutrient limitations is issued in a short amount of time, a particular municipality will likely lack the facilities necessary to achieve the nutrient requirements. A compliance schedule involving several years will have to be developed.
 2. Through the 201 planning process, treatment facilities for nutrient removal or land application procedures can be planned for and constructed. This option, however, also has with it a delay period for realizing the actual reduction of nutrients going into the Chowan River.
- B. Industries: Besides voluntary cutbacks, industries would be subject to the same processes as that described for municipalities in A.1. above.

Point Source Legislation

Attached in Addendum 2 is a copy of the recently ratified Senate Bill 641. This bill established G. S. 143-214.3, Revision to Water Quality Standard. The provisions of this statute provide an affected discharger the opportunity to

request revisions to established water quality standards for a particular stream segment on the basis of economic considerations which would, in effect, require a lesser degree of treatment than what would otherwise be required. Nutrient limitations, which are rarely required under EPA guidelines, could be directly affected by this statute. Therefore, it is important to note that any nutrient point source control program implemented in the Chowan through nutrient permit limitations is jeopardized by the availability of the statutory revision process in G. S. 143-214.3.

Non-Point Source Nutrient Control Options

The Chowan River Basin has been designated as a priority area in the North Carolina 208 Water Quality Management Plan for Agriculture and as such will receive intensified implementation and study efforts. This will involve intensive educational efforts and, to the extent possible, shifting available technical assistance capabilities and cost-sharing funds to the region to promote a maximum voluntary control effort from local farmers.

The intensive educational effort will be a highly cooperative venture, employing the excellent local support developed by each of the agencies represented on the 208 Agricultural Task Force. Local participation and involvement is crucial to the success of this program aspect and toward this end the formation of ad hoc committees is envisioned. These will consist of representatives of all concerned local groups, including Soil and Water Conservation District supervisors, SCS personnel, NCDAs representatives, local Farm Bureau and Grange officials and county extension staff, as well as representatives of task force organizations. This will stimulate the highest possible level of community awareness and benefit from being founded at the grassroots level. On-farm demonstrations, carried out with the cooperation of these same agencies, will be employed as part of the educational program to encourage the use of recommended practices.

Besides the voluntary approach currently anticipated, the EMC could utilize its "Special Order" authority for non-point source pollution. A third mode of action limiting additional tile drainage, drainage ditch construction and channel improvements would be unpopular in the area and is not currently being considered. It would, however, very likely assist in controlling nutrient delivery to streams in the basin. Additional monitoring is needed to determine the levels of nutrient loading coming from intensively-drained agricultural land.

A. Voluntary Use of Best Management Practices

This would consist of good faith effort by farmers to reduce nutrient input through applying less fertilizer, different fertilizer, or different timing of fertilizer. Soil tests could be used to assist in proper fertilizer application. Soil conservation practices could be used in appropriate areas and would be eligible for funding from the U. S. Agricultural Stabilization and Conservation Service if funding was available. Better practices would also be needed in locating animal operations and in managing animal waste disposal. The North Carolina 208 Agricultural Task Force could be used to assist in urging voluntary compliance.

B. Special Order

A Special Order is the most likely regulatory tool that could be used to control non-point source pollution. A Special Order may be issued by the EMC to any person causing or contributing to any pollution of the waters for which standards have been set. The order may direct the person, within a specified period of time, to take action deemed by the EMC as necessary and feasible in order to eliminate such pollution. During the 1979 Session of the General Assembly, a bill was passed to exempt agriculture from any Special Order of the EMC. Very few agricultural operations have ever been fined by the EMC, and these have been animal operations which are classified as point source pollution. Perhaps the EMC still has the authority to fine a non-point source agricultural operation, but now it cannot specify a time period for the operation to come into compliance in order to avoid that fine (see addendum 3). This now also applies to point source animal operations. Therefore, the EMC at this time has no practical regulatory tool to deal with agricultural non-point source pollution, the major contributor of non-point source nutrients.

C. Drainage and Channel Improvement Controls

By memorandum of agreement, the U. S. Army Corps of Engineers, the U. S. Soil Conservation Service and various North Carolina and Virginia counties could institute a moratorium on the public support of drainage improvements below agricultural areas. The U. S. Soil Conservation Service could agree not to supervise the installation of tile drainage in the

river basin. Since "normal farming" and "minor drainage" are exempt from the 404 Dredge-and-Fill Permit process, voluntary compliance by individual landowners would be needed to limit the installation of tile drainage and to minimize the amount of maintenance of existing ditch systems. In addition, agriculture is exempt from the provisions of the Coastal Area Management Act (CAMA) with one exception -- that all new ditch and canal outlets through estuarine shorelines or coastal wetlands require CAMA permits. Consequently, improvements to existing channels will not require CAMA permits.

Research currently being conducted by N. C. State University and U. S. Geological Survey is finding that if ditches are not cleared of vegetation, the plants will cleanse the waters of nutrients and less may be delivered to watercourses. Thus, landowners should be encouraged to conduct a minimum amount of ditch clearing. Preliminary research also conducted by N. C. State University has found that winter water table controls can help reduce the delivery of nitrogen to surface waters. This technique may provide a useful means of controlling nutrient delivery from cropland in the future.

Water Quality Management Plan for the Chowan River

Little authority exists to immediately limit nutrient delivery to the river. Consequently, the states of North Carolina and Virginia must prepare a Water Quality Management Plan for the entire Chowan Basin that will identify all the hard technical and political decisions concerning pollution abatement actions that will be needed to control nutrient delivery to the river.

North Carolina has prepared a Statewide 208 Water Quality Management Plan that delineates actions that need to be taken across the State to improve water quality. Due to its wide coverage from the mountains to the coast, this first Plan does not include detailed actions that should be specifically undertaken to solve the problem in the Chowan River. However, this first Plan did identify a process by which the 208 Water Quality Management Planning program can be used to develop a specific water quality management plan for river basins such as the Chowan River. Both Virginia and North Carolina must participate in this planning process to restore acceptable water quality to the river. A more detailed description of this process may be found in Appendix D

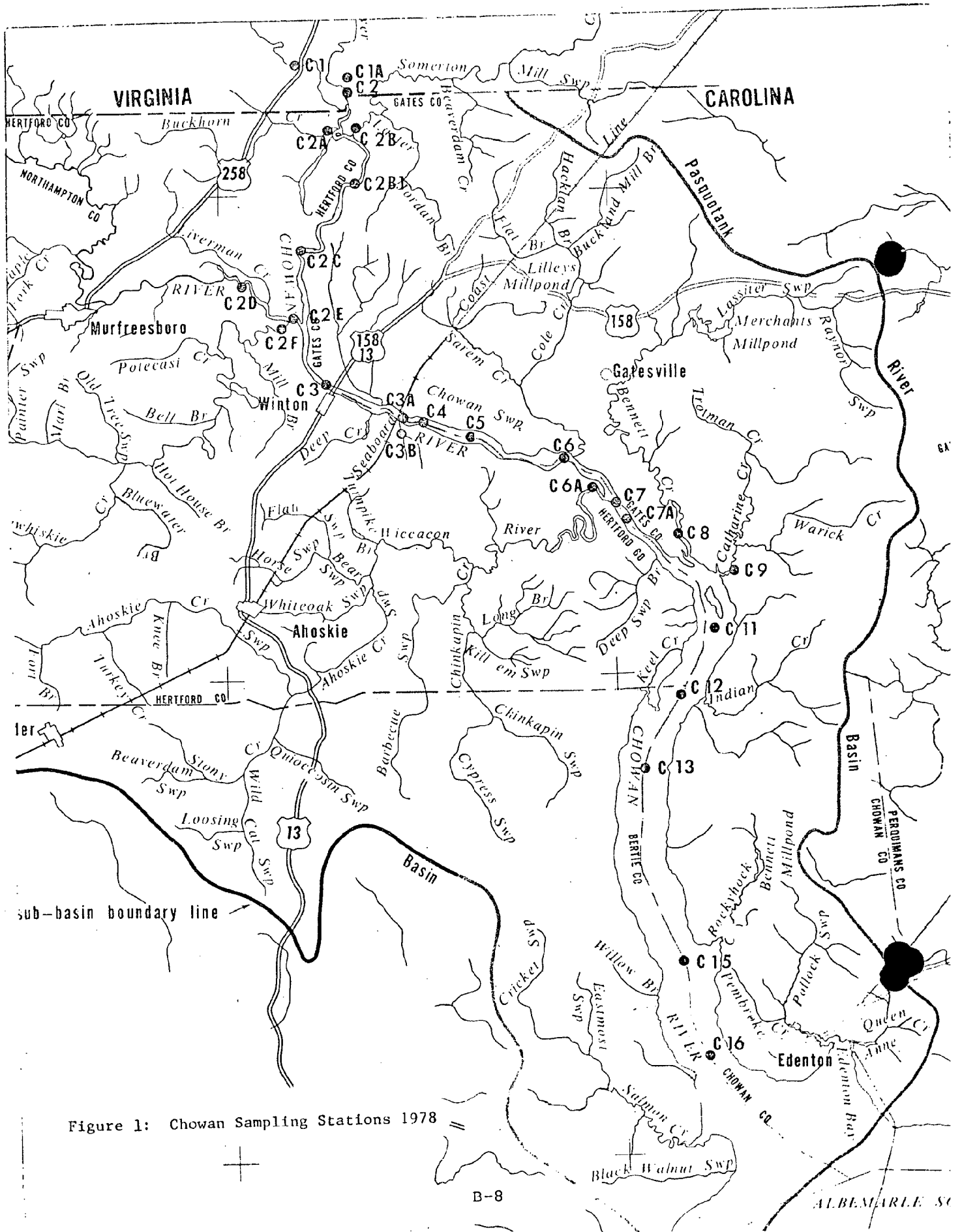


Figure 1: Chowan Sampling Stations 1978

TABLE 1

CHOWAN STATIONS

	River Mile from Va. Line	D.O. - Temp. - pH alk.-light	P&N - Water	Chlorophyll	Phytoplankton	P&N - Sediment	Spores - Sediment
C-1. Nottoway River above mouth at US 258.		W	W	W	W		
UC-1 Union Camp discharge		W	W	W	W		
C-1A* Discharge canal from Union Camp.		W	W	W	W		
C-1B Blackwater River at horseshoe bend above Union Camp		W	W	W	W		
C-2 Blackwater River 300 yds. above mouth.		W	W	W	W		
C-2A * Buckhorn Creek at Riddick Landing.		W	W	W	W		
C-2B Somerton Creek 100 yds. above mouth.		W	W	W	W		
C-2B1 Chowan At Gatlington Landing.	4.0	W	W	W	W		
C-2C Chowan at 90° bend above Meherrin.	8.8	W	W	W	W		
C-2D Meherrin River at horseshoe.		W	W	W	W		
C-2E* Meherrin River at Parker Ferry.							
C-2F Potecasi Creek at mouth.		W	W	W	W		
C-3 Chowan 100 yds. above bridge at Winton.	13.3	W	W	W	W	M	W
C-3A (Old C-RR) Chowan at Seaboard Railroad near Tunis.	16.2	W	W	W	W		
C-3B Catharine Creek at Tunis boat ramp.		W	W	W	W		
C-4 Chowan mid-river at CF Industries pier.	17.8	W	W	W	W	M	W
C-4Z Swamp drainage at downstream flag (sample on land)							
C-4C* Chowan 10' off bank at C-4Z							

C-4A	Chowan on CF side at swamp at automatic sampler.	17.9	W	W	W			
C-5	Chowan below bend below CF Industries at Marker 27.	18.8	W	W	W	W		
C-5A*	Barnes Creek at mouth.							
C-6	Chowan just below Island Creek.	22.7	W	W	W	W		
C-6A	Wiccacon River at 1st bend above mouth.		W	W	W	W		
C-6B*	Wiccacon at Tar River Landing		W	W	W	W		
C-7*	Chowan 200 yds. below Wiccacon.	25.5						
C-7A	Chowan River below Wiccacon at Marker 18	25.9	W	W	W	W		
C-8	Bennett Creek at 1st bend above mouth.		W	W	W	W		
C-9	Catherine Creek 100 yds. above mouth.		W	W	W	W		
C-11	Chowan 200 yds. below Holiday Island at Marker 12.	31.4	W	W	W	W	M	W
C-12	Chowan mid-channel at Dillard Creek (Indian Creek)	33.7	W	W	W	W		
C-13	Chowan mid-channel at Colerain.	37.1	W	W	W	W	M	W
C-14	Rockyhock Creek up into mouth.		W	W	W	W		
C-15	Chowan mid-channel at Rockyhock Creek.	44.2	W	W	W	W		
C-16	Chowan 50 yds. above NC 17 bridge.	48.2	W	W	W	W	M	W
C-17*	Chowan 400 yds. below NC 17 bridge.	48.5						
C-21*	Edenton Bay 300 yards S of Edenton.							

*Stations which have been discontinued.

M=Monthly
W=Weekly

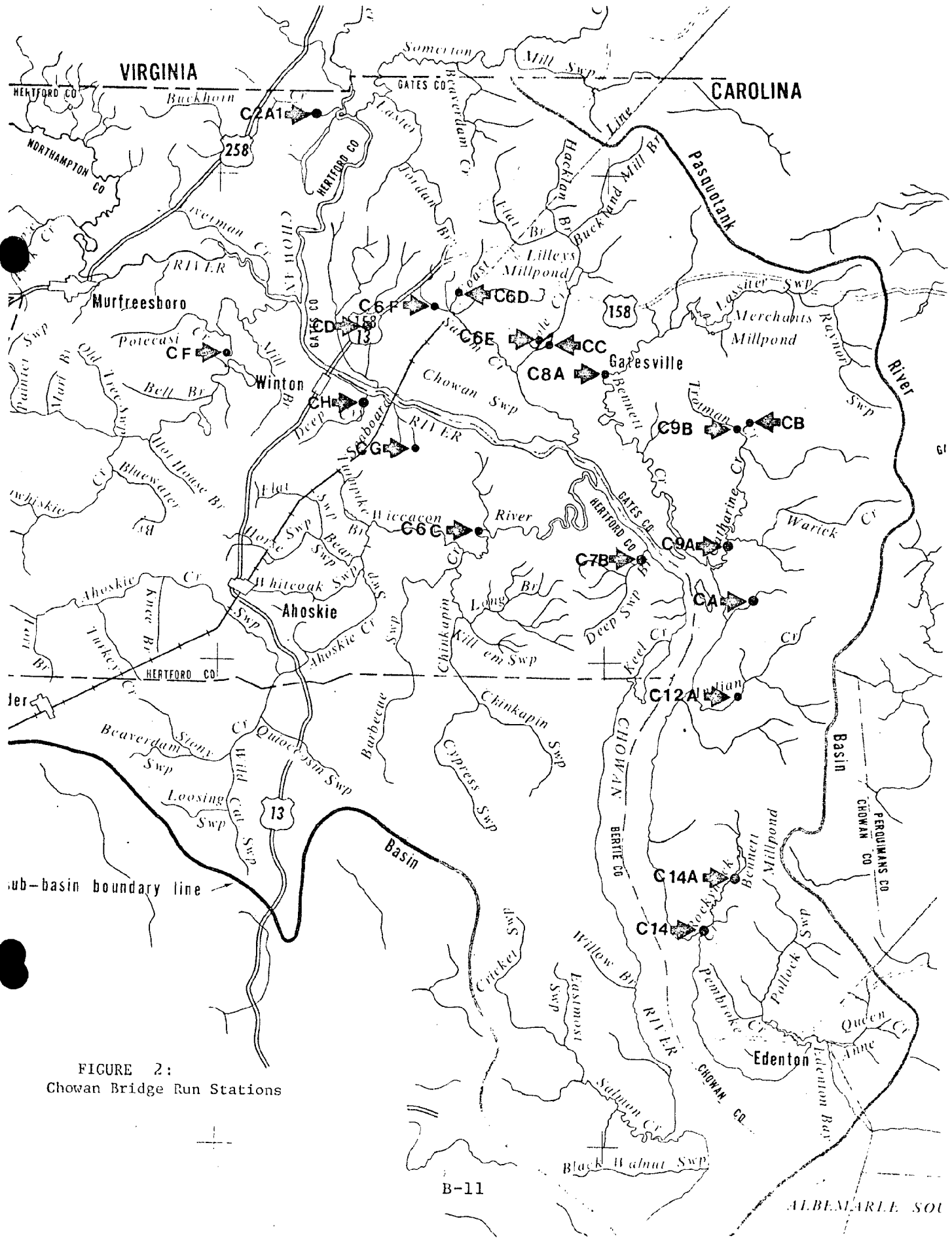


FIGURE 2:
Chowan Bridge Run Stations

Table 2. Bridge Run

<u>Station #</u>		<u>Parameter</u> *
C-14	Rockyhock Creek at SR-1207	P&N
C-14A	Rockyhock Creek at ST-1222	P&N
C-12A	Dillard Creek at ST-1226	P&N, Phyto
C-A	UT on ST-1232 just north of Cannon Ferry	P&N
C-9A	Catherine Creek At ST-1232	P&N
C-9B	Trotman Creek at ST-1100	P&N
C-B	Swamp area around Trotman Creek	P&N
C-8A	Bennetts Creek at Highway 37	P&N
C-6E	Cole Creek at SR-1112	P&N
C-C	2nd Bridge at Cole Creek at SR-1112	P&N
C-6D	Taylor Mill Pond at SR-1118	P&N, Phyto
C-6F	Sarem Creek at ST-1120	P&N
C-D	Run Swamp Creek at Highway 13/158	P&N
C-2A1	Buckhorn Creek at ST-1319	P&N
C-F	Potecasi Creek at Highway 158	P&N
C-G	Catherine Creek at ST-1400	P&N, Phyto
C-6C	Wiccacon River at Highway 45	P&N
C-7B	Taylor Pond at ST-1441	P&N, Phyto
C-H	Deep Creek at ST-1112	P&N
UPD	United Piece & Dye Effluent	P&N

* Also temperature, pH, D.O. and conductivity taken at all tributary stations.

