# FEASIBILITY STUDY UPDATE

FOR

# WATER FACILITIES

AS TO

## REQUIREMENTS, COST ESTIMATES, FINANCING AND RECOMMENDATIONS

FOR

# COUNTY OF CURRITUCK

## NORTH CAROLINA

BOARD OF COMMISSIONERS

BAXTER WILLIAMS, CHAIRMAN

HAROLD CAPPS STANLEY GRIGGS

R. H. FERRELL NEWTON HAMPTON

WEBB FULLER, COUNTY MANAGER

North Carolina. Coastal Zone Management Program

MOORE, GARDNER & ASSOCIATES, INC.
CONSULTING ENGINEERS

ASHEBORO, N. C. 27203

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

MOORE, GARDNER & ASSOCIATES, INC.
CONSULTING ENGINEERS

110 WEST WALKER AVENUE
P. O. BOX 728
ASHEBORO, N. C. 27203
TELEPHONE (919) 625-6111

March 15, 1982

Currituck County Courthouse
Currituck, NC 27929

Attention: Webb Fuller, County Manager

Dear Mr. Fuller:

RE: Feasibility Study Update on
Water Facilities
MGA Project No. 207432

We are pleased to furnish the County of Currituck herewith twenty (20) copies of the Water Facilities Report. The report details projects which may be constructed when project financing has been approved by County officials, approved by the voters in a bond referendum and grants received from state and federal sources.

We trust the information provided in this report will be helpful to County officials as they decide the best course of action for the County of Currituck.

Thank you for this opportunity to be of service to the County. Should questions arise, or if we can be of assistance in the development of this project, please advise.

Yours very truly,

MOORE, GARDNER & ASSOCIATES, INC.

Roy L. Spainhour

Roy L. Spainhour
Director of Feasibility Planning

RLS/jcw

Enclosures

TD224.N8 C64 1982

THIS REPORT IS RESPECTFULLY SUBMITTED TO COUNTY OF CURRITUCK THIS 17th DAY OF March, 1982.

MOORE, GARDNER & ASSOCIATES, INC.

BY Roy L Dawkins
Director of Feasibility Planning
and Project Development

I CERTIFY THAT THE ENGINEERING ASPECTS OF THIS REPORT WERE PREPARED UNDER MY DIRECT SUPERVISION.

SIGNED, SEALED AND DATED THIS 17th DAY OF MARCH, 1982.

BY Joseph E. Hardee
Joseph E. Hardee. P.E.
President

(SEAL)

MGA PROJECT NO. 207432

Table of Contents


| | Page |
|---|---|
| Letter | |
| Certification | ii |
| Table of Contents | iii |
| I. Background, Population Projections & Design Basis For Water Plan | I-1 |
| A. Purpose and Scope | I-1 |
| B. History and Background Data | I-1 |
| C. Population and Economy | I-3 |
| D. Population Projections | I-7 |
| 1. County and Proposed Service Areas | I-7 |
| 2. Outer Banks | I-9 |
| E. Water Demands and Requirements | I-10 |
| 1. Proposed Service Areas | I-10 |
| 2. Outer Banks | I-11 |
| II. Water Resources | II-1 |
| A. Water Supply Mainland | II-1 |
| B. Water Supply Outer Banks | II-4 |
| 1. Sources of Water Supply | II-5 |
| 2. General Recommendations | II-9 |
| III. Proposed Facilities | III-1 |
| A. Project Description | III-1 |
| 1. Phase I, Part 1 | III-1 |
| a. Raw Water System | III-1 |
| b. Water Treatment Plant | III-3 |
| c. Distribution System | III-3 |
| 2. Phase I, Part 2 | III-5 |
| 3. Knotts Island Project | III-6 |
| 4. Phases II and III | III-7 |
| B. Hydraulic Analysis | III-9 |
| C. Cost Estimates | III-10 |
| 1. General | III-10 |
| 2. Estimated Project Costs | III-10 |

Table of Contents (Cont'd)


| | | Page |
|---|---|---|
| | a. Raw Water Supply and Water Treatment Plant | III-11 |
| | b. Phase I, Part 1 Distribution System | III-14 |
| | c. Phase I, Part 2 Distribution System | III-16 |
| | d. Subdivision Systems | III-18 |
| | e. Knotts Island | III-18 |
| | f. Project Costs Summary | III-20 |
| 3. | Operation and Maintenance | III-21 |
| D. | Financing | III-22 |
| 1. | General | III-22 |
| 2. | Projected Annual Costs | III-24 |
| 3. | Revenues and Budget | III-24 |
| IV. | Summary and Recommendations | IV-1 |

# SECTION I

# BACKGROUND, POPULATION PROJECTIONS & DESIGN BASIS FOR WATER PLAN

## A. Purpose and Scope

The purpose of this report is to update the Currituck County Water Facilities Plan that was proposed in the 1973 Feasibility Study on Water Facilities prepared by Moore, Gardner & Associates. This update was considered necessary based on the fact that the County population has increased substantially over the past 10 years and a renewed interest in constructing a county-wide water system has developed in the County.

This report outlines the facilities necessary to provide water to the areas for a twenty (20) year period, phasing the construction of the facilities based on population density.

This report provides the officials of Currituck County with a water facilities plan designed to meet the initial and long range water demands for the citizens of the County through the year 2000. The report provides population data and population projections, water demand projections, the facilities proposed to meet those demands, cost estimates, and a financing plan.

## B. History and Background Data

Currituck County is the most northeasterly county in North Carolina. It is bounded on the east by the Atlantic Ocean, on the north by Virginia, on the south by Dare County and Albemarle Sound, and on the west by Camden County and North River. The county is divided into three (3) major land areas. The largest is the mainland portion which is the peninsula between North River and Currituck Sound; Knotts Island is a peninsula that extends into Currituck Sound from Virginia; and the Outer Banks is the third portion.

The topography of the county is characterized by northwest to north trending barrier sand ridges that are separated by low, flat swampy interridge areas that range from less than 5 to about 25 feet above mean sea level. The crests of the sand ridges generally have a maximum altitude of 15 to 25 feet above mean sea level. Prominent sand ridges are the Camden Ridge in the western part of the county, the Pungo-Powells Point Ridge, and Aydlett "Narrow Shore" Ridge, and the Knotts Island Ridge along the west margin of Currituck Sound. The county is drained by several small creeks and canals that flow into the Northwest and North Rivers and Albemarle and Currituck Sounds. Most of the northern and western parts of the county are swampland. Dismal Swamp and Great Swamp occupy most of the area between the Camden and Pungo-Powells Point Sand Ridges; Maple Swamp occupies the southern part of the area between the Powells Point Sand Ridge and the Aydlett "Narrow Shore" Ridge.

The county includes most of Currituck Sound and its islands and the modern Currituck Beach barrier-ridge spit on the Atlantic Ocean. Savanna is common in parts of Currituck Sound; in the northern part of the sound they connect Knotts Island, Bells Island, and Church Island with the Mainland. Relief along the western margin of Currituck Sound is greatest between Aydlett and the north end of Church Island where there are cliffs 15 to 25 feet high. Relief on the Outer Banks can range up to 75 feet at the major dunes.

The Outer Banks area of Currituck County is a narrow strip of land bounded on the east by the Atlantic Ocean and on the west by Currituck Sound. The Outer Banks are composed primarily of sands that are

constantly in motion except when stabilized with vegetation. The topography is generally of beach area, dunes, plain and marsh. Vegetation is of primary importance, as it is the only effective stabilizing force on the shifting dunes. The foredune area is very sensitive to development. The normal type development is detrimental to the delicate balance of nature existing on the Outer Banks.