ADDENDUM 1

Regulation 15 NCAC 2B .0214; NUTRIENT SENSITIVE WATERS; has been adopted and reads as follows:

.0214 NUTRIENT SENSITIVE WATERS

(a) In addition to existing classifications, the commission may classify any surface waters of the State as nutrient sensitive waters (NSW) upon a finding that such waters are experiencing or are subject to excessive growths of microscopic or macroscopic vegetation. Excessive growths are growths which the commission in its discretion finds to substantially impair the use of the water for its best usage as determined by the classification applied to such waters.

(b) NSW may include any or all waters within a particular river basin as the commission deems necessary to effectively control excessive growths of microscopic or macroscopic vegetation.

(c) For the purpose of this rule, the term "nutrients" shall mean phosphorous and/or nitrogen. When considering the assignment of this classification the commission may specify as a "nutrient" any other chemical parameter or combination of parameters which it determines to be essential for the growth of microscopic and macroscopic vegetation.

(d) Those waters additionally classified as nutrient sensitive shall be identified in the appropriate schedule of classifications as referenced in Section .0300 of this Subchapter.

(e) For the purpose of this rule the term "background levels" shall mean the concentration(s), taking into account seasonal variations, of the specific nutrient or nutrients upstream of a nutrient source.

(f) Quality Standards applicable to NSW: No increase in nutrients over background levels unless it is shown to the satisfaction of the director that the increase

- (1) is the result of natural variations, or
- (2) will not endanger human health, safety or welfare and that preventing the increase would cause a serious economic hardship without equal or greater benefit to the public.

History Note: Statutory Authority G. S. 143-214.1;
Eff. May 10, 1979.

Addendum 2
GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 1979
RATIFIED BILL

CHAPTER 929

SENATE BILL 641

AN ACT TO AMEND G.S. 143-214.3 SO AS TO REVISE THE WATER QUALITY STANDARDS.

The General Assembly of North Carolina enacts:

Section 1. A new section is added to Chapter 143 of the General Statutes to read as follows:

"§ 143-214.3. Revision to water quality standard.--(a) Any person subject to the provisions of G.S. 143-215.1 may petition the Environmental Management Commission for a hearing pursuant to G.S. 143-215.4 for a revision to water quality standards adopted pursuant to G.S. 143-214.1 as such water quality standards may apply to a specific stream segment into which the petitioner discharges or proposes to discharge.

(b) Upon a finding by the Environmental Management Commission that:

- (1) natural background conditions in the stream segment preclude the attainment of the applicable water quality standards; or
- (2) irretrievable and uncontrollable man-induced conditions preclude the attainment of the applicable water quality standards; or
- (3) application of effluent limitations for existing sources established or proposed pursuant to G.S. 143-215.1 more restrictive than those effluent

standards and limitations determined or promulgated by the United States Environmental Protection Agency pursuant to Section 301 of the Federal Water Pollution Control Act in order to achieve and maintain applicable water quality standards would result in adverse social and economic impact, disproportionate to the benefits to the public health, safety or welfare as a result of maintaining the standards; and

- (4) there exists no reasonable relationship between the cost to the petitioner of achieving the effluent limitations necessary to comply with applicable water quality standards to the benefits, including the incremental benefits to the receiving waters, to be obtained from the application of the said effluent limitations;

Then the Environmental Management Commission shall revise the standard or standards, as such standard may apply to the petitioner, provided that such revised standards shall be no less stringent than that which can be achieved by the application of the highest level of treatment which will result in benefits, including the incremental benefits to the receiving waters, having a reasonable relationship to the cost to the petitioner to apply such treatment, as determined by the evidence; provided, however, in no event shall these standards be less stringent than the level attainable with the application by the petitioner of those effluent standards and limitations determined or

promulgated by the United States Environmental Protection Agency pursuant to Section 301 of the Federal Water Pollution Control Act; provided, further, that no revision shall be granted which would endanger human health or safety."

Sec. 2. There is appropriated from the General Fund to the Department of Natural Resources and Community Development forty-five thousand dollars (\$45,000) for the 1979-80 fiscal year and forty-five thousand dollars (\$45,000) for the 1980-81 fiscal year, in addition to all other appropriations, for the purpose of carrying out the provisions of this act.

Sec. 3. This act shall become effective July 1, 1979.

In the General Assembly read three times and ratified, this the 8th day of June, 1979.

JAMES C. GREEN

James C. Green
President of the Senate

CARL J. STEWART, JR.

Carl J. Stewart, Jr.
Speaker of the House of Representatives

ADDENDUM 3
GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 1979
RATIFIED BILL

CHAPTER 889

HOUSE BILL 1456

AN ACT TO AMEND G.S. 143-215.2 CONCERNING THE USE OF SPECIAL
ORDERS AGAINST FARM OPERATIONS.

The General Assembly of North Carolina enacts:

Section 1. G.S. 143-215.2(a) is amended by adding the
following sentence at the end thereof:

"Provided, however, that the provisions of this section shall
not apply to any agricultural operation, such as the use or
preparation of any land for the purposes of planting, growing, or
harvesting plants, crops, trees or other agricultural products,
or raising livestock or poultry."

Sec. 2. This act is effective upon ratification.

In the General Assembly read three times and ratified,
this the 8th day of June, 1979.

JAMES C. GREEN

James C. Green

President of the Senate

CARL J. STEWART, JR.

Carl J. Stewart, Jr.

Speaker of the House of Representatives

APPENDIX C

VIRGINIA ACTIVITIES AND COMMITMENTS

VIRGINIA ACTIVITIES AND COMMITMENTS

At a meeting in Raleigh, North Carolina on March 9, 1979, Mr. R. V. Davis, Executive Secretary, Virginia State Water Control Board, spoke on behalf of the Commonwealth of Virginia and pledged Virginia's cooperation "to the fullest extent possible in assessing the water quality situation of the Chowan River Basin in Virginia." Since that meeting, Virginia has met with officials from North Carolina on several occasions and coordinated various proposals to study and develop a Special 208 Study outline for the Chowan. It is in this light that the following list of activities by Virginia in the Chowan River Basin is presented.

1. A Section 303(e) (Public Law 92-500) River Basin Water Quality Management Plan for the Chowan River Basin in Virginia has been developed. This Plan essentially covers the management of all the point source discharges in the Chowan River Basin and further makes an assessment of non-point sources, environmental impact, and wasteload allocations into the river. It is felt that the implementation of this Plan will result in the removal of the maximum amount of nutrients from the point sources located in the Chowan River Basin in Virginia. Implementation is being carried out through the National Pollutant Discharge Elimination System at this time.
2. A Section 208 (Public Law 92-500) Water Quality Management Plan for the Southeastern portion of Virginia, included in the Chowan River Basin, the counties of Isle of Wight, Southampton and Nansemond, and the Town of Franklin, has been developed by the Hampton Roads Water Quality Agency. The purpose of this Plan is to set forth the measures to be taken by agencies, companies and localities throughout the Hampton Roads area (including the Chowan River Basin area) to obtain and maintain the water quality goals as specified in the Federal and state laws and regulations. These goals include those pertaining to nutrients and nutrient removal controls as it may apply to the Chowan River Basin. Specifically, the Plan recommends that standards for nutrients (including nitrogen and phosphorus) will be defined and applied to area receiving waters. Additionally, stream classifications will be refined and impact evaluation tools will be developed to evaluate significant discharges into the Chowan system. Also necessary monitoring to include additional parameter coverage such as missing nutrients, heavy metals and

toxicants is being recommended. Further basin analysis, including receiving water modeling for non-point and nutrients will be carried out for the Albemarle Sound/Chowan River Basin and the waters in the basin will be classified as effluent-limited until additional studies are performed. The Plan recommends that localities implement additional best management practice measures as outlined in the engineering report to control non-point sources of pollution. Additional control recommendations for non-point sources will be based on test site results as well as on proposed water quality modeling to be conducted. It is felt that elements of this Plan, as implemented, will complement the State's plan listed in the next item for best management practices application to those known sources or areas where non-point sources of pollution are affecting the water quality.

3. The Statewide 208 Program for 1977-78 included the development of best management practices as the top priority item for implementation of a management program to control non-point sources of pollution in six categories. They are:
 - a. Agricultural
 - b. Forestry
 - c. Urban
 - d. Sources affecting groundwater
 - e. Hydrologic modifications
 - f. Surface mining

Currently, there is being developed a management handbook for implementing best management practices throughout the State, including the Chowan River Basin, where problems from non-point sources of pollution have been evaluated and assessed to be of a nature which demands their control.

4. The Tidewater Regional Office of the State Water Control Board has initiated a one-year monitoring study intended to determine the nutrient loading of the Blackwater, Nottoway and Chowan Rivers in Virginia as they cross the border from Virginia to North Carolina. Variables such as dissolved oxygen, temperature, pH, micronutrients, and direction of flow will also be observed. It is thought that the following information will be generated from the data gathered in the study.
 - a. Nutrient contribution from Virginia to the Chowan Basin
 - b. The comparative nutrient loading of the three Virginia rivers that flow into the Chowan Basin

- c. Comparisons between ambient quality monitoring stations from grab samples and the detailed transect sampling
 - d. Yearly exchanges in the flora, to be observed
 - e. Micronutrient observation
 - f. Further statistics with respect to various means of monitoring and correlation matrices for nutrients and algae data.
5. Development of a proposal to do a Special 208 Study in the Chowan Basin in conjunction with North Carolina has been developed by Virginia. This proposal will detail:
- a. The coordination and management
 - b. Water quality/pollutant loading analysis
 - c. Evaluation of alternative control strategies
 - d. Evaluation of implementation program/institutional arrangements
 - e. Environmental assessment
 - f. Public participation
 - g. A reporting mechanism

The details of this program are being coordinated with North Carolina officials at the present time.

6. Virginia has developed a first-cut study to determine the total pounds of nitrogen in the three major tributaries to the Chowan near the Virginia-North Carolina line. The tributaries are the Blackwater, Nottoway, and Meherrin Rivers.
7. Virginia is an active participant in the ongoing USDA study of the Chowan-Pasquotank River Basin, which includes the relationship between agricultural runoff of nutrients and other pollutants versus the water quantity and water quality goals for the Chowan-Pasquotank River Basins.
8. Virginia is also participating in several other water resource related studies, such as that done by the Corps of Engineers for water supply in Southeastern Virginia and being expanded to that water supply in Southeastern Virginia and Northeastern North Carolina, a Level B Water Resource Council Albemarle Sound River Basin Study, activities of the Southeastern Virginia Planning District Commission water supply studies, and numerous groundwater studies in the area of Southeast Virginia, the use of groundwater possibly having some effect on water quality in the Chowan River Basin.



COMMONWEALTH of VIRGINIA

Office of the Governor

Richmond 23219

June 15, 1979

Maurice B. Rowe
Secretary of Commerce and Resources

RECEIVED
OFFICE OF THE SECRETARY
JUN 2 1979
N. C. DEPT. OF NATURAL
RESOURCES & COMMUNITY
DEVELOPMENT

Honorable Howard N. Lee, Secretary
Department of Natural Resources and
Community Development
State of North Carolina
Raleigh, North Carolina 27611

Dear Secretary Lee:

This is with reference to Governor Dalton's letter to Governor Hunt dated March 9, 1979, and to Governor Hunt's response of April 18, 1979 relative to the appointment of Virginia members to the Technical Panel, which would be involved in the project for the Lower Chowan River.

We are pleased to report to you that six persons have been appointed from Virginia to serve as Virginia members of the Technical Panel to be engaged in activities concerning the Lower Chowan River Project. Those individuals who have been appointed to serve from Virginia are as follows:

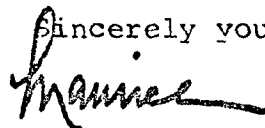
- R. V. Davis, Executive Secretary, Virginia State Water Control Board
- S. Mason Carbaugh, Commissioner, Department of Agriculture and Consumer Services
- Clifford W. Randall, Department of Civil Engineering, Virginia Polytechnic Institute and State University
- William J. Hargis, Jr., Director, Virginia Institute of Marine Science
- Joseph B. Willson, Jr., Director, Virginia Soil and Water Conservation Commission
- Larry S. McBride, Regional Director, State Water Control Board, Tidewater Regional Office

Honorable Howard N. Lee
Page Two
June 15, 1979

As indicated during the May 22, 1979 meeting of the North Carolina-Virginia Water Resources Management Committee, we have made those modifications referred to during that meeting, and have incorporated them in a revised version of the paper describing the Lower Chowan River Project, a copy of which is provided herewith for execution and return to us for our Committee files.

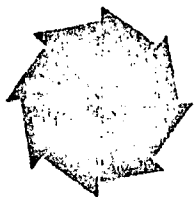
Your earliest convenient consideration in executing the referenced document will be appreciated. We look forward to joining you in positive efforts toward amelioration of the water quality and associated problems in the Lower Chowan River in North Carolina.

With kindest regards and all good wishes, I am

Sincerely yours,


Maurice B. Rowe

Enclosure



North Carolina Department of Natural Resources & Community Development

James B. Hunt, Jr., Governor

Howard N. Lee, Secretary

July 2, 1979

The Honorable Maurice B. Rowe
Secretary
Commerce and Resources
Office of the Governor
Commonwealth of Virginia
Richmond, Virginia 23219

Dear Maurice:

Thank you for your letter of June 15 responding to our request for members to be appointed to the Chowan River Technical Panel. We also appreciate your sending along the revised document concerning the lower Chowan River.

I am happy to enclose the signed agreement. In our view, this agreement to work together needs to be further developed as we determine specific measures to be taken to clean up the river. In North Carolina we are, of course, moving ahead with a number of very specific actions which go beyond the study phase. We will look forward to sharing these with you at our next meeting.

We will designate members of the Steering Committee and Technical Panel to work with you as soon as we can discuss the matter further within the Department. As we already have a Technical Panel in operation, it will simply be a matter of deciding which six members will represent us on the joint Virginia-North Carolina Technical Panel. We trust this will meet the spirit of the July 15 project initiation date.

Thank you again for all of your cooperation and Virginia's commitment to help us clean up the Chowan River.

With kindest regards and best wishes, I am

Respectfully yours,


Howard N. Lee

Enclosure

cc: Dr. Neil S. Grigg
Mr. A. F. McRorie

C-6

NORTH CAROLINA-VIRGINIA WATER RESOURCES
MANAGEMENT COMMITTEE
PROJECT
FOR
LOWER CHOWAN RIVER
NORTH CAROLINA

1. INTRODUCTION:

On April 27, 1978, the Governors of Virginia and North Carolina entered into a formal written agreement which recognizes that programs and activities for water resources management in water courses common to both states generate issues of mutual concern, which should be resolved through their designated representatives.

As a result of the agreement, a committee was appointed by the Governors of Virginia and North Carolina to study and to develop joint policy, to devise institutional agreements, and to develop and implement procedures for the resolution of water resources matters of mutual interest to the two states.

Since its establishment, the committee, known as the North Carolina-Virginia Water Resources Management Committee, has considered several subjects of mutual interest and concern to both states. On May 22, 1979 the Committee deliberated the subject of Lower Chowan River in North Carolina and a suggestion by North Carolina representatives to address water quality issues in that reach of the river. This project proposal is formulated based on decisions reached by the Committee on May 22, 1979.

2. BACKGROUND:

The Chowan River in North Carolina is formed at the juncture of the Blackwater River and Nottoway River in North Carolina several miles upstream from Winton, North Carolina. The headwaters of Blackwater River and Nottoway River are in Virginia with both rivers crossing the Virginia-North Carolina boundary upstream from their juncture which forms the Chowan River which empties into Albemarle Sound near Edenton, North Carolina. The basin drains about 5,000 square miles in Southeastern Virginia and in Northeastern North Carolina and with notable exceptions, the basin is comprised of a rural economy for the most part. Urban areas in Virginia lying within the basin include the Cities of Franklin and Emporia with Edenton, Ahoskie, and Murfreesboro in North Carolina providing urban concentrations. The largest single employers in manufacturing in the basin include pulp, paper, wood products, textiles, and a fertilizer manufacturing operation located in Tunis in North Carolina. Historically, the Chowan estuary has been plagued naturally with algal blooms and other related water quality problems.

The slow moving nature of waters in the Chowan River in North Carolina, particularly in the lower reaches, provides conditions favorable for the growth of aquatic plant life, and seasonal algal blooms have been reported to be a natural phenomenon in the Chowan River with algal blooms of short duration expected to occur in late

spring and again during late summer. It has been suspected that factors necessary to produce nuisance blooms of algae have been present since 1956 while in 1972 the seasonal algal bloom arrived in May and persisted until fall of that year providing a "pea soup" appearance from bank to bank in the lower half of the Chowan and in some spots massive tufts which in the decaying process provided unsightly and malodorous material which was reported to have restricted various uses of the river and beaches. Conditions similar to and perhaps more pronounced than the 1972 condition occurred in 1974 and in 1978.