The existing wastewater collection and treatment facilities serving Universal Trailer Park and Ocean Sands are the only wastewater system in Currituck County. The wastewater treatment plant effluent is disposed of by spray irrigation.

There are four existing water systems providing potable water to the following trailer parks and subdivisions: Universal Trailer Park, Wedgewood Lakes, Tulls Bay Colony and Walnut Island. Of these, only Tulls Bay Colony provides any treatment beyond chlorination.

C. Population & Economy

In 1900, the population of Currituck County was approximately 6,500 persons, increasing to 7,700 by 1910. The county experienced a decline between 1910 and 1950 to a population 6,200 persons. By the 1970 Census, the population had increased to approximately 6,976 persons.

The 1980 Census reveals the population increased at a significant rate during the ten years, with a 1980 population of 11,089 persons. The mainland portion of the county received the major increase, apparently being affected by growth of the Norfolk, Virginia area.

Historically, Currituck County has been a rural area with its economy tied directly to agriculture. In the past few years, the trend has begun to change. With the proximity to Elizabeth City and Norfolk, Currituck is becoming a bedroom area for individuals employed in these areas.

The mechanization of agriculture has reduced the number of full-time farm employees. These individuals have joined the civilian labor force that commutes to the more industrial areas in Norfolk and Elizabeth City. Presently there are several small industries located in Currituck County, resulting in gradual increase in the number of persons employed in industry within the county. There has been an increase in the number of individuals who are employed in recreation-related industry, as hunting and fishing guides, and in marine and campground-related services.

Future economic growth will most likely occur in the housing and related services area. Recreational, seasonal second homes, and retirement homes will occur mainly on the Outer Banks, the southern portion of the Mainland and Knotts Island. Additional housing for those individuals who commute to Elizabeth City and Norfolk for employment will most likely occur in the north portion of the county.

Industrial development will most likely occur in the northwest portion of the county in the Moyock and Shawboro Area, where access is available from both the Norfolk and Southern Railway and State Route NC 168.

The intracoastal waterway passes through the county, entering from Virginia by North Landing River, following Currituck Sound to Coinjock, and crossing the county in an east-west direction by canal to North River and Albemarle Sound. The waterway provides an opportunity for economic development by providing full-service marinas.

Development in the second home industry is closely tied to the Norfolk urban area. The vacation and second home market is primarily a function of driving time if the criteria of scenery and recreational opportunities are met. Therefore, the provisions of access other than the Dare Beach access would tend to accelerate the growth rate of Currituck Outer Banks.

Population densities have increased in many areas to the extent that pollution of the groundwater aquifer is a distinct possibility due to the use of septic tanks for treatment of domestic waste.

With groundwater aquifers being used for domestic supply through individual wells, it is necessary that positive steps be taken to guarantee these areas a source of potable water. The provision of a county-wide water distribution system would provide such protection. With the provision of a county-wide water distribution system, the necessity of a county-wide wastewater collection and treatment system will be decreased, but by no means eliminated.

Currituck County has left its rural past behind and is entering the future as a metropolitan county. Growth of Currituck, during the twenty-year period from 1950 to 1970, averaged less than one percent per year. The period from 1970 to 1980, average approximately 4.7% per year. This trend is expected to continue in the future. The increase in dwelling units is also a sign of the change to a more urban trend. The 1970 Census recorded 2,735 dwelling units compared to 5,405 in 1980. This is an increase of 97.6% during the ten year period.

For the purpose of this study, population estimates are based on census data, past growth trends and house counts. House counts are based on inspection of County maps and building inspection files. These estimates are used primarily as the basis for determining feasibility of a water facilities project.

As previously mentioned, the population within Currituck County has increased substantially over the past decade. The county had an increase of 4,113 persons between 1970 and 1980 according to the 1980 Census. The largest growth took place in the Moyock Township which had an 107.2 percent (%) population increase. Growth is expected to continue at a moderate rate over the next twenty years. The primary influence causing the increase, as previously stated, is the migration from the Virginia area. One fact that could curtail the growth patterns would be land use, such as soil suitability that would limit development. The following table illustrates the growth rate in each of the townships over the past two decades.

Population Growth

| Township | 1960 | % Growth | 1970 | % Growth | 1980 |
|---|---|---|---|---|---|
| Crawford | 2,332 | 6.6 | 2,487 | 59.8 | 3,974 |
| Fruitville | 440 | 15.5 | 508 | 78.3 | 906 |
| Moyock | 1,207 | 23.8 | 1,494 | 107.2 | 3,095 |
| Poplar Branch | 2,622 | - 5.1 | 2,487 | 25.2 | 3,114 |
| Total County | 6,601 | 5.7 | 6,976 | 59 | 11,089 |

D. Population Projection

1. County and Proposed Service Area

The projections of population are of primary importance in attempting to design facilities in a reasonably acceptable manner for long range needs. It is necessary to plan these facilities so that regardless of what final timetable is required, the facilities installed will integrate into an overall, long range plan that meets the county's needs as they may arise.

Population projections have been made recognizing that they will not occur precisely at the time nor the place indicated. These projections are based on the 1980 Census, population projections from the NC Division of Environmental Management and on the best judgment of the Engineers. Unanticipated major industrial expansion or other unusual conditions could drastically affect the projections; however, construction of the proposed facilities are considered essential for meeting the projected demands.

The projections of population have been made for the years 1990 and 2000. The projections are based on past trends as recorded in the U.S. Census Data, and projected by means of a proportion method based on township.

Periodic updating at intervals no greater than five years will be necessary in order to keep the projections in line with actual occurrences. Listed below are the population projections.

POPULATION

| | US Census | | Projected | |
|---|---|---|---|---|
| Township | 1970 | 1980 | 1990 | 2000 |
| Crawford | 2,487 | 3,974 | 6,010 | 8,754 |
| Fruitville | 508 | 906 | 1,513 | 2,436 |
| Moyock | 1,494 | 3,095 | 5,934 | 10,960 |
| Poplar Branch | 2,487 | 3,114 | 3,509 | 3,808 |
| Total County | 6,976 | 11,089 | 16,966 | 25,958 |

It is essential to know within reasonable limitations what the service area population will be in order to design a facility to meet the demands of a growing area. The potential customers in the proposed water service areas for Phase I construction have been calculated from house counts along the service lines. The house counts are based on County mapping and upon the County's building inspection files. Phase I construction, as shall be detailed in a later section, includes construction on the mainland only. Using the 1980 US Census data of 2.05 persons per household, the following table lists the estimated service area population.

Service Area Population Projection (Mainland)

3,661 Existing residences x 2.05 persons per household = 7,505

| 1982 | 1990 | 2000 |
|---|---|---|
| 7,505 | 11,482 | 17,568 |

In addition to the 3,661 residences in the service area, there are 5 schools, 194 commercial establishments and 1 prison unit.

2. Outer Banks

There are appoximately 7,700 acres of developable land on the Outer Banks of Currituck County. By using the existing density of recorded subdivision and the PUD concept of development on all large undivided tracts, it is possible to project the ultimate development of Currituck Outer Banks. Assuming there are no major concept changes in land use planning, the ultimate density would be 36,500 dwelling units. At the present occupancy rate, this would be a population of 127,700.

The Outer Banks South has an area of approximately 3,100 acres with a potential development of 17,200 dwelling units and a population of 60,200. The resulting densities would be 5.6 dwelling units per acre and 19.5 persons per acre.

The Outer Banks North has an area of 4,600 acres with a potential of 19,300 dwelling units and a population of 67,500. The resulting densities would be 4.2 dwelling units per acre and 14.5 persons per acre. The lower ultimate densities on the northern portion of the Outer Banks

results from a higher percentage of subdivisions previously recorded at the 20,000 square foot minimum lot size.