Governor Hunt on March 9, 1979 held an informational meeting on Chowan River problems in Raleigh, N. C. which was attended by representatives from point source dischargers in the Chowan River Basin and by representatives from regulatory and agricultural agencies in both Virginia and North Carolina. The purpose of the meeting, as expressed by Governor Hunt, was to provide an opportunity to discuss the seriousness of the situation concerning the Chowan River Basin and to discuss that which might be done to stem the nuisance algal blooms which appear periodically. During that meeting, the following points were made by Governor Hunt:

- a. Virginia was asked to join with North Carolina in efforts to abate the algal blooms.
- b. North Carolina's industries and municipalities were requested to monitor the nutrient levels from their discharges and submit that data to the North Carolina Secretary of Resources and Community Development.
- c. Agricultural interests in North Carolina were requested to follow soil and water conservation practices to reduce nonpoint source contributions.
- d. There was an expression of need that forests in the Basin be closely managed to eliminate or reduce considerably non-point source pollutants.
- e. North Carolina legislators present were reminded that there was then pending a supplementary request to accelerate pollution abatement in the Chowan River Basin.
- f. Governor Hunt expressed the thought that all should join together to implement a Chowan River Restoration Project.
- g. Governor Hunt emphatically stated that "save the Chowan" was his top priority in the State insofar as pollution abatement efforts are concerned.
- h. The Governor of North Carolina requested that Virginia designate the Chowan as its top priority, along with North Carolina.

In a communication to Governor Hunt, on March 22, 1979, Governor Dalton pledged to assess the effectiveness of agricultural conservation practices which have been employed throughout the Basin

over the past several years, with consideration to be given also to the following:

- a. The use of those practices designed to prevent or to reduce nonpoint sources of pollutants to a level compatible with water quality goals.
- b. Review of ambient monitoring data (chemical and biological) to ascertain the nutrient contributions to the Basin over the past several years.
- c. Emphasis of continued and more intense monitoring of nutrient sources within the Basin.
- d. Bring up to date, if necessary, data on pollutant levels from point sources in the Basin.

Governor Dalton also expressed continued interest in the subject and continued full cooperation in reviewing the problems associated with the Lower Chowan River. Assurance was given of the forthcoming appointment of Virginia members to be added to the membership of a Technical Panel of scientists in North Carolina who are already engaged in Chowan River water quality investigatory work.

3. SCOPE:

The scope of the project is to examine the Lower Chowan water quality issues with special attention to be given to the relationships to algal production of point and non-point discharges within the Basin and to provide information derived from sound scientific data, analyses, and conclusions, upon which to base and design a plan of positive action, the purpose of which is to ameliorate the nuisance condition of algal blooms in the Lower Chowan River in North Carolina.

4. PROJECT ORGANIZATION:

The project is to be carried out during a twenty-four month period commencing July 15, 1979, by a Technical Panel comprised of not more than 12 eminent scientists and engineers, six each from North Carolina and Virginia, appointed by a Steering Committee under the overall direction of the North Carolina-Virginia Water Resources Management Committee. The Steering Committee shall be comprised of the Virginia Secretary of Commerce and Resources, the North Carolina Secretary of Natural Resources and Community Development, along with two other members, one each to be selected by the two respective secretaries. Members of the Steering Committee and of the Technical Panel shall be appointed no later than July 15, 1979.

5. PROJECT ACTIVITIES:

Project activities will include the development jointly by the Technical Panel, a study plan designed to yield a plan of action to ameliorate the condition of nuisance algal blooms in the lower Chowan

River, which plan is to be based on sound scientific data analyses, and conclusions, to include minimal adverse environmental and economic impact to those entities located throughout the Basin in North Carolina and Virginia.

Project activities will include execution of those elements of the plan of action deemed appropriate, desirable, and necessary to be executed in the Virginia and North Carolina portions of the Basin as determined by each respective state.

6. LEVEL OF EFFORT:

The level of effort to be applied to the project will be determined for each respective state by each state's member of the project Steering Committee.

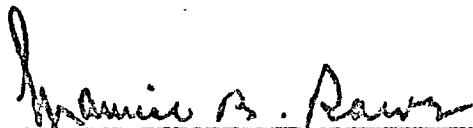
7. FUNDING:

The project funding by each respective state will be determined for each respective state by each state's member of the project Steering Committee.

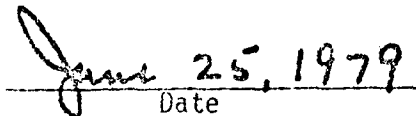
8. MEMORANDUM OF UNDERSTANDING:

This document, executed by the Virginia Secretary of Commerce and Resources, and the North Carolina Secretary of Natural Resources and Community Development, co-chairmen of the North Carolina-Virginia Water Resources Management Committee, consists of the sole and only Memorandum of Understanding between the parties hereto for the conduct of this project.

In witness whereof, the parties hereto affix their hands and seals:

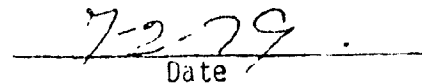


Maurice B. Rowe, Secretary
Commerce and Resources
Commonwealth of Virginia


Date



Howard N. Lee, Secretary
Natural Resources and
Community Development
State of North Carolina


Date

JMA/hkw

APPENDIX D

BI-STATE WATER QUALITY MANAGEMENT PLAN

BI-STATE WATER QUALITY MANAGEMENT PLAN

In March 1979, Governor Hunt called for a unified effort between localities, citizens and state agencies of both North Carolina and Virginia in solving this pressing problem. It was at this same meeting that the Executive Secretary of the State Water Control Board, in speaking for the Commonwealth of Virginia, pledged full cooperation in assessing the water quality situation in the Virginia portion of the Chowan River Basin. This pledge of cooperation has led to the development of an outline of a Plan of Action by Virginia to be conducted in coordination with North Carolina as a Special 208 Study of the Chowan Basin. The purpose of this summary is to lay forth the general proposal that Virginia has developed with respect to the Virginia portion of the special Chowan Water Quality Management Plan. It should be noted that a detailed work task outline of the Chowan Basin Special 208 Study is being developed concurrently as the North Carolina efforts progress and in coordination with the staff of the Environmental Management Commission of North Carolina. The finalized joint proposal would then be submitted to the EPA to see if funds could be made available to support the project. North Carolina has already committed a significant portion of its existing resources to the Chowan, which would be supplemented by this request, but Virginia will need additional funds to develop this Water Quality Management Plan for the Virginia section of the Basin.

The proposed study will be delineated into seven general sections or subjects which require detailed task outlines. Those subjects are:

1. The procedures for coordination and management
2. An analysis of water quality/pollutant loadings (assuming that point source control programs are adequate for continuous and special point sources)
3. The development of alternative control strategies and evaluations of these strategies singularly and in combination with other strategies and other programs
4. The development of recommendations for implementation, to include institutional arrangements
5. The description of environmental assessment responsibilities or subjects which should be addressed
6. A program of full public participation to assist in the development and direction and approval of this study

7. A methodology of reporting on this study, to include status reports, evaluation reports and final plan recommendations and summaries, backed up by technical reports.

I. Project Coordination and Management

The purpose of this section of the report would be to assure the establishment of a Management Plan Control Group which would manage and coordinate the study from beginning to finish and direct the appropriate subcontrol groups in their work toward a joint effort in solving the overall problems in the Chowan River Basin as it relates to the algal growth. It is felt that this group would include representatives of both states and the U. S. Environmental Protection Agency, and would include an appropriate staff to carry out the management responsibilities. Staffing might consist of existing resource personnel or management consultant personnel or combinations thereof. The major responsibilities of this group would be to carry through, after certification, the management and review procedures to be employed in conducting the study and the monitoring results throughout this planning process. Coordination with all other efforts and all other levels of studies such as water resources and water quality studies and participation of efforts by various levels of interest groups, such as citizens, public and municipalities in Federal and state agencies is also an essential responsibility of this management team or control group. A coordinated approach involving a detailed review and evaluation of previous studies conducted in the basin and relationship to other water programs, including a sound environmental approach is necessary. It is felt that coordination by this management group with the policies and desires of the states and the Project Steering Committee and the work already done by Water Resource Research Centers in the Chowan are potentially significant responsibilities. Integration of the control strategies and outputs from all sections of the study is also necessary for making final recommendations. Coordination of the public participation, administrative review and reporting elements is essential as a task that falls under the responsibility of such a management team and is an essential element of this section of the report.

II. Analyses of Water Quality/Pollutant Loadings

The purpose of this section is to obtain and correlate all water quality data in existence from both North Carolina and Virginia sources, and to utilize the analyses of this data in developing a program for water quality monitoring including both the hydrologic and water quality response elements (models) to obtain tools by which to test alternative strategies. Then, the monitoring and modeling

program must be carried out to obtain the necessary inputs for making particular recommendations regarding effectiveness of controls and wasteload allocations. It is anticipated that this section of the overall plan will be the most costly and time consuming, but one without which the study cannot achieve meaningful results. Major elements of this section would include:

- A. The collection and correlation of all water quality data from both states
- B. The examination of the variations in water quality in the varying flow situations
- C. The development therefrom of a detailed monitoring program for the Blackwater, Nottoway and Meherrin River Sub-basins in Virginia
- D. The appropriate selection of a water quality model sufficient to meet parameter response needs
- E. The evaluation of rate effectiveness of present point and non-point source controls
- F. The establishment and updating of total maximum daily wasteload allocations, when compared to various alternative strategies, and monitoring results

It is important to note in this section of the report that it is essential to establish "critical periods" of response for loading, and the growth of plankton. The establishment of a monitoring program to detect the "critical period" might include such things as a point source loading documentation, the hydrologic conditions and anomalies, non-point source sampling by land use types, the ambient river conditions under a variant of hydrologic conditions, benthic sampling, both chemical and biological, especially in North Carolina's tidal portion, including an emphasis on the uptake/release rates. Other special monitoring needs for decision-making would be biological studies of plankton species, in diversity and patterns. Additionally, it is necessary to establish the mass balance of the limiting nutrients and perform an evaluation of problem segments.

III. The Establishment and Evaluation of Alternative Control Strategies

The purpose of this section is to inventory existing control strategies, develop new ones where needed, and assess the applicability and effectiveness of various strategies under different scenarios for all sources of pollution.

The selection process and recommended control strategy for all sources is to be accomplished. These efforts will require close interface with all the efforts of both states and under the confines of the regulations laid down by EPA.

Major tasks would include inventory and tabulation by category of all potentially applicable best management practices for the basin, including a correlation of their effectiveness ratings with each land use category in the basin. A modification of point source control programs for use as potential control strategies is also a necessary element. Various control scenarios are to be developed and tested for cost-effectiveness and use of the various source controls available. The control technique scenarios are to be evaluated for regulatory and nonregulatory programs, and the establishment of a display criterion practicality and effective use is necessary before a recommended plan or a plan of action for control strategies can be accomplished. The final key element would be to select and recommend the proposed control strategy for all sources of pollutants.

IV. Development of Implementation Program Including Institutional Arrangements

It is anticipated that this section will be developed under the auspices of the North Carolina-Virginia Water Resource Management Committee as a Special 208 Study which will not preclude recommendations found in ongoing Virginia or North Carolina 208 planning efforts, including any designated 208 agency work. The major thrust of this section would be to develop a plan which would lead to an implementable procedure acceptable to the state and local government entities. The major elements of such a plan will include an inventory of existing institutional arrangements and their roles in the basin development which, along with an analysis of the recommended control strategies with respect to management decisions, would lead to appropriate implementation recommendations regarding agencies, designations and management schemes. Further, this section will attempt to identify an implementation schedule and the necessary financial commitments to carry through with the process. A continuing planning process and public participation commitments and concurrences is necessary to round out this section.

V. Environmental Assessment Tasks

Once a recommended program approach is developed by the local governments, it must be assessed with respect to its environmental impact on all of the local and state governments involved. This environmental assessment will consist

basically of the inventory of the effects on the environment of the recommended program, including the relative magnitude and priority of each particular action. The major effects would include both the environmental impacts and environmental enhancement effects. An evaluation criteria or scale for the importance of each of these effects would also be developed and utilized to determine the relative priority. The end result of the environmental assessment section of this report should be a listing or summary table with specific evaluation criteria of the varying impacts, both urban and rural, of the recommended action plan for implementation, displayed in such a manner that decision-makers in the institutional management group can make appropriate decisions with respect to the recommended alternatives.

VI. Public Participation

In any water quality study funded by 208 or other Federal funds, there is a need for appropriate public participation to assure the proper decision-making role of the affected publics. This section will address the necessary activities consistent with Public Participation Regulations as promulgated by EPA in 1979. This section will develop a program which will serve to enhance the awareness of water quality problems as well as foster the open processes of governmental decision-making. There are certain elements which must be addressed and are touched on below. However, there are often activities which are unplanned or executed in the course of the study which would be appropriate to public participation needs as they arise during the study. The major element to be covered is the design and establishment of appropriate public advisory groups representative of all sections of the population in substantially equal proportions. The two other major elements would be the actual conduct of a number of public meetings, forums and/or hearings, and the development of media relationships and vehicles to be used as educational material for the public through radio, TV, newspapers, audio visuals and special forums.

VII. Report and Evaluation

This section will deal mainly with the format for reporting to the public and the management committees both during the process, the formal certification at the end of the process, and the format for the reporting documents to be used. It will consist essentially of four elements, the first being the status report format to include timing and materials presentation. The second, third and fourth major elements

of reporting would be the format for the technical reports, the plan recommendations, and the public summary. The latter element - public summary - would be designed for public distribution to be used for educating and explaining to the public what the final recommended plan was in hopes it can be appropriately certified and implemented. It should be noted that the progress reports or status reports of the first element would evaluate the study as it is progressing and keep everyone informed of its progress.

APPENDIX E

WATER RESOURCES RESEARCH INSTITUTE

STATEMENT OF WORK

WATER RESOURCES RESEARCH INSTITUTE STATEMENT OF WORK

Following the algal bloom of 1972, the Water Resources Research Institute of the University of North Carolina (WRRI) participated in the multi-agency Chowan River Project. Representatives of the WRRI served on steering committees which formed overall policy and coordinated the individual studies. Institute sponsored research developed estimates of stream-flow, investigated the role of aquatic plants in nutrient recycling processes, described algal growth response to changing nutrient levels, studied seasonal limiting factors and their effect on algal growth, and developed water quality models applicable to the system. Researchers from North Carolina State University, East Carolina University, and the University of North Carolina at Chapel Hill were supported in this research by the WRRI and the Office of Water Research and Technology, USDI.

Continuing and proposed work will investigate nutrient contributions from rural land runoff, refine and expand existing water quality models, determine the function of bottom fauna in nitrogen recycling, explore the nutrient kinetics of the algal bloom, quantify nitrogen fixation by blue-green algae, and develop a multi-species phytoplankton nutrient criterion standard for the estuary.

Research conducted by WRRI-sponsored investigators is closely coordinated with, and provides essential information to, State Government activities, and individual researchers are frequently called upon for advice and counsel. The following lists summarize the completed publications and also the proposed research efforts for the Chowan.

PUBLICATIONS

- Amein, M. and Galler, W. S. Management model for the Chowan River. UNC-WRRI Report No. 130. 1979.
- Bond, S., Cook, G. and Howells, D. H. Summary Report - The Chowan River Project. UNC-WRRI. n.d.
- Brinson, M. M. and Davis, D. J. Primary productivity and mineral cycling in aquatic macrophyte communities of the Chowan River. UNC-WRRI Report No. 120. 1977.
- Daniel, C. C. III. Digital flow model of the Chowan River estuary, North Carolina. USGS, Water Resources Investigations, 77-63. 1977.
- Stanley, D. E. and Hobbie, J. E. Nitrogen recycling in the Chowan River. UNC-WRRI Report No. 121. 1977.
- Witherspoon, A. M. Phytoplankton response to water quality in the Chowan River. UNC-WRRI Report No. 129. 1979.

ONGOING RESEARCH

- Humenik, F. J., Koehler, F. and Peroutka, A. A. Investigation of strategies for reducing agricultural non-point sources in the Chowan River Basin. May 1979 to December 1980.

PROPOSED RESEARCH

- Kuenzler, E. J. Nutrient kinetics in relation to algal blooms in the Chowan River. October 1979 to September 1982.
- Lauria, D. T. and O'Melia, C. R. Chowan River quality models. October 1979 to September 1982.
- Mosley, S. C. Bottom fauna of the Chowan River. October 1979 to September 1981.
- Paerl, H. W. Nitrogen fixation as a eutrophication factor in the Chowan River, North Carolina. October 1979 to September 1981.
- Witherspoon, A. M. A phytoplankton multi-species nutrient criterion standard for the management of the Chowan River estuary. October 1979 to September 1981.