## E. Water Demand and Requirements

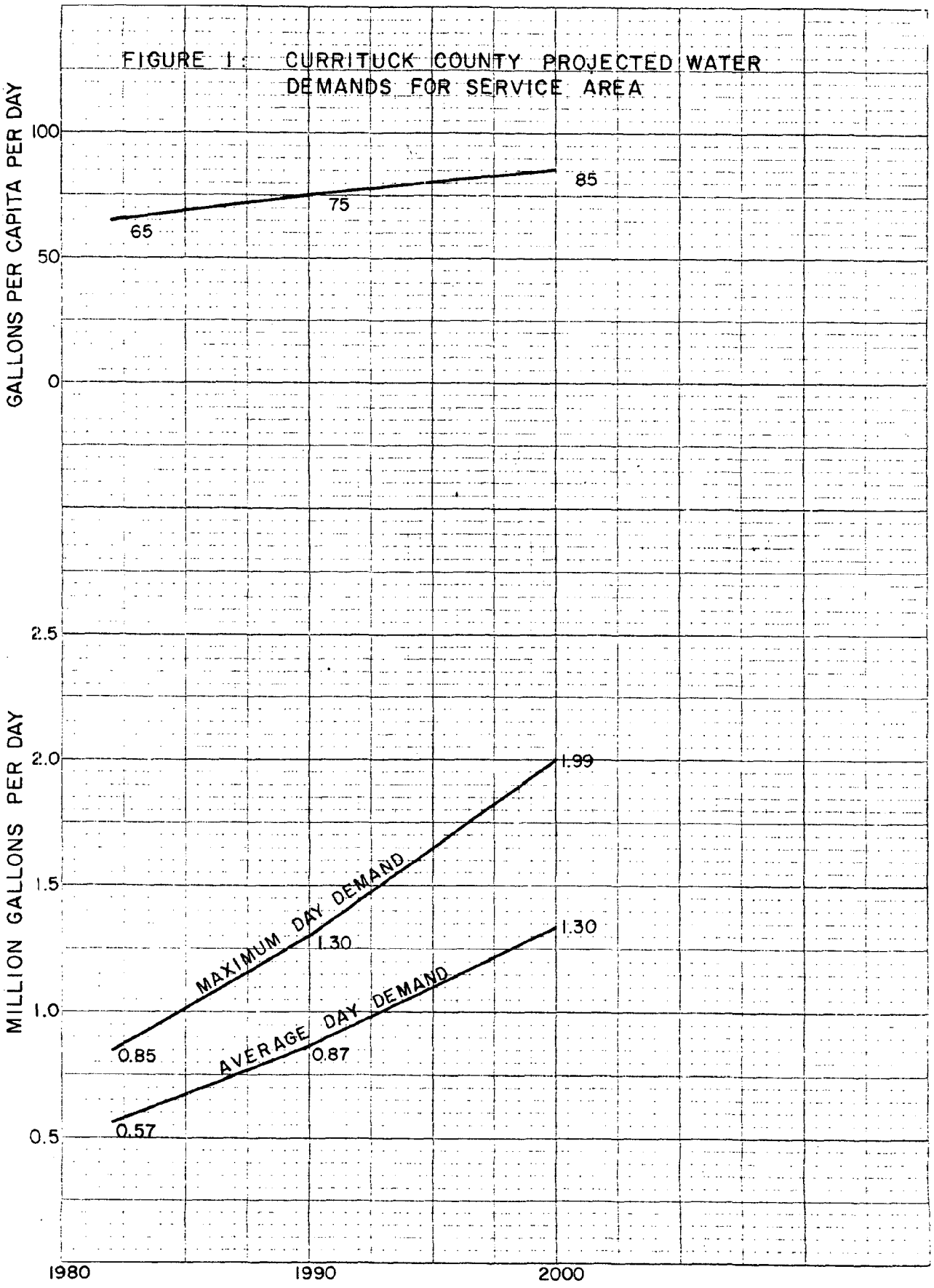
### 1. Proposed Service Area

The projection of water requirements is an essential element in the design of a water system. Once demand has been projected the adequacy of the raw water source must be determined. If the raw water source is adequate, water facilities must be designed such that the projected demand can be delivered to the customer.

The water requirements for the service area are based on the projected population and estimated per capita water consumption. The projected per capita water consumption in this report is based on water production records from area similar to Currituck County.

It is estimated that the initial per capita water consumption on the average day will be approximately 65 gallons per capita per day. Based on the US Census of 2.05 persons per household, the average residential unit is expected to use approximately 133 gallons per day or approximately 4,000 gallons per month. The following table lists the estimated water demands for the service area and Figure 1 illustrates the projected demands through the year 2000.

FIGURE 1: CURRITUCK COUNTY PROJECTED WATER DEMANDS FOR SERVICE AREA



Projected Water Demands for Existing Service Area

| Existing Units | Demands Per Day | Total Demands Per Day |
|---|---|---|
| Residential (3,661) | 133.00 | 486,913 |
| Commercial (194) | 150.00 | 29,100 |
| 5 Schools (1,836 students) | 25 per student | 45,900 |
| 1 Prison Unit (186 Inmates) | 60 Per Inmate | 11,160 |
| TOTAL | | 573,073 |
| Maximum Day Demands (1.5 x 573,073) | | 859,610 |

2. Outer Banks

The anticipated usage rate for the Outer Banks of 75 GPCD (Gallons Per Capita Per Day) initially and increasing to 100 GPCD by 2000 is based on the assumption that Currituck Outer Banks will continue to remain residential in nature. discouraging high water usage, and prohibit any water using industry. The probability of estimating the exact demand, or the precise time at which future demands will occur is slight, however, this does not create any real problem since the projected demand will occur slightly before or after the estimated time. If the projected demand occurs before the estimated time, this simply means additional revenue with which to finance the necessary additions and extensions to the system. If the projected demand occurs after the estimate time, the expected life of the facility is greater than anticipated and would still be in use when the projected demand occurs.

As previously discussed, the primary objectives in projecting water requirements are: (1) determine if adequate raw water supplies are available to meet the projected demands and (2) design adequate water

facilities for delivery to the customer the projected water requirements. The average day demand is determined by multiplying the per capita consumption rate by the estimated population. The maximum day demand is determined as a percentage of the average day and may in some small communities reach as high as 200 percent. The maximum day demand is useful in determining the total required production rate.

SOUTH CURRITUCK OUTER BANKS

| YEAR | ESTIMATED PEAK DAILY POPULATION | AVERAGE DAY | MAXIMUM DAY |
|---|---|---|---|
| 1980 | 700 | 52,500 | 94,500 |
| 1985 | 4,550 | 341,250 | 614,250 |
| 1990 | 7,700 | 616,000 | 1,108,800 |
| 1995 | 9,450 | 850,500 | 1,530,900 |
| 2000 | 12,950 | 1,295,000 | 2,331,000 |

| Basis: | Average Day | Maximum Day |
|---|---|---|
| | 1980 - 75 GPCD | 180% of Average Day |
| | 1985 - 75 GPCD | |
| | 1990 - 80 GPCD | |
| | 1995 - 90 GPCD | |
| | 2000 - 100 GPCD | |

## NORTH CURRITUCK OUTER BANKS

| YEAR | ESTIMATED PEAK DAILY POPULATION | AVERAGE DAY | MAXIMUM DAY |
|---|---|---|---|
| 1980 | 405 | 30,375 | 54,675 |
| 1985 | 1,750 | 131,250 | 236,250 |
| 1990 | 3,500 | 280,000 | 504,000 |
| 1995 | 5,100 | 459,000 | 826,200 |
| 2000 | 7,700 | 770,000 | 1,386,000 |

| Basis: | Average Day | Maximum Day |
|---|---|---|
| | 1980 - 75 GPCD | 180% of Average Day |
| | 1985 - 75 GPCD | |
| | 1990 - 80 GPCD | |
| | 1995 - 90 GPCD | |
| | 2000 - 100 GPCD | |

It is anticipated that by 1995, population densities will have increased to the point that it will be desirable to connect the Outer Banks Water System with the Mainland Water System by means of a submerged water main.