Table 1. Summary of Research Proposals

Investigator	Objectives	Inputs/Experiments				Output/Results
		Type	Station	Depth	Frequency	
Paerl	<p>1. Determine the quantitative importance of N₂ fixation by blue-green algae in the lower Chowan River.</p> <p>2. To identify the environmental factors enhancing and limiting N₂ fixation by blue green algae.</p> <p>3. Work with modelers in terms of N₂ fixation as N input.</p>	1. Water samples & acetylene	1. Colerain	1. 0.5 m incr. to 2.0 m, 1m incr. beyond	1. 14 day (May-Oct) Monthly (Nov.-Apr)	1. Rate of N ₂ Fixation
		2. Water samples + 15N ₂	2. Colerain	2. Same as 1	2. Same as 1	2. Confirm actual stoichiometry of 1, above
		3. Water samples + 14C	3. Colerain	3. Same as 1	3. Same as 1	3. Rate of photosynthetic CO ₂ fixation
		4. Probe Sensor	4. Colerain	4. Same as 1	4. Same as 1	4. DO, °C
		5. Quantun photo-meter sensor readings	5. Colerain	5. Same as 1	5. Same as 1	5. Photosynthetically active radiation
		6. Water samples, millipore and glass fiber filtered, preserved	6. Colerain	6. Same as 1	6. Same as 1	6. Algal species composition, biomass, chlorophyll <u>a</u> , carotenoids.
		7. Water samples, diurnal studies and laboratory studies	7. Colerain	7. Surface to 1 m	7. Diurnals-monthly; laboratory-2-3 days/wk.	7. Effect of O ₂ and CO ₂ concentration on N ₂ fixation
Mozley	<p>1. Determine distribution and composition of larger bottom fauna.</p> <p>2. Determine population dynamics and production of common bottom fauna species.</p> <p>3. Estimate bottom fauna's contribution to bloom via nitrogen, phosphorus, and silica cycling</p>	1. Sediment, grab, dredge, artificial substrate samples	1. 28, same as DEM locations	1. 0.1m to 12m bottom only	1. Once, Nov. 1979	1. Distribution of benthos-preliminary survey
		2. Seasonal benthic grab samples	2. Same as 1	2. 1 to 12m bottom only	2. 3 mos. over 1 yr.	2. Seasonal distribution of benthos
		3. Benthic samples	3. Colerain, Winton	3. 5m, bottom only	3. 14 day over 1 yr.	3. Environmental factors, sediments
		4. Population dynamics				4. Change in benthic populations
						5. Estimates of bottom fauna, contribution to sediment water cycling for use in model

Table 1. (Continued)

Investigator	Objectives	Inputs/Experiments				Output/Results
		Type	Station	Depth	Frequency	
Kuenzler	<p>1. Measure uptake rates of inorganic C, NH₄, NO₃, PO₄ by phytoplankton under ambient conditions.</p> <p>2. Determine limiting nutrient during bloom</p> <p>3. Determine sediment metabolic rates and rates of inorganic N & P movement into water column.</p> <p>4. Integrate data into nutrient process models.</p>	1. Water samples, in situ measurements-- physical & chemical characteristics	1. Harrellsville, Colerain, Edenhouse	1. 0.5, 1.5, and 4m	1. 4 wks	1. Turbidity, color, °C, conductance, DO, filterable reactive P, filterable unreactive P, particulate P, NH ₄ , NO ₃ , NO ₂ , DON, particulate ON, dissolved OM, particulate organic C.
		2. Water samples, in situ measurements-- physical & chemical characteristics	2. Above + 2 additional	2. Same as 1	2. 2 wks during summer bloom	2. Same as 1.
		3. Water samples, phytoplankton distribution by fluorescence	3. Transects	3. 0.0 to 0.5m	3. Same as 2	3. Horizontal algal distribution and concentration
		4. Water samples, growth & uptake kinetics	4. Same as 1	4. Same as 1	4. Same as 1	4. Photosynthetic rates and PO ₄ , NO ₃ , and NH ₄ uptake
		5. Water samples, algal enrichment studies	5. Same as 1	5. Same as 1	5. Same as 1	5. Relative N, P, or other nutrient limitations
		6. Sediment samples--frozen	6. Same as Mozley	6. 0 to 2m, 2 to 5m, >5 m.	6. Once	6. Sediment characteristics--% sand, silt, clay; OM; Total N, Total P, interstitial H ₂ O, PO ₄ , NH ₄ .
		7. Sediment--water exchange in situ experiments with R/V Muchapunga	7. Between Harrellsville & Edenhouse	7. Same as 6	7. Quarterly	7. Exchange of DO, NH ₄ , PO ₄ , between water and sediments
Witherspoon	<p>1. Develop data base upon which Chowan River WQ model can predict response of algal bloom species.</p> <p>2. Establish nutrient standard based on response of 5 bloom species.</p>	1. Water and sediment samples	1. Winton, Harrellsville, Colerain, Edenhouse	1. Top & bottom	1. Bi-weekly for 14 mos.	1. Isolation of 5 species
		2. Water samples	2. 25 stations	2. Top, center, bottom	2. Weekly for 12 mos.	2. Ambient nutrient concentrations
		3. Isolates (5 spp)	3. Lab and above stations	3. Sediment	3. Monthly for 12 mos.	3. Growth rate and standing crop along nutrient gradient (biomass & chlorophyll a)
		4. Isolates (5 spp)	4. Lab and above stations	4. Sediment	4. Monthly for 12 mos.	4. N concentration required to trigger bloom

Investigator	Objectives	Inputs/Experiments			Output/Results
		Type	Station	Depth	
Lauria & O'Melia	<ol style="list-style-type: none"> 1. Refine parameters in existing Chowan model 2. Investigate new and revised reactions for inclusion in the model 3. Expand model to predict new constituents 4. Examine model suitability 5. Simulate Chowan quality 6. Communicate research findings 	<ol style="list-style-type: none"> 1. Analyze salinity data to determine dispersion; evaluate reaction rate constants from nutrient data; calculate pollution discharges to estuary. 2. Analyze N and P data for water column and sediments. 3. Analyze Chowan data to determine interrelationships among chemical/biological species. 4. Comparison of field data with model predictions 5. Prepare computer program, and select alternative waste loadings for Chowan. 6. Meetings, conferences, workshops, short course 			<ol style="list-style-type: none"> 1. Mathematical models of transport phenomena, reactions, and loadings. 2. Mathematical models of nutrient cycling within the estuary. 3. Mathematical models to predict reaction and particulate N and P, chlorophyll-a and biomass 4. Calibrated and verified predictive model 5. Water quality simulation research 6. Tool for water quality management

APPENDIX F

PROGRESS IN WORKING
WITH
MUNICIPALITIES AND INDUSTRIES

PROGRESS IN WORKING WITH MUNICIPALITIES AND INDUSTRIES

A. Municipal Point Sources

In May 1979, thirteen towns in the Chowan River Basin demonstrated a commitment to voluntary action to reduce discharges into the Chowan.

Upon the invitation of these towns, the State's Ad Hoc Alternative Sewage Disposal Task Force met with the town officials and their consulting engineers in Winton, North Carolina. The Task Force was requested to assist local governments in pursuing the possibilities of land application of municipal waste to eliminate nutrient discharges into the river while increasing the productivity of farm and forestry lands.

The Ad Hoc Alternative Sewage Disposal Task Force agreed to work with the towns in the Chowan Basin to develop a comprehensive plan for effective and efficient sewage disposal, and the communities agreed to work toward a cooperative regional approach which would serve as a demonstration model for land application, septic tank management and other alternatives to conventional sewage disposal.

The Environmental Management Commission (EMC) imposed a moratorium on 201 planning in the Chowan Basin until such time as the EMC completed its rule-making on classification of the Chowan as nutrient sensitive. On August 9, the EMC declared the Chowan as nutrient sensitive by unanimous vote. The Task Force has proceeded to meet its commitment to the local governments through the following activities:

1. A concept paper was prepared and presented to the Rural Development Coordinating Committee which approved the concept of a regional plan for alternative and innovative sewage disposal at its meeting on May 17, 1979.
2. The concept was next presented to the principal funding agencies of the Rural Water and Sewage Committee formed under the President's Rural Development Initiatives. On May 23, this Committee determined "that the thirteen towns in the Chowan Basin have a sewage disposal problem and that the concept paper approved by the North Carolina Rural Development Coordinating Committee constitutes a valid goal for all agencies to work towards."

Significantly, the Rural Water and Sewage Committee stated that it would concentrate on the towns in this river basin and provide assistance to the local units of government in applying for Federal and State funding available to assist in the construction of such facilities.

3. In spite of the planning moratorium, Task Force members proceeded to evaluate the cost effectiveness of alternatives to conventional sewage disposal for each of the towns involved working closely with each town and its consulting engineers.
4. Having established the cost of land application and other alternatives for most of the thirteen towns, the Task Force is in the process of working with each town to determine the "package" of financial assistance which will be required from the State and Federal agencies represented on the Rural Water and Sewage Committee for their consideration and commitment.
5. A follow-up meeting in late August is scheduled to assist towns and their consulting engineers in adequately assessing alternative and innovate sewage disposal and in preparing proposals for analysis by the Rural Water and Sewage Committee (HUD, EPA, FmHA, EDA, State Government) for funding opportunities under the President's Rural Initiative Program.

Secondary benefits beyond the primary goals of this arrangement have emerged and are under way.

Primary Goals:

1. Eliminate municipal discharge into the Chowan
2. Productive use of land application on farm and forest lands
3. State/local/Federal cooperation in effective and efficient sewage disposal

Secondary Benefits:

Training Program:

1. Assist with revisions to design manuals and develop curriculum for wastewater treatment plant operators
2. Prepare land treatment operators school feasibility study.

3. Grant application for land treatment operators school
4. Conference on land treatment systems

Industrial Point Sources:

1. Technical assistance with treatment alternatives
2. Technical assistance with industrial loans and grants

Agricultural and Other Non-point Sources:

1. Technical assistance
 - evaluate current erosion control practices
 - nutrient application rates
2. Education

Financial Aid:

1. Use this experience to evaluate State/Federal cost-sharing practices

General education on management arrangements for innovative and alternative sewage disposal

As other rivers in North Carolina and the United States experience algal blooms and eutrophication, the Chowan model and demonstration project will provide a "packaged" comprehensive approach to help significantly reduce nutrient runoff and discharge into waterways. The key has been and will continue to be a firm partnership between local, State and Federal Governments to utilize the complex range of resources available to assist rural communities in meeting their sewage disposal needs.

Thirteen North Carolina towns border the Chowan demonstrating a commitment to voluntary action to reduce discharges into the Chowan River.

Winton

Harrellsville

Murfreesboro

Edenton

Ahoskie

Colerain

Aulander

Rich Square

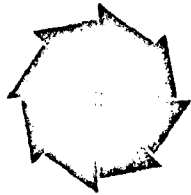
Seaboard

Woodland

Conway

Jackson

Severn



North Carolina Department of Natural Resources & Community Development

James B. Hunt, Jr., Governor

Howard N. Lee, Secretary

DIVISION OF ENVIRONMENTAL MANAGEMENT

September 18, 1979

Sent to Municipal dischargers in the
Chowan River Basin

As part of the program to restore the water quality of the Chowan River to acceptable levels, the Division of Environmental Management (Division) through the Environmental Management Commission (Commission) has established the Nutrient Sensitive Waters (NSW) classification. At the Commission's May 1979 meeting the Nutrient Sensitive Waters Classification regulation was adopted and the waters of the Chowan River Basin were temporarily classified as nutrient sensitive under the Commission's emergency powers. Following the required public hearing, the Commission at their August, 1979 meeting permanently classified the waters of the Chowan Nutrient Sensitive. As a result, all point source wastewater dischargers in the basin are subject to effluent controls for nutrients.

Pursuant to this mechanism, the Division has developed a methodology for the assignment of nutrient effluent limitations for POTW (Publicly Owned Treatment Works). This area was considered first in order to keep the 201 planning process in the Chowan basin moving.

The nutrient sensitive waters regulation provides the authority to limit nutrient inputs to "no increase in nutrients over background levels". However, it also provides that the increase can exceed background levels if "it is shown to the satisfaction of the Director that the increase (1) is the result of natural variations, or (2) will not endanger human health, safety or welfare and that preventing the increase would cause a serious economic hardship without equal or greater benefit to the public".

In establishing the permanent NSW classification for the Chowan, the staff designated both phosphorus and nitrogen as "nutrients". Thus, effluent limitations for both these nutrients has been established.

The Division staff has reviewed existing technologies for the removal of nitrogen and phosphorus from POTW wastewater. It has been determined that effluent limitations of 3 mg/l of total nitrogen and 1 mg/l of total phosphorus as a 30 day average are well within the reach of existing technologies. In fact, existing removal processes have shown that lower effluent values can consistently be achieved.

It is very important to point out that while these limitations will allow surface water discharge of effluents it is the Division's position that non-surface water discharge treatment facilities (land application) are the more desirable treatment methodology for the removal of nutrients from the Chowan River system. It is, however, the Division's aim to provide a wastewater treatment alternative that will avoid any "serious economic hardship" consequences that could occur from a no discharge policy, and at the time effectively reduce nutrients going into the river system.

The development of these technology level limitations for POTW are controlled by existing treatment procedures. With the development of more advanced technologies, new discharge requirements are a possibility in the future. Therefore, surface water discharge systems could be required to meet more restrictive nutrient limitations at a later date. Such requirements, however, will be evaluated in reference to expected water quality benefits.

Attached is a tabulation of the effluent limits required. The limits are maximum monthly mean values unless otherwise noted. The limits reflect current policies and methodologies in the State Continuing Planning Process and are part of the Chowan River Basin Plan.

We have also attached a discussion and explanation of the effluent limits and a copy of the nutrient sensitive waters regulation. Please contact Mr. Forrest Westall of my staff if you have any questions concerning the limits.

We hope you find our information complete for your development of the Edenton 201 Facilities Plan.

Sincerely,

Original Signed By:

R. W. Van Tilburg

R. W. Van Tilburg, Chief
Environmental Planning Section

Attachment

cc: Forrest Westall ✓
Louis Eckley
Vernon Harris
Paul Wilms
Jim Mulligan

DIVISION OF ENVIRONMENTAL MANAGEMENT

July 18, 1979

MEMORANDUM

TO: Mr. A. F. McRorie, Director

FROM: Vernon O. Harris, Jr., Supervisor *201*
Local Planning Management Unit

SUBJECT: Status Report - 201 Facility Plans
Chowan River Basin

As directed by Mr. Bob Van Tilburg and in answer to Ms. Eva Clayton's July 9, 1979 inquiry letter to Deputy Secretary Walton Jones, we are presenting a summary of the status of the 201 areas for the subject basin. These areas and their status are as follows:

1. Ahoskie-Aulander

Ahoskie is currently proposing a 0.8 mgd discharging treatment plant that has effluent limits assigned to it of $BOD_5 = 5$ mg/l and NH_3-N of 2 mg/l. The mode of treatment is to upgrade the existing trickling filter plant by following it with activated sludge and tertiary filters.

Aulander currently proposes a 0.125 mgd discharging treatment plant with assigned effluent limits of $BOD_5 = 10$ mg/l, $NH_3-N = 4$ mg/l. The 201 proposes a new extended aerated treatment plant followed by tertiary filters. This 201 has been held up due to an I/I problem in the Town of Aulander that requires the completion of the Phase I SSES in order to get a handle on the flows. We are now told that land application for the Town of Aulander will probably be cost effective according to EPA's 201 criteria.

2. Colerain

The Town of Colerain presently has a new oxidation ditch that discharges effluent that is assigned limits of $BOD_5 = 30$ mg/l and suspended solids = 30 mg/l. The design capacity of this treatment plant is .075 mgd. We are not aware of a 201 being prepared for this project.

3. Conway/Severn

The Town of Conway has an existing 0.12 discharging treatment plant. The Town of Severn has a 0.03 mgd discharging treatment plant. Since the 201 is in the preparation stage by the consultant and no I/I has been turned in, we have no other information that can be added at this time.

4. Edenton

Edenton currently proposes to upgrade their existing trickling filter plant by the addition of activated sludge to meet effluent limits of BOD₅ = 30 mg/l and total suspended solids = 30 mg/l. The Edenton 201 Facility Plan was certified by this Division to EPA on September 20, 1977. Since that time, EPA has written a letter of approval for the 201 Plan in a letter dated March 31, 1978. Step 2 grant applications are currently being held in this Division's Grants Administration Unit.

5. Harrellsville

Harrellsville currently has no existing sewerage system in the town. The 201 Facility Plan proposes to build a 0.02 mgd three-cell stabilization lagoon that would have discharge limits of 30 BOD₅ and NH₃-N of 10 mg/l and 90 mg/l suspended solids. A negative declaration for this project was prepared and signed by Secretary Howard N. Lee on September 26, 1978. By the time the negative declaration was signed and the certification letter was forwarded for your signature, the Commission ruled on the moratorium for the Chowan River Basins; therefore, the certification letter to EPA was never signed.

6. Jackson

Jackson currently has no sewerage system, but a 201 Facility Plan is under preparation by the consultant. We have no other information on this particular project.

7. Murfreesboro

The Town of Murfreesboro proposes to build a 0.476 mgd discharging treatment plant that will have effluent limits of BOD₅ = 30 mg/l and total suspended solids of 90 mg/l. The existing lagoons would be upgraded through the addition of aerated tubes. The Murfreesboro 201 Plan was also ready for certification at the time the Environmental Management Commission declared the Chowan River moratorium. This project is, therefore, on hold as is Harrellsville.

8. Seaboard

The Town of Seaboard currently is constructing a 0.072 mgd land application system. Seaboard was certified by this Division to EPA on March 15, 1977 and, of course, plans and specifications have been reviewed and approved by this Division prior to the project going to construction.

9. Winton

The Town of Winton proposes to build a 0.235 mgd discharging wastewater treatment plant that will meet effluent limits of 30 mg/l BOD₅ and total suspended solids of 30 mg/l. The new treatment plant will replace the existing trickling filter plant and is proposed to be an oxidation ditch type facility. Winton was certified to EPA on May 26, 1977. Plans and specifications for this project have been prepared by the consultant and are currently being held in the Engineering Unit of this Division awaiting final action by the Commission.

10. Woodland - Rich Square

The Town of Woodland currently has under construction a 0.185 mgd land application system. Woodland was certified to EPA as a breakout project on May 14, 1976.

The Town of Rich Square is also proposing to build a land application system that will have a capacity of 0.24 mgd. This project is approvable, except for the fact that archaeological surveys have not been completed that would allow us to prepare a negative declaration and to certify the Rich Square portion; thus completely certifying the 201 Facility Plan.

All of the above information is presented as is currently contained in the facility plans per EPA and Federal regulations. Once the questions of nutrient limits and the finalized assigning of effluent limits are completed, re-analysis of the 201's proposed for discharging can begin. In an effort to aid the Technical Services Branch of this Division, I have previously forwarded a map of all wastewater dischargers in the Chowan River Basin with a description of their size and treatment plant process.

jl
cc: Mr. R. W. Van Tilburg
Mr. Forrest Westall

DIVISION OF ENVIRONMENTAL MANAGEMENT

June 20, 1979

MEMORANDUM

TO: Forrest Westall, Head
 Technical Services Branch

FROM: Vernon O. Harris, Jr., Supervisor *for*
 Local Planning Management Unit

SUBJECT: Certified & Proposed Project 201 Facility Plans
 Cost of Conventional vs. Cost of Land Application Alternative
 Chowan River Basin

Per our telephone conversation of June 19, 1979, I am furnishing you information regarding 201's in-house that are proposing discharges in the Chowan River Basin. I present two tables - one with total present worth analysis and one that is purely capital construction cost. Any discharge (i.e., Colerain, etc.) not mentioned is because we have no 201 in-house for that town. Additionally, I have left off the towns going with land application per the existing 201 rules and regulations that have proven to be cost effective with no change in effluent limits (i.e., Woodland, Rich Square, Seaboard, Aulander).

TABLE I

<u>Project</u>	<u>Selected Alternative</u>	<u>Cost (TPW)</u>	<u>Land App. Cost</u>
Edenton	Trickling Filter-Act. Sludge Discharge	\$2.117 Million	Not Costed Out
Harrellsville	3-Cell Lagoon Discharge	\$0.401 Million	\$0.549 Million
Murfreesboro	Aerated Lagoon Discharge	\$0.937 Million	\$1.564 Million
Winton	Oxidation Ditch Discharge	\$1.104 Million	\$1.537 Million
Ahoskie	Trickling Filter-Act. Sludge Discharge	\$2.408 Million	\$2.932 Million

TABLE II

<u>Project</u>	<u>Capital Cost Selected Alt.</u>	<u>Capital Cost Land App.</u>
Edenton	\$1,300,000	Not Costed Out
Harrellsville	\$ 364,124	\$ 355,313*
Murfreesboro	\$ 596,000	\$1,258,800
Winton	\$ 820,000	\$1,276,000
Ahoskie	\$1,682,000	\$2,364,000

*Alternative included leasing land from Union Camp Paper Company

TPW = Total Present Worth (20 years) = Capital + O&M

TOWN OF HARRELLSVILLE

HARRELLSVILLE, N. C. 27942

April 11, 1979

Hon. Roy Harrell
Town of Edenton
Edenton, N. C. 27932

Dear Mayor Harrell:

At the joint Hertford County Municipal Government and County Commissioners Meeting last week, several concerns about a cost effective method of sewage treatment were expressed by Harrellsville and Winton. Other Town representatives also expressed the same concerns because of the need for upgrading systems, especially in view of the point discharge problem relating to the Chowan River algae bloom.

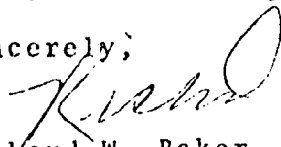
I shared with the group that an Alternative Sewage Disposal Task Force, made up of University people, private interests and representatives of several departments of State government, had been organized for the purpose of determining alternative and innovative sewage treatment systems which are more cost efficient than the traditional expensive sewage treatment plant. This group will also help identify necessary financing of such systems. The group at last week's meeting unanimously agreed that representatives of this Task Force be invited to come and share their findings with representatives of our Towns as soon as possible.

I would like to confirm Thursday, May 3, for this meeting at 12 o'clock noon at the Elks Shrine in Winton. Anne Taylor, Special Assistant for Natural Resources, is coordinating the Task Force. This will include Dr. Neil S. Grigg, Chairman of the Chowan Technical Panel of the Chowan River Reclamation Project; Dr. Bobby Carlile, NCSU Ag Extension Service, the State's best sewage treatment expert; Bob Rubin, NCSU Ag Extension and assistant to Dr. Carlile; A. F. McRorie, Director of Environmental Management; Coy Batten, also of the N. C. Division of Environmental Management; Steve Steinbeck, N. C. Department of Human Resources, a soil scientist; and Eva Clayton, Assistant Secretary of Community Development.

We would like to invite two people representing your Town, and if you like, one member of your engineering firm, making a total of three persons from each of the following Towns: Edenton, Colerain, Harrellsville, Ahoskie, Cofield, Winton, Murfreesboro and Como. A special invitation is being sent to the Mayor of Franklin, Virginia. Please send us a card stating who your three representatives will be (by name and position) or you may call 332-3819 and leave the message.

Please come with questions and suggestions as to how we might design more cost effective systems maintaining reasonable per user rates.

Sincerely,



Richard W. Baker, Jr.
Mayor

F-11

RWB/jf
cc: Bill Gardner, Town Mgr.

RURAL DEVELOPMENT COORDINATING COMMITTEE

Federal Representatives

Mr. Harold Perry, Director
Farmers Home Administration
310 New Bern Avenue
Raleigh, NC 27611
755-4640

Mr. Art Campbell
Area Coordinator
Farmers Home Administration
Room 5313
South Agricultural Building
Washington, D. C.
(202) 447-8806

Mr. Dale Jones, State Director
Economic Development Administration
Room 314 Federal Building
310 New Bern Avenue
Raleigh, NC 27611
755-4570

Mr. Al Baldwin, Executive
Director
Southeastern Federal Regional
Council
101 Marietta, Suite 2121
Atlanta, GA 30323
(404) 221-4162

Ms. Betsy Stafford
Area Director
Department of Housing and
Urban Development
415 N. Edgeworth Street
Greensboro, NC 27401
378-5361

State Representatives

Chairperson

Governor James B. Hunt, Jr.
State of North Carolina
Capitol Building
Raleigh, NC 27603
733-5811

Mr. D. M. Faircloth, Secretary
Department of Commerce
430 N. Salisbury Street
Raleigh, NC 27611
733-4962

Vice-Chairperson

Mr. Howard N. Lee, Secretary
Department of Natural Resources
and Community Development
P. O. Box 27687
Raleigh, NC 27611
733-4984

Mr. T. W. Bradshaw, Jr., Secretary
Department of Transportation
P. O. Box 25201
Raleigh, NC 27611
733-2520

Mr. Arnold Zogry, Assistant
Secretary for Policy
Development & Management
Department of Administration
116 W. Jones Street
Raleigh, NC 27603
733-4131

Dr. Sarah Morrow, Secretary
Department of Human Resources
325 N. Salisbury Street
Raleigh, NC 27611
733-4534

Mr. J. A. Graham, Commissioner
Department of Agriculture
P. O. Box 27647
Raleigh, NC 27611
733-7125

City Representatives

Honorable Ferd Harrison
Mayor
Town of Scotland Neck
P. O. Box 176
Scotland Neck, NC 27874
826-3111

Honorable John C. McKenzie
Mayor
Town of Pilot Mountain
P. O. Drawer AA
Pilot Mountain, NC 27041
368-5511

County Representatives

Mr. J. Richard Condor
Chairman
Richmond County Board of
Commissioners
P. O. Box 1217
Rockingham, NC 28379
997-5551

Mr. Grover C. Lancaster, Jr.
Chairman
Craven County Board of
Commissioners
Route 1, Box 142
Vanceboro, NC 28586
638-1424

North Carolina Home Builders Association

Mr. Nick De Mai
Executive Vice-President
North Carolina Home Builders Association
P. O. Box 18625
Raleigh, NC 27609
782-3300

North Carolina Agriculture Extension Service

Mr. Carlton Blalock
Director
North Carolina Agriculture Extension Service
P. O. Box 5157
N. C. State University
Raleigh, NC 27650
737-2811

UNITED STATES DEPARTMENT OF AGRICULTURE
FARMERS HOME ADMINISTRATION
Room 525, 310 New Bern Avenue
Raleigh, North Carolina 27601

Mr. Dale L. Jones, EDR
U. S. Department of Commerce
Economic Development Administration
Room 314, 310 New Bern Avenue
Raleigh, NC 27611

April 25, 1979

RECEIVED

APR 26 1979

DIV. OF
ENVIRONMENTAL MGT.
RALEIGH, N. C.

Mr. L. Page Benton, Jr., Chief
Environmental Planning Section
Division of Environmental Management
North Carolina Department of Natural
Resources & Community Development
P. O. Box 27687
Raleigh, NC 27611

Mr. Coy M. Batten, Branch Head
Local Programs Planning Section
Division of Environmental Management
North Carolina Department of Natural
Resources & Community Development
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Mr. Ed Coble, Director
HUD Area Office
Community Planning and Development Division
415 N. Edgeworth Street
Greensboro, NC 27402

Mr. John Booth, Director
Office of Intergovernmental Relations
Department of Natural Resources &
Community Development
P. O. Box 27687
Raleigh, NC 27611

B. Industrial Point Sources

Both Governor Hunt and Secretary Lee have requested dischargers in the North Carolina portion of the basin voluntarily cut back on the nutrients being input to the Chowan. Governor Hunt at the March 9, 1979 meeting in Raleigh concerning the Chowan River also asked for a report from each discharged by July 15, 1979, outlining what steps they could take to reduce their nutrient inputs. Special interest has been generated in two industrial dischargers: C. F. Industries and Union Camp. See Appendices G and H, respectively, for recent actions undertaken with regard to these dischargers. However, it is the intention of the State to work with all of the North Carolina industrial dischargers in the Chowan River Basin to reduce their contribution of nutrient input.



THE UNITED PIECE DYE WORKS

P. O. BOX 589 • EDENTON, NORTH CAROLINA 27932 • 919 - 221-4121

June 29, 1979

Mr. Bob Holman
Rt. 2, Box 277
Edenton, N. C. 27932

Re: Nutrient Adjustment

Dear Mr. Holman:

As per our telephone discussion on June 29, 1979, I am submitting this letter, as requested, as to United Piece Dye Works Nutrient Adjustment to help the algae problem in the Chowan River.

Up through the month of April and part of May, we were using three 55-gallon drums of Ammonium Hydroxide to feed our system. The last week in May, we adjusted this amount to two drums. Seeing no adverse effect to this adjustment, we cut back to one drum the last week of June.

During shut-down June 30 - July 7, we will be moving the aerators around in the basin to give better coverage. After this is achieved, we will begin cutting down and eventually cutting out the defoamer which we are now using.

If there is anything else United Piece Dye Works can do to help the algae situation in the Chowan River, please notify us. We will cooperate in any way we can.

Sincerely,

THE UNITED PIECE DYE WORKS

Deborah Anderson /gt.
Deborah Anderson
Technical Superintendent

DA:gt

cc: Ernest Knighton
Harold Summerford -- New York Office

APPENDIX G

HISTORY
OF
CF INDUSTRIES ABATEMENT EFFORTS

History of CF Industries Abatement Efforts

Farmers Chemical Association, Inc. (FCAI) decided in 1967 to construct the Tunis, North Carolina facility. The plant began operating in late fall of 1969. The operation initially included the production of ammonia, nitric acid, urea, ammonium nitrate, nitrogen solutions and nitrogen-phosphorus-potassium (N-P-K) fertilizer. The Tunis site was selected, according to one source, "because of its outstanding transportation potential, and because of its location in the center of a rich fertilizer market" (1).

FCAI apparently initiated contact with the Department of Water and Air Resources (DWAR), forerunner of the Division of Environmental Management, in 1968. After a number of conferences and exchanges of correspondence, FCAI agreed that only non-contaminated waters introduced to their site (rain, etc.) would be discharged to the waters of the State (2). The DWAR issued Permit No. 1707 on December 10, 1969 to FCAI for the Tunis Plant. This permit allowed for the construction and operation of a wastewater treatment facility that was "... for monitoring, storage and, if necessary, return of wastewater to the plant process water system to prevent the discharge of any contaminated waters to the Chowan River ..." (3). Among other things, the permit contained a condition which required FCAI to effectively maintain and operate the proposed facility in such a manner that at no time should there occur a "... discharge of nutrients in quantities which result in the production of undesirable aquatic organisms ...", and if a discharge was made, it should be of such a quality so as to protect the receiving waters.

In January 1970, it was determined that most of the wastewater being supplied to the waste holding ponds was heavily contaminated, and since the system had not been designed to utilize such large quantities, FCAI began to discharge the contaminated wastewater (2). FCAI was informed that they were in violation of permit requirements. As a result, FCAI and the DWAR entered into an Assurance of Voluntary Compliance, dated July 29, 1971. This agreement required FCAI to develop and construct wastewater handling facilities capable of adequately containing their wastewater (4). It further required that FCAI place the approved facilities in operation on or before May 31, 1972. The Assurance of Voluntary Compliance was amended July 25, 1972, changing the date for having the facilities operational to August 15, 1972 (5).

After the original Assurance of Voluntary Compliance was issued, and in response to that document, FCAI applied for and was granted Permit No. 2262 allowing them to operate their existing wastewater collection system. Along with this allowance, FCAI was to construct and operate several other wastewater control systems (6). The transmittal letter, dated February 1972, informed FCAI that Permit No. 1707 was voided.

In an effort to provide the wastewater reclamation-recycling facilities that would eliminate the discharge of all process waters and prevent the discharge of contaminated runoff from the site, as provided for in Permit No. 2262, FCAI was to construct four pressure filters and two ion exchange units as well as other related facilities. However, FCAI's system was not in operation by August 15, 1972 as required by the amended Assurance of Voluntary Compliance, but an inspection of the Tunis Plant on August 16, 1972 and frequent intervals thereafter prior to October 5, 1972 revealed no discharge (2). On October 6, 1972, FCAI was found to be discharging waters from their site. Chemical analysis of that water revealed that it was heavily contaminated with nutrients. This constituted an additional violation of the Assurance of Voluntary Compliance and also violated Permit No. 2262.

Mr. George E. Pickett, Director of DWAR sent a letter dated October 6, 1972, to Mr. H. T. Rosser, Assistant Attorney General, requesting that Mr. Rosser "... proceed immediately with any and all appropriate legal action against the FCAI" (7). In response to this request, a complaint against FCAI was prepared and filed in Wake County Superior Court (8). The court ordered that the case be heard and set a date of hearing for October 24, 1972 (9).

The complaint requested that the court restrain FCAI from further discharge of waters containing nutrients, and from operating their facility until all wastewaters were treated to the satisfaction of the DWAR. To further restrain FCAI from operation until it had demonstrated the capability to adequately treat its wastewaters and to require FCAI to undertake a monitoring and analysis program that would allow the DWAR to ensure FCAI's compliance with these terms. The complaint stipulated that FCAI had, in its operation, contributed substantial nutrients to the Chowan River since it began operation and was a triggering factor in the increasing algal blooms of the river (8). The September 1972 "Interim Report of the Chowan River Water Quality Study" was cited in the complaint. The report recommended, among other things, that the discharge of nutrients

from FCAI not be allowed to recur, but while concluding that FCAI was a triggering agent in the 1972 bloom, it did not state that FCAI was the only cause of eutrophication in the Chowan River (10).

Following the hearing, Judge Pilston Godwin ordered the phased shutdown of the Tunis facility to be completed by November 23, 1973. FCAI agreed to employ a professional engineer to evaluate existing waste storage and treatment facilities for adequacy.

On December 4, 1972, the FCAI matter came before the court again. The court issued an order which allowed FCAI to resume normal operation of its production facilities and contained numerous agreements between FCAI and the State. The total thrust of the order centered around a renewed program of providing adequate waste storage capacity and treatment. The order provided for specific new holding pond construction, other control construction, proposal preparation for treatment facilities, operational procedures aimed at preventing discharge, and a reporting process that would keep the DWAR informed of FCAI's progress in these activities.

The DWAR issued a temporary permit (No. T-558) which allowed FCAI to continue the operation of existing wastewater containment facilities, provided there was no discharge to surface waters (14). This permit incorporated the required court order conditions.

The court hearings brought to light the inadequate nature of FCAI's wastewater containment and treatment facilities. FCAI reported to DWAR that the discharge which had occurred on October 5-6 was unavoidable due to heavy rainfall (8). The existing facilities were not designed to retain this volume of water. Their concern with the huge amount of nitrogen contaminated water generated by the Tunis site is indicated in the fact that they applied for and received a permit on September 29, 1972, for a spray irrigation system consisting of 200 acres of irrigation area with a 400 gpm loading capacity (15).

Under the court orders, FCAI began to develop a larger, more viable wastewater retention system. They applied for and received permits for storage ponds and related facilities (16, 17, 18). The additional storage facilities permit consisted basically of four ponds with a combined capacity of 163 million gallons. FCAI's effort to comply with the court orders is outlined in the "Engineering Report on Wastewater Treatment" for FCAI at Tunis, North Carolina by

Rose and Purcell, Inc. (19). FCAI's program included closing down the N-P-K operation at Tunis and reducing the plant to the production of direct application nitrogen solutions and ammonium nitrate prills. FCAI, after a careful evaluation of the N-P-K process with input from their consultants and in response to a State requirement, concluded that the process was the major source of runoff contamination. In addition, the N-P-K stack was the worst source of air pollution. While the removal of the N-P-K process was beneficial from the standpoint of environmental considerations, it resulted in an adverse economic impact to FCAI. It reduced total daily production by 900 tons and lowered the total end product dollar value by approximately 50% (19). FCAI's efforts toward handling the existing wastewater storage situation at the site involved the movement of huge volumes of water and the construction and installation of large holding and pumping facilities.