Until such time as the Outer Banks System is connected to the Mainland Water Supply, it will be necessary for new developments to set aside the necessary areas for well fields capable of supplying the recorded density.

One day supply of water should be provided in storage with at least one-half of the required storage being in the form of elevated storage

and the remaining in ground storage tanks. The elevated storage tanks should have an overflow elevation of 158.6 which will provide a maximum pressure of 60 psi at ground elevation of 20 feet, the average elevation for both the Mainland and Outer Banks.

Major distribution lines should be sized to provide the peak demand with a residual pressure of 30 psi.

# SECTION II

# WATER RESOURCES

A. Water Supply Mainland

The groundwater resources of Currituck County have been described in previous reports from Moore, Gardner & Associates. This section describes the selection of well field sites and the methods of construction and development of groundwater as a source for a county public water supply.

A review of previous reports indicates that there are three potential aquifers in the area. The surficial aquifer (water-table aquifer), the Upper Miocene (Upper Yorktown) aquifer and the Upper Miocene (Lower Yorktown) aquifers are considered as potential sources of groundwater. The water-table aquifer, of Post Miocene Age, includes fine to coarse grained sand interbedded with clay lenses and beds. A review of data from wells tapping the water-table acquifer shows that these wells yield from 2 to 10 gallons per minute with specific capacities of less than .05 gallons per foot of drawdown. The wells tapping this aquifer are less than 100 feet deep and generally supply adequate quantities of water for single-home domestic use. The water from this aquifer usually contains objectionable amounts of dissolved iron and is locally hard to very hard. Because this aquifer has low permeability and low well yields, the water-table aquifer is not considered the best aquifer for the development of public supply wells.

The aquifers below the upper miocene formations are considered to be too salty for use as a water supply. In adjacent areas the Beaufort formation, and older formations, are known to contain chlorides in excess of 250 mg/l and it is assumed that these formations are also too salty for use in Currituck County.

The aquifers of Upper Micocene Age (The Yorktown Formation) are considered to be the best potential source of water supply for the county system. The Yorktown formation is divided into two aquifers designated as the Upper Yorktown and Lower Yorktown aquifers. In the county, the Yorktown is composed of sandy shell beds underlain by marl and shell with interbedded sandy clay. The top of the Yorktown is about 50 feet below mean sea level in the northwest part of the county and about 150 feet below sea level in the southeast part.
(See Figure 2) The formation ranges in thickness from about 300 feet in the northwest to about 450 feet in the southcentral part of the county (see Figure 3).

Water from the Yorktown will require treatment for iron and hardness removal. The Upper Yorktown does not contain excessive chlorides in most of the county. Figure 4 shows the ranges of chlorides in the Upper Yorktown. The closure of high chlorides in the vicinity of Moyock is a result of upward saltwater intrusion because of pumpage near Moyock. The low chloride zone trending northeast-southwest through the central part of the county probably indicates that a more permeable part of the aquifer has been flushed of saltwater by recharge from the Dismal Swamp area. The low chloride zone in the southeastern part is from local recharge. The water-table is about 5 feet higher than the Yorktown potentiometric surface. This is apparently a sufficient head difference to force fresher water from the water-table through the confining clay beds and into the Yorktown aquifers. If this small amount of head difference can force freshwater downward then a reversal of head by