During the startup period for FCAI's discharge control program, management changes there were well underway. In a letter to Mr. E. C. Hubbard, dated January 11, 1973, Mr. John A. Lawrence, General Manager Nitrogen Operations, CF Industries, stated that he was Acting Manager of FCAI's Tunis plant and that all management functions of the plant would be assumed by CF Industries on February 1, 1973 (20).

The plant site water balance problems were examined in detail in the Rose and Purcell Report, February 1973 (19). The Summary and Conclusions of that report recommended that the plant be required to use only Chowan River water for the demineralizer and that this wastewater, which contains only the minerals present in the clarified raw water plus certain conditioners, be discharged back to the Chowan. This disposal method is typical of power plants and large boiler operations throughout the State. This matter was heard before Judge Hamilton Hobgood on March 12, 1973 (22). The order resulting from this hearing permitted FCAI to return its demineralizer regenerate and boiler blowdown streams to the Chowan River.

Under the provisions of the Clean Water Act of 1972 (P.L. 92-500), the Federal permitting program, National Pollution Discharge Elimination System (NPDES) came into effect. FCAI applied for and received a NPDES permit for the discharge of demineralizer regenerate and boiler blowdown to the Chowan River (23). This permit allowed for a total nitrogen discharge of 42 lbs/day. This loading was basically the same amount of nitrogen that FCAI would draw from the Chowan River.

During the time that the Tunis plant had been in operation, the DWAR had maintained close contact with the facility and its management through the Washington Regional Office.

In fact, much of the work leading up to the court hearings in late 1972 and early 1973 was provided by the Washington Regional Office. Following the issuance of the NPDES permit, this contact was maintained. Close inspection of the wastewater treatment and retention system was provided. Records show that numerous, detailed inspections of the Tunis site took place over this period. The inspections following the construction of new holding ponds and the court orders indicated that FCAI was having difficulty keeping the required 3 ft. of freeboard in the ponds. On January 29, 1974, CF Industries (CFI) informed the DWAR that they were experiencing an overflow from two of their freshwater ponds (24). Sample analyses indicated that the discharge contained significant amounts of nitrogen. The overflow appeared to be due to rainfall.

CFI (FCAI's management authority) continued to look for alternatives for addressing their water balance problems at the site. They approached DWAR with a proposal for barging less contaminated waters to an ocean dumping site located off Oregon Inlet. The DWAR informed CFI that the General Statutes prohibited ocean dumping within the three-mile limit (25).

The tremendous amount of water introduced to the site over the Tunis' plant's life, along with the numerous contaminated water holding ponds, represented a potential problem over and above that of a surface discharge, that is the storage of nitrogen in the sediments and groundwater and the movement of these contaminated waters in the groundwater flow. The DWAR and CFI received a report on this potential problem in mid-1974 (26). A major groundwater formation in this area is the dense clay-loam Yorktown which is 35 to 40 feet below the ground surface at the Tunis site. The report concluded that this formation acts as an aquiclude and that significant quantities of nitrogen do not move into the Yorktown. The study found that heavy concentrations of nitrogen were contained in the groundwater and that this material represented a potential of nitrogen input to the waters around the site; namely, the freshwater ponds and the Chowan River. The report recommended that some minor site alterations be made in order to lower the amount of rainwater getting into the sediments and to improve surface drainage patterns. Following a conference with CFI, the investigators and the DWAR requested that the study recommendations be implemented by CFI (27).

In addition to these technical developments, one final court order in this matter was issued in 1974. In that order, dated March 7, 1974, Judge Donald L. Smith stated that since the State no longer wished the court to retain jurisdiction

for further orders, the court relinquished this jurisdiction and the judgement and orders which had been previously entered became the final judgement (28). Thus, while the jurisdiction was relinquished, the previous orders continue to remain in effect.

The site inspection procedure by the State continued to be utilized and CFI continued their operation without any apparent discharge to the Chowan River system until early 1976. The algal bloom conditions in the Chowan in 1976 probably contributed to intensified site inspections at the Tunis plant. The algal bloom condition increased the pressure on the DWAR (now the Division of Environmental Management) to determine the cause of these conditions. Because the State report had concluded the CFI was a triggering factor in the algal bloom occurring that year, the Division of Environmental Management (DEM) maintained close surveillance of CFI (10).

Beginning on June 14, 1976 and continuing for several days thereafter, DEM staff in the Washington Regional Office observed several seepage areas around diked ponds of CFI's site (30). Through chemical analysis of samples taken from these seeps, it was found that this water was very heavily contaminated with nitrogen. The seepage area examined was located at the bluff between the plant site and the Chowan River. There is actually a swamp between the bluff and the river.

Following the discovery of these seeps, CFI contacted their engineering consultant, Rose and Purcell, Inc. A representative of Rose and Purcell, Mr. C. A. Purcell, Jr., was present at the site on June 17, 1976, and CFI began to initiate a program to prevent further seepage from entering the swamp adjacent to the Chowan River (32). As a temporary solution, the seeps were collected in sumps and pumped to storage ponds. To examine a permanent solution to the seepage problem, CFI, through Rose and Purcell, initiated a groundwater study of their site. During the time that the temporary solution was being put into action and the study effort begun, CFI and their representatives maintained contact with the DEM.

The DEM staff recommended that civil penalties be assessed against CFI (31). This recommendation was made based on the conclusion that CFI's discharge was in violation of G.S. 143.215.1(1), and also that the seepage constituted a violation of the terms of their EPA issued NPDES permit. In response to this recommendation, Mr. W. Everette Knight, Director of DEM, assessed civil penalties of \$1250 per day for a total of \$15,000 over twelve days (33). CFI

forwarded the payment of the civil penalties in a letter dated August 5, 1976 (34).

CFI knew that without long-term corrective action, the seepage problem would still remain. While 62 sumps were installed along the bluff in order to collect the seeps, this system was both temporary and not very reliable (32). In a meeting on August 25, 1976 with DEM staff, C. A. Purcell, Jr. reported the results of their groundwater study and offered a proposed solution to the problem. The study reinforced the conclusion reached in the 1974 NCSU study; nitrogen bearing groundwaters had not entered the Yorktown formation.

Groundwater nitrogen concentration contours showed that the groundwater was very contaminated; concentrations reaching 30,000 mg/l of total nitrogen were measured near the bluff. The solution proposed for groundwater containment called for the installation of a 10,000 linear feet slurry trench wall around the main plant site, an area of approximately 100 acres. Also included in the proposed solution was the continued use of a collection system outside the wall to collect the seeps until they were no longer significant. It is important to note that the proposed solution, as outlined in the Rose and Purcell Report, calls for reclaiming the high concentration nitrogen contaminated groundwater behind the wall, but calls for the discharge to surface waters of the low concentration nitrogen contaminated groundwater collected within the wall, and states that groundwaters outside the containment wall would be allowed to continue their natural flow patterns (32). The provision for discharge of the low concentration nitrogen contaminated groundwater was included in the proposed solution because it was known that without the removal of some water from the site's holding facilities, they would be exhausted, including the volume behind the proposed slurry wall container. Water buildup behind the slurry wall is due to surface infiltration behind the wall.

At the September 9, 1976 meeting of the Environmental Management Commission (EMC), the governing body for DEM, Mr. Purcell, in his presentation of the proposed solution, requested that CFI be allowed to discharge low nitrogen content groundwaters in amounts necessary to offset infiltration. This low concentration Mr. Purcell referred to was stated at the meeting to be 100 mg/l or less of total nitrogen (35). This concentration, by comparison, is approximately five times that found in secondary treated domestic sewage. In the staff report at the EMC meeting, Mr. Knight stated that it might not be feasible to reclaim all nitrogen contained in the waters on the property, but indicated concern

over the fate of the nitrogen outside the slurry wall. The staff, however, recommended that the EMC approve the slurry wall concept so that an effort could be made to contain as much material as would be reasonable and practicable. The EMC moved that DEM issue the necessary permit.

The DEM issued CFI permit No. 4082 on October 1, 1976 for construction of the slurry wall as previously described (36). The permit did not contain discharge provisions. The permit set January 1, 1977 as the date of completion. Also included was a provision requiring seepage collection and retention until seepage nitrogen concentrations became less than 100 mg/l total nitrogen.

Prior to, during and after the construction of the slurry wall, Washington Regional Office staff continued to conduct inspections of the site and seep containment activities. The seepage pumping operation was observed over this period and was found to be in both good and bad condition. CFI appears to have responded well to correcting poor operating conditions.

In a letter dated October 27, 1976, W. E. Knight amended the slurry wall completion date from January 1 to February 1, 1977 (37). The completion date was amended further to be no later than March 15, 1977, unless documented evidence supporting a further delay was presented (38). However, this date was again amended after CFI submitted a request for an extension to May 1, 1977 (39). The wall was functionally completed on April 29, 1977, requiring only backfilling and surface grading (40).

During the slurry wall construction process, the site water balance problems which have been discussed previously were again brought to the attention of the EMC. At the February 10, 1977 EMC meeting, Archie Purcell discussed the impact of the fuel shortage on water balance at the Tunis plant (41). CFI utilizes fuel-produced heat to evaporate the waste liquid as a means of concentrating the nitrogen in the water and lowering the wastewater volume at the site. He also pointed out that heavy rains could overload available storage capacity. It was requested that the EMC allow CFI to discharge 70 tons of nitrogen into the Chowan. Mr. Purcell stressed that a discharge during the winter could be advantageous because the nitrogen would be flushed out of the system before warm weather brought algal bloom conditions. A discharge of 43 million gallons of wastewater over a 28-day period was requested. L. P. Benton, Jr. presented the staff recommendation in regard to the proposed discharge. Mr. Benton stated that the staff could not recommend such a discharge, but if one were to be granted, it should occur in

late fall prior to December 1 of any year. It was also stressed that since CFI was using fuel oil that the water balance concerns had not reached a critical stage yet. Based on the staff's own calculations, it was projected that water storage at the plant would not be critical in the near future. The staff position was that no discharge be allowed at that time, but that a discharge might be considered in late 1977. The EMC adopted the staff recommendation. An update of the CFI fuel problems was provided at the March 1977 EMC meeting (42). The staff told the EMC that natural gas was again available and in use at the Tunis Plant.

CFI was issued an NPDES permit for a 10,000 gpd treated domestic wastewater discharge to Catherine Creek on February 25, 1977 (43).

The seepage collection system utilized by CFI outside the slurry wall continued to be inspected by DEM staff. In addition, the Tunis site inspections showed that nitrogen contaminated waters were being lost to the swamp area through a drainage ditch east of the plant (44).

An area of interest not previously discussed is the swamp area between the river and the plant. Nitrogen contaminated waters have moved from the site to this swamp area. Trees in this swamp have died, apparently due to the high nitrogen concentrations in the air and water. This potential area of concern has been studied as part of the recent DEM efforts on the Chowan River.

CFI's concern over the water balance at their site prompted a request for a permit for a one time, 60 million gallon discharge (45). At the public hearing held to consider this proposal, CFI withdrew its request for such a permit for the stated reason that EPA opposed the proposal. However, in the recommendations of the Hearing Officer following the January 17, 1978 hearing, it was stated that should CFI again make such a request, more consideration would need to be given to the effects of such a discharge on the Albemarle Sound, its effects on aquatic life with particular reference to fish, and that any request for a discharge without adequate consideration of these things be returned to CFI without action (46).

In an effort to relieve water accumulation behind the slurry wall, CFI proposed the installation of a well point system and spray header for withdrawing slurry wall water with nitrogen concentrations up to 100 mg/l and then spraying this water into the swamp bordering the Chowan River (47). The DEM regarded this system as a discharging, rather than a non-discharging system and, as such, would require an

NPDES permit. It was further stated that DEM's intention would be to deny such a permit.

Algae conditions in the Chowan achieved bloom proportions in 1978 and DEM intensified monitoring on the river. This study program is continuing, broadening in scope and involves consideration of the CFI site as a nitrogen source. The impact of the CFI site on the Chowan River is being evaluated through the results of the river sampling, a groundwater evaluation of the "dead-tree swamp," and consideration of nitrogen air emissions from the plant. The sampling results from the river stations near the CFI site have indicated increases in total organic and inorganic nitrogen ($\text{NH}_3\text{-N} + \text{NO}_2\text{-N} + \text{NO}_3\text{-N}$) downstream of the Tunis plant. The November 30, 1978 Chowan Quarterly Report stated that for a selected period from September 6, 1978 through October 12, 1978, the river data showed an approximate increase in total nitrogen downstream of CFI of 1200 lbs/day (48). The report did state that this figure was an approximation. It also noted that nitrogen loading increased according to many, but not all, sampling results above and below CFI. An evaluation of all the data through March 1979 shows that consistent and significant increases in total nitrogen downstream of Tunis were observed. This increase is greater than what could be attributed to forested and agricultural runoff expected between the stations.

Much of the study at the CFI site, completed to date, has been around the swamp. Nitrogen values in the swamp are normally well above the 100 mg/l level and values have exceeded 2000 mg/l (49). Subsurface swamp water samples have indicated even higher values. In late 1978, samples of swamp runoff, following a one inch rain, contained total inorganic nitrogen values between 300 and 1500 mg/l (48). Swamp runoff data from the winter of 1978-79 showed even higher total inorganic nitrogen concentrations, exceeding 2000 mg/l (49). These surface runoff samples were taken at two sites in the swamp where there is normally a movement of this water toward the river.

Automatic sampling data from a site on the Chowan at the downstream side of the swamp indicate that nitrogen is moving from the swamp to the river; this movement is normally more pronounced following a rainfall event (49). Grab samples of the swamp areas along the Chowan have indicated total nitrogen values less than 10 mg/l. It is important to note that virtually all of this nitrogen is organic in nature, indicating the dead-tree swamp nitrogen contamination, which is largely in the inorganic form, most likely originated from the CFI site. However, based on groundwater studies performed by DEM, this contamination

occurred prior to the slurry wall installation. Therefore, during rainfall events or high river stage, large quantities of nitrogen are being flushed from the swamp.

DEM installed 30 wells at various sites in the dead-tree swamp (49). Nitrogen data from these wells indicate high, but variable, concentrations of the material throughout the swamp's surface and subsurface waters. Analysis of the swamp's groundwater hydrology has indicated that a slight groundwater gradient toward the river exists, but that subsurface flows are small and very slow. DEM is presently preparing a comprehensive report on the groundwater situation at CFI. A tentative conclusion of that study is that movement of nitrogen from the swamp by the groundwater route is very small and, as stated before, nitrogen from the swamp is flushed out by the introduction of flow into the swamp area. In addition, the data gathered indicates that the slurry wall is effective in containing most of the nitrogen contaminated water within that enclosure.

The basic conclusions of the recent intensified studies of CFI is that there is a large amount of nitrogen-bearing water within the groundwater outside the slurry wall, that the dead-tree swamp contains a significant amount of nitrogen, and that this nitrogen is flushed from the swamp into the Chowan River.

An additional area of concern at the CFI site is that of nitrogen air emissions. Based on CFI emission inventories, large quantities of nitrogen are discharged to the atmosphere at the site (49). To date, only limited data exist, based on very crude sampling procedures, and further investigation of this potentially significant source seems warranted. DEM is presently developing a monitoring program to evaluate this concern.

As the history of the Tunis plant indicates, the containment facilities have not been, and are not presently designed, to operate as a non-discharge system indefinitely. CFI's constant concern over water balance is illustrated throughout this report. It is highlighted again by CFI's application for a permit for an experimental land application system (50). DEM issued CFI this permit on May 25, 1979 and it is effective until rescinded. The record shows that a number of wastewater disposal options have been considered by CFI, such as land application, marketing nitrogen water as fertilizer, a more extensive nitrogen reclamation program, denitrification treatment, and perhaps others. It is not clear from available records, however, whether detailed examination of disposal alternatives have been considered. Through the Chowan River

Technical Panel, Dr. Frank Humenik, N. C. Agricultural Extension Service, has worked with CFI in obtaining some of the nitrogen contaminated water in order to test it as a possible direct application fertilizer material. Preliminary results show that it is an acceptable fertilizer. CFI has shown a willingness to address this problem, as shown by the two permits obtained for land application systems, and has discussed the problem with State representatives on several occasions.

The water balance difficulties at the Tunis plant are important, but are removed somewhat from the problem related to nitrogen outside the slurry wall. It is important to remember that as part of the proposed slurry wall solution, CFI's consulting engineers stated that nitrogen water outside the wall area would be allowed to continue its natural flow patterns (32). In addition, at the EMC meeting that considered the slurry wall, DEM staff reported that although there was concern over the fate of nitrogen in the groundwater outside the proposed wall area, the slurry wall approach appeared to be the most workable and feasible solution to the problem (35). The most recent data indicate that significant amounts of nitrogen enter the Chowan River from the swamp area. It is very likely that this input is a contributing factor to algae conditions in the river. CFI, in a letter dated June 27, 1979, has committed to examining the swamp area. This will be a step toward addressing this concern. It has been recommended to CFI that their permitted discharge be relocated such that all discharges will be made directly into the river instead of to the swamp. This move, as indicated by the June 27, 1979 letter, is acceptable to CFI and efforts are underway to accomplish this.

CFI's NPDES permit is for treatment plant wastewater and boiler blowdown. This permit was issued February 2, 1979, with an expiration date of November 30, 1979 (51). The short duration of the permit was set in order to enable DEM and CFI to incorporate and implement recommendations made as a result of the studies now underway on the Chowan River.

In examining the pollution control efforts made by CFI over the years of their existence at Tunis, it is clear that significant money has been spent toward this concern. It is estimated that pollution control has cost CFI in excess of \$7 million in capital costs alone (52). This is a sizable expense. The evaluation of the conditions at the CFI site indicates clearly that many problems remain. A cooperative working relationship between CFI and the State must continue to successfully address these problems.

REFERENCES

1. Report to the Staff, Committee and Board of the State of North Carolina Department of Natural and Economic Resources, Office of Water and Air Resources, by Farmers Chemical Association, Inc. (prepared by AWARE, Associated Water and Air Resources Engineers, Inc.), December 5, 1972.
2. Affidavit of Mr. A. C. Turnage, Jr., employed with the North Carolina Department of Water and Air Resources, dated October 16, 1972.
3. North Carolina Board of Water and Air Resources, Raleigh. Permit for the discharge of sewage, industrial wastes, or other wastes, No. 1707, issued December 10, 1969, effective until December 31, 1974.
4. Assurance of Voluntary Compliance for Farmers Chemical Association, Inc. (Tunis, North Carolina), July 29, 1971.
5. Supplemental Assurance of Voluntary Compliance for Farmers Chemical Association (Tunis Plant), July 25, 1972.
6. North Carolina Department of Natural and Economic Resources, Office of Water and Air Resources, Raleigh. Permit No. 2262, for the discharge of sewage, industrial wastes and other wastes, issued February 14, 1972, effective until December 31, 1972.
7. Letter from E. C. Hubbard to H. T. Rosser, dated October 6, 1972.
8. Complaint signed by G. E. Pickett and H. T. Rosser, dated October 16, 1972.
9. Court order signed by Judge Walter J. Bone, dated October 17, 1972.
10. "Interim Report of Chowan River Water Quality Study," Office of Water and Air Resources, Department of Natural and Economic Resources, September 1972.
11. Court order signed by Judge A. Pilston Godwin, Jr., dated October 24, 1972.
12. "The Development of an Integrated Wastes Management Program for the Farmers Chemical Association's fertilizer plant at Tunis, North Carolina," Associated Water and Air Resources Engineers, Inc., November, 1972.

13. Court order signed by Judge Harry Cannaday, dated December 12, 1972.
14. North Carolina Department of Natural and Economic Resources, Office of Water and Air Resources temporary Permit No. T-558, issued December 22, 1972, effective until December 31, 1973.
15. North Carolina Department of Natural and Economic Resources, Office of Water and Air Resources, Permit No. 2448, issued September 29, 1972, effective until July 31, 1973.
16. North Carolina Department of Natural and Economic Resources, Office of Water and Air Resources, Permit No. 2500, issued November 27, 1972, effective until December 31, 1973.
17. North Carolina Department of Natural and Economic Resources, Office of Water and Air Resources, Permit No. 2536, issued December 18, 1972, effective until December 31, 1973.
18. North Carolina Department of Natural and Economic Resources, Office of Water and Air Resources, Permit No. 2547, issued January 3, 1973, effective until December 31, 1973.
19. "Engineering Report on Waste Water Treatment," Farmers Chemical Association, Inc., Tunis, North Carolina, by Rose and Purcell, Inc., Surveyors-Engineers-Planners, Fayetteville. February 1973.
20. Letter from Mr. John A. Lawrence of C. F. Industries to Mr. E. C. Hubbard, North Carolina Office of Water and Air Resources.
21. Letter from Mr. V. A. Minch of AWARE to Mr. E. C. Hubbard, dated January 26, 1973.
22. Court order signed by Judge Hamilton H. Hobgood, dated March 23, 1973.
23. NPDES Permit No. NC0003409, issued December 31, 1973, expires December 31, 1979 (issued by the U. S. EPA).
24. Memorandum from Mr. Robert P. Norris to Mr. A. C. Turnage, Jr., dated February 22, 1974.
25. Letter from Mr. A. C. Turnage, Jr., Office of Water and Air Resources to Mr. John H. Heckert, C. F. Industries, dated July 1, 1974.

26. "Nitrogen in Sediments and Movement to Chowan River at C. F. Industries, Inc. Fertilizer Plant in Hertford County, North Carolina," by J. W. Gilliam, R. W. Skaggs, R. B. Daniels and E. E. Gamble.
27. Letter from Mr. E. C. Hubbard, Office of Water and Air Resources to Mr. J. H. Heckert of C. F. Industries, dated July 5, 1974.
28. Memorandum from Mr. John R. B. Matthis, Deputy Attorney General to Mr. M. W. Puette, Enforcement Director, Division of Environmental Management, dated July 2, 1976.
29. "Summary Report, The Chowan River Project," by Sharon Bond, Grover Cook and David H. Howells, Water Resources Research Institute of the University of North Carolina.
30. "Report of Dike Seepages at C. F. Industries, Tunis," by A. C. Turnage, Jr. and other staff members, dated June 14, 15, 16, 1976.
31. Memorandum from Mr. L. P. Benton, Jr. to Mr. W. E. Knight, dated June 23, 1976.
32. "Engineering Report, Seepage Investigation - C. F. Industries, Inc., North Carolina Nitrogen Complex," Rose and Purcell, Inc., dated September 27, 1976.
33. Certified letter from Mr. W. E. Knight to Mr. W. C. Pickett, Farmers Chemical Association, dated July 7, 1976.
34. Letter from Mr. J. Allen Adams, Attorney for FCA, Inc. to Mr. W. E. Knight, dated April 5, 1976.
35. Minutes, Environmental Management Commission Meeting, September 9, 1976.
36. North Carolina Department of Natural and Economic Resources, Division of Environmental Management, Permit No. 4082, issued October 1, 1976, effective until rescinded.
37. Letter from Mr. W. E. Knight to Mr. Wallace Hoelscher, C. F. Industries, dated October 27, 1976.
38. Letter from Mr. W. E. Knight to Mr. Wallace L. Hoelscher, dated January 27, 1977.
39. Letter from Mr. W. E. Knight to Mr. Wallace Hoelscher, dated March 16, 1977.

40. Memorandum from Mr. A. C. Turnage, Jr. to Mr. Robert Carter, dated May 10, 1977.
41. Minutes, February 10, 1977 meeting of the Environmental Management Commission.
42. Minutes, March 10, 1977 meeting of the Environmental Management Commission.
43. NPDES Permit No. NC0031721, signed February 25, 1977, effective from February 28, 1977 to December 31, 1981.
44. Several site reports by Mr. Harry Kaufman, Northeastern Regional Office.
45. Letter from Mr. B. R. Phillips, C. F. Industries to Mr. A. F. McRorie, dated January 17, 1979.
46. "Report of Proceedings at a public hearing concerning the proposed issuance of a State NPDES Permit to C. F. Industries for a one-time discharge to the Chowan River at Tunis, Hertford County," January 17, 1978.
47. Letter from Mr. A. C. Turnage to Mr. B. R. Phillips, dated July 10, 1978.
48. "Quarterly Report: Investigation of the Chowan River Estuary Algal Bloom," dated November 30, 1978.
49. "Quarterly Report: Investigation of the Chowan River Estuary Algal Bloom," dated April 17, 1979.
50. Cover letter from Mr. A. F. McRorie to Mr. B. R. Phillips, transmitting Permit No. 5318, dated May 30, 1979.
51. NPDES Permit No. NC0003409, issued February 2, 1979, expires November 30, 1979.
52. Memorandum to files from Mr. Roger K. Thorpe, dated October 19, 1977.

BCX 2500
 AHOSKIE, NORTH CAROLINA 27910
 TELEPHONE: 919/358-5011
 TWX 510-929-0951



CF Industries, Inc.
 North Carolina Nitrogen Complex

June 27, 1979

RECEIVED

JUN 29 1979

NRCD OFFICE OF
 ADMINISTRATION

Mr. Howard N. Lee, Secretary
 North Carolina Department of Natural
 Resources and Community Development
 P. O. Box 27687
 Raleigh, North Carolina 27611

Dear Mr. Secretary:

One of the ever present challenges of members of Governor Hunt's cabinet is finding the time to respond to the many requests for attention to challenges and problems. CF Industries would like to express their thanks and appreciation for the generous amount of time which you and your staff allotted to examining and discussing our mutual challenges. Our company firmly believes that through such direct and honest communication, challenges can be discussed in a positive manner, and approaches to solutions can be created.

Confirming our discussions on June 27th, CF personnel will promptly proceed to take the following actions---

Travel to Raleigh for the purpose of visiting Dr. Grigg to review and discuss the data which has been collected during recent work by the State in examining the movement of nitrogen from the "swamp" area by the plant into the Chowan River.

Develop a draft proposal for an engineering study to quantitatively examine the nutrient movement around the "swamp" area referred to in the previous section. This draft proposal would define the scope of the sampling and modeling work to be done, as well as the costs associated with such a study. With this draft proposal completed--- hopefully by the end of September, CF personnel then would be in a position to meet with Dr. Griggs, or other people whom you might designate, and define how and when such a study could be implemented and completed.

Prepare an engineering proposal for the relocation of the discharge piping identified in our present NPDES permit, so that such effluent would be discharged directly into the Chowan River. When this proposal is complete--- probably no later than the end of July, CF personnel would meet with the appropriate State agencies to discuss its implementation.

Mr. Howard N. Lee

-2-

June 27, 1979

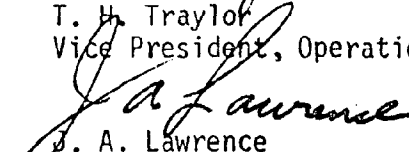
Again, CF, its management, and employees wish to thank you for the opportunity to meet with you and your staff.

Sincerely,

CF INDUSTRIES, INC.



T. H. Traylor
Vice President, Operations



J. A. Lawrence
Vice President, Manufacturing -
Northern Region



B. R. Phillips
Plant Manager

THT/ksv

SALEM LAKE DRIVE
LONG GROVE, ILL. 60047
PHONE (312) 438-9500

JOHN A. LAWRENCE
Vice President
Manufacturing • Northern Region

April 30, 1979

RECEIVED
OFFICE OF THE SECRETARY

MAY 7 1979

DEPT. OF NATURAL
RESOURCES & COMMUNITY
DEVELOPMENT

North Carolina Department of
Natural Resources and
Community Development
P. O. Box 27687
Raleigh, North Carolina 27611

Attention: Mr. Howard N. Lee, Secretary

Dear Sir:

Thank you for your letter to our Executive Vice President, Mr. Donald Borst, regarding his attendance at the March 9, 1979 meeting on the Chowan River.

As I am directly responsible for our nitrogen plant on the Chowan River, I am taking the liberty of answering your letter and commenting on Governor Hunt's request which pertains to our company.

Governor Hunt's Item 2: That plant's should monitor their discharge.

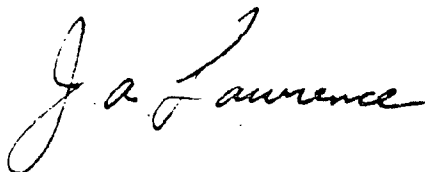
As you know, under the permit from your office, we monitor our discharges for flow and pH and constituents and report these items to your office. Our nitrogen discharge, by your office's permit, cannot exceed the nitrogen in the water the plant takes from the river. In previous discussions with your people, it has been explained that there is no available technology to handle this material which normally runs about 40 pounds per day.

As you may also recall, our company has worked diligently with your people. We were pioneers in using ion exchange for nitrogen removal.

We built the first nitrogen plant slurry wall containing ground water and have done many minor items inside the plant, including the stacks, to reduce the discharge of nitrogen. These items have a capital cost of several million dollars and an annual operating cost of over a million dollars per year. They serve only one function; to minimize nitrogen from our plant.

We will continue to work with you as much as possible to continue to solve the complex problems of low velocity waterway eutricification.

Yours very truly,

A handwritten signature in cursive script that reads "J. a. Lawrence". The signature is written in dark ink and is positioned below the typed name.

f
CF Industries

State of North Carolina
Department of Natural Resources
and Community Development
Raleigh 27611

JAMES B. HUNT, JR.
GOVERNOR

HOWARD N. LEE
SECRETARY
TELEPHONE
AREA CODE 919-733-4984

May 5 1979

Mr. Donald V. Borst
Executive Vice President
C. F. Industries, Incorporated
Salem Lake Drive
Long Grove, Illinois 60047

Dear Mr. Borst:

Since you were with us at Governor Hunt's meeting on March 9th, the "Chowan River Restoration Project" has made substantial progress. You learned at that meeting about our serious commitment to clean up the Chowan River and we were pleased to hear your statement about the willingness of C.F. Industries to cooperate. I am writing to you today to make a specific request about your cooperation.

As you know, we have been studying the river very carefully for several years. We have considerable data about river nutrient levels, as well as specific information about runoff from the C. F. site. We have recent results from close surveillance of direct nitrogen inputs to the river from the vicinity of the fertilizer plant. We have a report in preparation about specific quantities of nitrogen in the runoff and we are convinced that it will disclose that average daily discharges of nitrogen from the plant site are substantial. By this I refer to discharges caused by overland flow during rainfall events and seepage which reaches the river through underground flow. These discharges are not considered in the C. F. discharge permit and are often misunderstood.

We are aware of the very substantial work completed by C. F. Industries in past years to eliminate these discharges. It appears to us at the present time that this past work has not been adequate and that significant amounts of nitrogen are still reaching the river. We believe that it can be considered a significant source of nutrients and a possible major contribution to the algae blooms.

Page 2

Mr. Donald V. Borst

May 5, 1979

We know that the best future operation of your plant will depend on acceptance by the local population. It seems best for C. F., the State of North Carolina, and Chowan residents that we work as hard as we can on this difficult problem. We therefore would like to meet with you as soon as possible on the site to discuss with you specifically what measures C. F. Industries might take to halt this source of nutrient inputs.

At a public meeting in Edenton, North Carolina on Thursday, April 19, I stated that I would be visiting the C. F. plant site soon to inspect firsthand the waste management system. I hope you can meet with us on the site so that we can discuss between your engineers and ours the possibilities for correcting this problem. We would hope to receive a commitment from you at that time to undertake a substantial effort to remedy these problems.

We will be in touch with you to determine whether you can meet us on the site.

With kindest regards and best wishes, I am

Respectfully yours,
Original Signed

By

SECRETARY HOWARD N. LEE
Howard N. Lee

HNL/ch

APPENDIX H

UNION CAMP DISCHARGE PERMIT ACTIONS

UNION CAMP DISCHARGE PERMIT ACTIONS

Union Camp Corporation and its predecessor companies have operated on the Blackwater River at Franklin, Virginia since 1850. Beginning as a sawmill, it has grown into the present bleached pulp and paper and building products complex, employing at the site about 2,600 people. The plant has had secondary treatment since 1964. The treatment system was upgraded in 1972 and further refined in 1977. The present system consists of a clarifier, wet sludge lagoons, 10-day aerated stabilization basin, and a storage pond, capacity about 12 billion gallons. A final pond is used only during the four month release period for controlling rate of discharge of treated effluent to the Blackwater River.

The discharge is limited to the months of December, January, February and March. These are the months when stream flows are at a maximum and therefore during the period of minimum impact. The company contends that the nutrients discharged during this period are well downstream of the algal bloom areas by the time algal activity begins and, hence, cannot be utilized by the algae. Union Camp is the largest single point source contributor of nitrogen in the basin, and the North Carolina Division of Environmental Management suspects that the nutrients are stored in the Chowan and remain there for considerable periods. If this is the case, the nutrients are available for recycling during the summer months.

A hearing was held on May 21, 1979, concerning the re-issuance of the Union Camp discharge permits. At that hearing the State of North Carolina vigorously objected to the issuance of the permit unless it was modified to require that:

1. Union Camp Corporation characterize its nutrient contributions to the Chowan River Basin, and
2. Union Camp Corporation establish an adequate program for nutrient removal or control.

By March 1980 the State of North Carolina will establish the levels of nutrient which can be tolerated in the Chowan River. The State of North Carolina, therefore, requested that the permit be terminated on March 1, 1980, or that the permit be amended to assure that the company will begin implementing a program of nutrient control designed to bring its discharge into compliance with North Carolina's nutrient limits when they are established.

Such a control program should be initiated no later than March 1, 1980, and should be completed no later than March 31, 1982.

While the position of the State of North Carolina in this matter was unusual in that the State had not yet established the levels of nutrients which would be allowed in the Chowan River, this method follows the precedent of the EPA which requires that major permits be reopened so that requirements for control of certain toxic constituents can be inserted in the permits. If the permit terminated on March 1, 1980, the new permit would then contain all the requirements for implementing an adequate nutrient control program. An alternative action that would be acceptable to North Carolina was to include a reopener clause in the permit.

The reissued permit does not contain a reopener clause and will expire March 31, 1981. Union Camp will be required to monitor nutrients as a condition of the reissued permit.

STATEMENT CONCERNING
NPDES PERMITS NO. VA0004162 and VA0004154 to
be presented to the Virginia Water Control
Board at a Public Hearing in Franklin, VA
May 21, 1979

By: A. F. McRorie

I appreciate this opportunity to comment on the draft NPDES permits for wastewater discharges from Union Camp Corporation, Franklin, Virginia, into the Blackwater River in the Chowan River Basin. As you are aware, the major discharge from Union Camp Corporation is into the Blackwater River immediately above the Virginia-North Carolina border. The major impact of this discharge is on North Carolina waters.

Union Camp Corporation has provided a high level of treatment for the biodegradable materials and solids in their wastewater. The firm has also provided for wastewater storage so that the full year's accumulation of waste can be discharged during the high flow winter months - December through March. These activities have resulted in an improvement in river water quality as far as solids and biodegradable materials are concerned. However, further steps are now necessary to protect water quality and to avoid algal blooms.

The Chowan River, formed by the Blackwater and Nottoway Rivers, has been experiencing increasingly severe algal blooms in recent years. The river and the people of the area suffered from a devastating bloom during the summer of 1978. Early indicators suggest that there will be a similar problem in the summer of 1979.

In the past, the Chowan River has been an extremely productive fishery and a significant recreational asset. In North Carolina, many people depend on this fishery and recreational asset for their livelihood. The resources of the Chowan River are a very significant part of the economy of the entire lower basin.

The algal blooms have interfered with fish life and recreation on the river. This has had a serious effect on the well-being of the entire lower basin. Take, for example, the herring fishery. In the 1960's, it averaged a catch of twelve million pounds annually. This year, following the severe algal bloom of 1978, the herring fishery yielded the lowest catch on record - 4½ million pounds, roughly 37% of the earlier figure. In addition, during the summer and fall of 1978, the algal bloom brought recreational activities on the lower Chowan River to a halt.

The recent algal blooms have been studied by the State of North Carolina, and other agencies, in an attempt to find a solution. Preliminary indications are that the most likely method for preventing over-productivity of algae in the Chowan River Basin is to reduce the nitrogen contributions to the river.

The North Carolina Environmental Management Commission, after public hearings on the issue, acted on May 10 to establish a new classification for waters of the State of North Carolina. This classification allows for additional control measures in waters which are exhibiting a sensitivity to nutrients. In addition to adopting the "Nutrient Sensitive Classification," the Commission, through emergency rulemaking procedures, acted to apply this classification to all the waters of the Chowan River Basin which are under its control. During the next few months, the State of North Carolina will identify control measures necessary to reduce nutrient levels. As a result, dischargers in North Carolina will be called on to expend additional time and money to reduce their nutrient input to the river. Our goal is to control eutrophication or overabundance of algae in the Chowan River so as to preserve that resource for the people of the State. Let me note, at this point, that we are also very seriously concerned about the future of the Albemarle Sound.

The draft permits under consideration today for Union Camp Corporation do not address the control of nutrients. The company's application does indicate that there are significant quantities of nitrogen in its discharge. However, the application does not specify the levels of various nitrogen compounds to be discharged. Our preliminary staff work suggests that Union Camp is the leading point source of nitrogen in the Chowan Basin. Although this discharge occurs under high flow winter conditions, we believe that the nutrients are stored in the Chowan and remain there for considerable periods. We are very concerned about the effects of nutrient recycling.

The State of North Carolina must vigorously object to the issuance of the Union Camp Corporation permits unless they are modified to require that:

1. Union Camp Corporation characterize its nutrient contributions to the Chowan River Basin and
2. Union Camp Corporation establish an adequate program for nutrient removal or control.

Furthermore, it is noted that this permit will expire on March 31, 1982.* This date is likely two years beyond the time

*This statement was made in error. The expiration date has always been March 31, 1981.

when the State of North Carolina will establish the levels of nutrient which can be tolerated in the Chowan River. The State of North Carolina requests that this permit be terminated on March 1, 1980, or that the permit be amended to assure that the company will begin implementing a program of nutrient control designed to bring its discharge into compliance with North Carolina's nutrient limits, when they are established. Such a control program should be initiated no later than March 1, 1980, and should be completed no later than March 31, 1982.

I realize that the position of the State of North Carolina in this matter is unusual in that the State has not yet established the levels of nutrients which will be allowed in the Chowan River. However, this method follows the precedent of the Environmental Protection Agency which requires that major permits be reopened so that requirements for control of certain toxic constituents can be inserted in the permits. We would prefer that these permits terminate on March 1, 1980, so that the new permit would then contain all the requirements for implementing an adequate nutrient control program. However, since we are certain that we will establish nutrient control levels for the Chowan River, a reopener clause for this purpose is acceptable.

I thank you again for allowing us to make this presentation.

Herzog Co

DIVISION OF ENVIRONMENTAL MANAGEMENT

August 29, 1979

Mr. R. V. Davis
Executive Secretary
Commonwealth of Virginia
State Water Control Board
Post Office Box 1143
Richmond, Virginia 23230

Subject: Union Camp Corporation
NPDES Permit
Franklin, Virginia

Dear Mr. Davis:

Your letter of July 26, 1979, was received, and your concern for the Chowan Basin is appreciated.

We still feel that a reopener clause for nutrients is needed in NPDES Permit No. VA0004162 for Union Camp Corporation. EPA, Region IV, has notified us that they feel the reopener clause request is reasonable. It is unlikely that the EPA standards for the pulp and paper industry which you referred to in your letter will adequately address nutrients. Also, we understand your prudence in regard to toxics. Therefore, we feel that, at least, the same consideration should be given to the existing nutrient problem in the Chowan River.

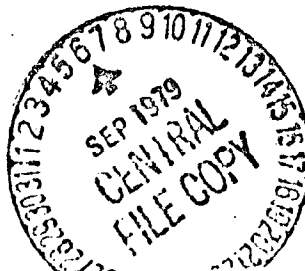
The sooner attempts can be made to restore the Chowan River, the sooner results can occur. Please reconsider our request for the reopener clause.

Yours very truly,

Original Signed By
Neil S. Grigg
Neil S. Grigg
Acting Director

cc: Mr. Bob Holman
Mr. Ian MacBryde
Washington Regional Office
Tidewater Regional Office
Mr. A. C. Turnage, Jr.

[Handwritten initials]





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WASHINGTON OFFICE

AUG 6 1979

P. E. M.

COMMONWEALTH of VIRGINIA

STATE WATER CONTROL BOARD

2111 Hamilton Street

R. V. Davis
Executive Secretary

July 26, 1979

Post Office Box 11143
Richmond, Virginia 23230
(4) 257-0056

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AUG 3 1979

ENVIRONMENTAL OPERATIONS

Mr. A. F. McRorie, Director
North Carolina Department of Natural
Resources and Community Development
P. O. Box 27687
Raleigh, North Carolina 27611

RE: Union Camp Corporation NPDES Permit

Dear Mr. McRorie: *A.F.*

Thank you for your letter of July 13, 1979 concerning the NPDES Permit for Union Camp Corporation, Franklin, Virginia. I appreciate the comments that you and other members of your staff had at the public hearing concerning this permit and I understand your current concern.

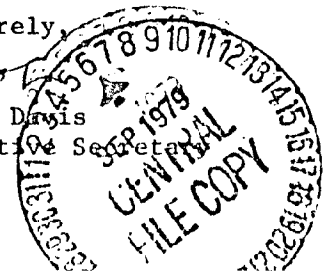
We feel, however, that the permit as reissued, does in fact, adequately address your concern. The permit was set to expire on March 31, 1981 in accordance with EPA regulations. A "reopener clause" for toxics was also included, which would allow for permit modification or reissuance to comply with the requirements of the Clean Water Act. As you know, the EPA is working towards promulgation of the applicable standards for the subject industry by early 1980. If the permit is reopened in 1980 and North Carolina is ready then to present evidence of the Company's effluents effect on the Chowan River, we will certainly reevaluate the permit's requirements on nutrients. If, however, the permit is not reopened in 1980, North Carolina will still have a chance to provide input on additional nutrient control, when the permit comes up for reissuance prior to March 31, 1981.

It is also felt that due to the Company's winter release schedule (the reissued permit covers only two discharge seasons) and the weekly nutrient monitoring requirement during each discharge season, there is some nutrient control program during the life of the short-term permit. In addition, after the first year of issuance, the State of Virginia may reevaluate the nutrient monitoring requirement and make modifications as deemed appropriate.

I hope that this adequately addresses your concerns on this issue, and I look forward to the day when we have solved the water quality problem in the Chowan Basin. If I may be of any further assistance, please let me know.

Sincerely,

R. V. Davis
R. V. Davis
Executive Secretary



sf
cc: EPA Region III; BAT, BE, TRO

H-7

*Millard B. ...
Union Camp*



RECEIVED
WASHINGTON OFFICE

JUN 20 1979

D. E. M.

COMMONWEALTH of VIRGINIA

STATE WATER CONTROL BOARD
2111 Hamilton Street

R. V. Davis
Executive Secretary

Post Office Box 11143
Richmond, Virginia 23230
(804) 257-0056

Please reply to: Tidewater Regional Office
287 Pembroke Office Park
Suite 310 Pembroke No. 2
Virginia Beach, Virginia 23462
(804) 499-8742

BOARD MEMBERS
Millard B. ...
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William L. Tate
R. Alton Wright

June 18, 1979

Mr. Jim Mulligan
North Carolina Division of Environmental Management
1502 North Market Street
Washington, North Carolina 27889

RE: Union Camp Corporation
NPDES Permit No. VA0004162 - Reissuance

Dear Mr. Mulligan:

At its June 2-5, 1979 meeting, the Virginia State Water Control Board authorized the staff to reissue NPDES Permit No. VA0004162 to the Union Camp Corporation's Bleach Paper and Board Division.

As a result of the concern voiced by the State of North Carolina during the May 21, 1979 Public Hearing in Franklin, Virginia, we have incorporated a nutrient monitoring requirement into the permit. This special condition, which is attached, will involve sampling once per week for nutrients throughout each discharge season.

We appreciate North Carolina's concerns in this matter. If we may be of any further assistance, please feel free to contact us.

Sincerely,

L. S. McBride
Tidewater Regional Director

bts
Attachment
cc: BAT, BE
TRO File
Mr. A. F. McRorie



APPENDIX I

POINT SOURCE DISCHARGER NITROGEN CONTRIBUTIONS

POINT SOURCE DISCHARGER NITROGEN CONTRIBUTIONS

Estimated average discharge rate and nitrogen discharge for point sources in the Chowan Basin-ranked by nitrogen discharge.

(X denotes a Virginia discharger)

	<u>Discharger</u>	<u>Flow (MGD)</u>	<u>N Discharge (lbs./day)</u>
X	Union Camp Bleached Paper	145.*	5565*
	Edenton	1.0	234
	Ahoskie	0.8	211
X	Fort Pickett	1.04	191
X	Hercules	3.1	130
X	Virginia Dyeing Corporation	0.12	115
	United Piece Dye Works	0.93	78
X	Franklin	0.46	65
X	Lawrenceville	0.28	44
X	Emporia	0.5	42
	CF Industries	0.25	42
X	Petersburg	0.2	42
	Aulander	0.14	36
	Murfreesboro	0.2	32
X	Waverly	0.15	29
X	Kenbridge	0.15	25
	Winton	0.14	23
	Woodland	0.08	20
X	Southampton State Correctional Farm	0.07	18
X	Jarrett	0.07	15
	Conway	0.06	15
X	McKenney	0.05	14
X	Spurlock Corporation	0.002	14
X	South Hill #2	0.168	14
X	South Hill #3	0.16	13
X	Wakefield	0.15	13
	Colerain	0.04	10
X	Ramada Inn	0.036	8
	Seaboard	0.0305	8
	Severn	0.03	8
X	Bollingbrook Inn & Allstate MHP	0.029	8
X	Piedmont State Hospital	0.05	8
X	Victoria (west)	0.086	7
X	Victoria (east)	0.086	7
X	Boykins	0.085	7
	Fiberform, Division of USI	0.01	7
	N. Hampton High School	0.025	6
X	Green Acres Trailer Court & Motel	0.025	6
X	Southside Community College	0.021	6
X	Beazly Elementary School	0.02	6
X	Steven Kent Motel	0.02	6
X	Surry County High School	0.02	6

Discharger		Flow (MGD)	N. Discharge (lbs./day)
X	Alberta	0.077	5
X	LaCrosse	0.06	5
X	Prince George High School and Country Aire Mobile Home Park	0.06	5
X	Bennie's Mobile Home Park	0.06	5
	Roanoke Housing Authority	0.02	5
X	Virginia Rest Stop (I-95)	0.02	5
X	Central High School and E.S.	0.017	5
X	Vulcan Materials	0.06	3
X	Holiday Inn South	0.04	3
X	South Plains Subdivision	0.04	3
X	Edgehill Subdivision	0.04	3
X	Richard Bland College	0.04	3
X	Vulcan Materials	0.02	3
	N. C. Department of Corrections #4130	0.013	3
	Riverview Elementary School	0.012	3
X	Southampton High School	0.011	3
	Perry-Wynn Fish Company	0.01	3
	Eastside Elementary School	0.01	3
	CF Industries (domestic)	0.01	3
X	Southampton High School	0.01	3
X	Colonial Motel & Jarrett Motel	0.008	3
X	Field Correctional Unit #3	0.008	3
X	Dinwiddie County High School	0.022	2
X	South Elementary School	0.02	2
X	I-85 Rest Stop	0.02	2
X	Walton Elementary School	0.01	2
X	Prince George Jr. High School	0.008	2
	Chowan County High School	0.008	2
	West Colerain	0.008	2
X	Weldon Mills	0.007	2
X	Belco Motel & Restaurant	0.007	2
	Central Jr. High School	0.006	2
X	Belfield Elementary School	0.006	2
X	Georgian Rathskeller	0.006	2
X	Brookside Trailer Park	0.006	2
X	Hunterdale Elementary School	0.005	2
X	Red Oak Elementary School	0.005	2
X	Hicksford Elementary School	0.005	2
X	Stuckey's	0.005	2
X	Hill's Trailer Park	0.005	2
X	Johns-Manville Corporation	0.11	1
X	Wilmurts Motel	0.015	1
X	Holiday Inn Trav-L-Campgrounds	0.015	1
X	Mannings Mobile Home Park	0.015	1
X	Whispering Pines Trailer Court	0.013	1
X	Brunswick Jr. High School & Totaro E.S.	0.01	1
X	Petersburg Jail Farm	0.01	1
X	Nottoway Motel and Restaurant	0.01	1
X	Dinwiddie County Jr. High School	0.01	1

Discharger	Flow (MGD)	N Discharge (lbs./day)
X Convict Camp #20	0.01	1
X Harrison Elementary School	0.009	1
X Town of Chase City (#2)	0.008	1
X Brunswick Academy	0.008	1
X Emporia Truck Stop	0.007	1
X Emporia Motel & Restaurant	0.007	1
Buckland Elementary School	0.005	1
Sunbury Primary School	0.005	1
Gatesville Elementary School	0.005	1
.I-95 Rest Stop	0.005	1
C. G. White Elementary School	0.005	1
Aulander Elementary School	0.005	1
X L. P. Jackson Combined School	0.005	1
X Boykins Elementary School	0.004	1
X Meherrin-Powellton Elementary School	0.004	1
X Sturgeon Elementary School	0.004	1
X Reste Motel	0.004	1
X Courtland Elementary School	0.004	1
T. S. Cooper Elementary School	0.0035	1
John P. Lae Elementary School	0.003	1
White Oak School	0.003	1
X Berlin-Ivor Elementary School	0.003	1
X Zion Elementary School	0.003	1
X Burkeville Intermediate School	0.003	1
X Capron Elementary School	0.003	1
X Davis Restaurant	0.003	1
X Prince George Texaco	0.003	1
X Clairmont Motel	0.002	1
X Edmunds Trailer Court	0.002	1
X Wilson Trailer Court	0.002	1
X Humble Oil Company #712	0.002	1
X Sussex Courthouse	0.002	1
X LaSalle Motel	0.002	1
Edenton Cotton Mills	0.001	1
X Spurlock Corporation	0.16	<1
X Eastside Elementary School	0.003	<1
X Ellwynn Motel	0.002	<1
X Busby Sunoco	0.001	<1
X Gizzards Sunoco	0.001	<1
X Deering Exxon	0.001	<1
M. J. Tynch	Intermittent	<1
X Trego Stone Corporation	2.0	stone wash water
X Hercules, Inc.	2.0	cooling water
X Union Camp Bleached Paper	0.72	cooling water
X Southern Johns-Manville Products	0.511	cooling water
Carolina Aluminim Company	0.4	cooling Water
Georgia-Pacific, Inc.	0.15	cooling water

Discharger	Flow (MGD)	N Discharge (lbs./day)
X Boykins Narrow Fabrics	0.1	no data
X Masonite Corporation	0.1	cooling water
West Point Pepperell	0.03	cooling water
X St. Regis Paper Company	0.019	cooling water
X Victoria Industrial Dev. Authority	0.018	no data
X Masonite Corporation	0.012	cooling water
X Union Camp Building Products Div.	0.0115	cooling water
Edenton Water	0.008	no data
Chowan County Water	0.006	no data
X Master Tank and Welding Company	0.002	no data
X R. M. Felts Packing Company	0.001	no data
X Lawrenceville WTP	no data	
X Emporia WTP	no data	
X Kenbridge WTP	no data	
X South Hill WTP	no data	
X Victoria WTP	no data	
X Crews WTP	no data	
X Fort Pickett WTP	no data	
X Burkeville Veneer	no data	
X Dinwiddie Laundramat	no data	
X Jenny System Mayfield Carwash	no data	

* Discharges for a 4-month period (December - March)

APPENDIX J

DESCRIPTION OF SLIDE/TAPE SHOW

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