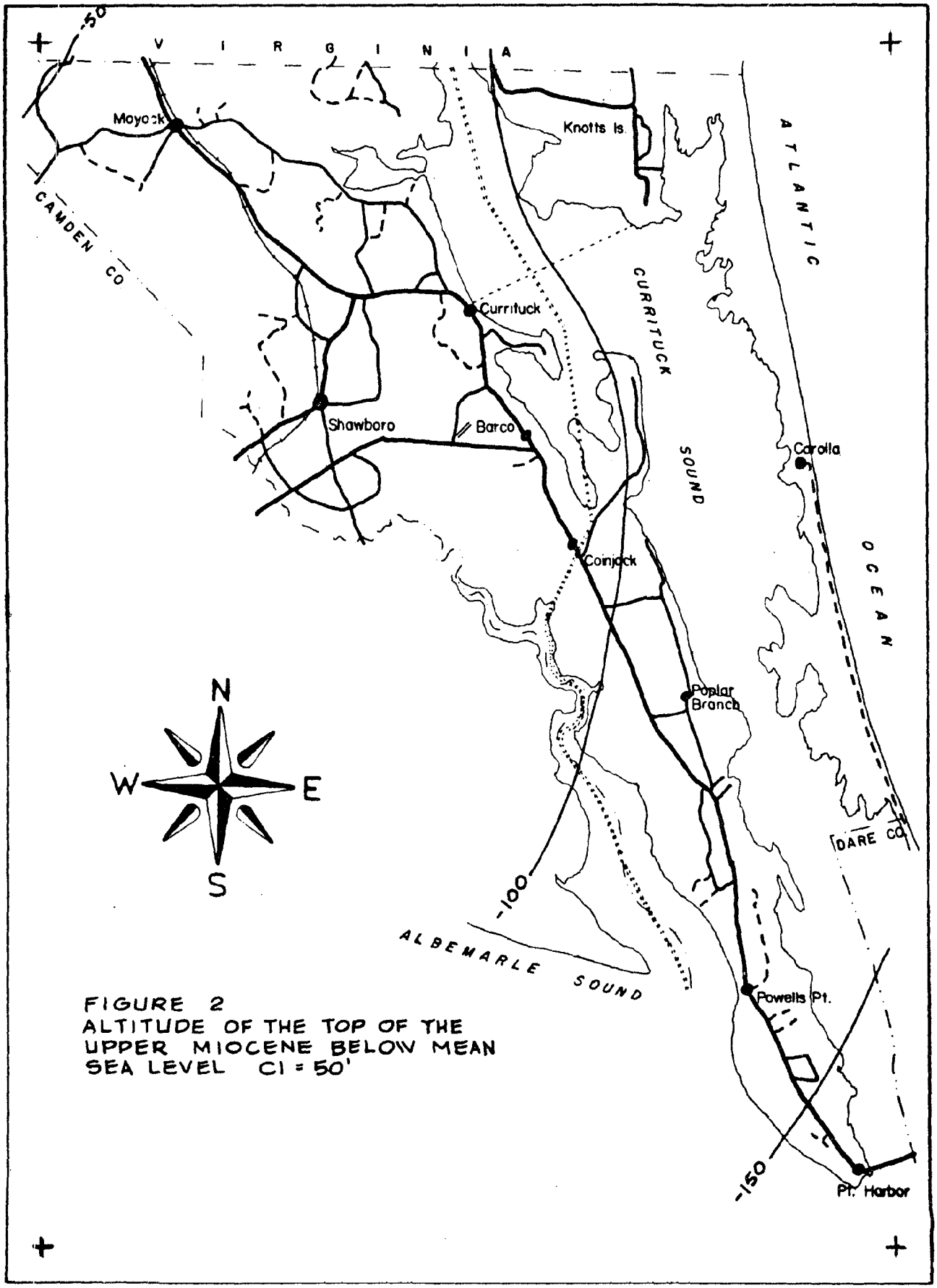



FIGURE 2
ALTITUDE OF THE TOP OF THE
UPPER MIOCENE BELOW MEAN
SEA LEVEL CI = 50'

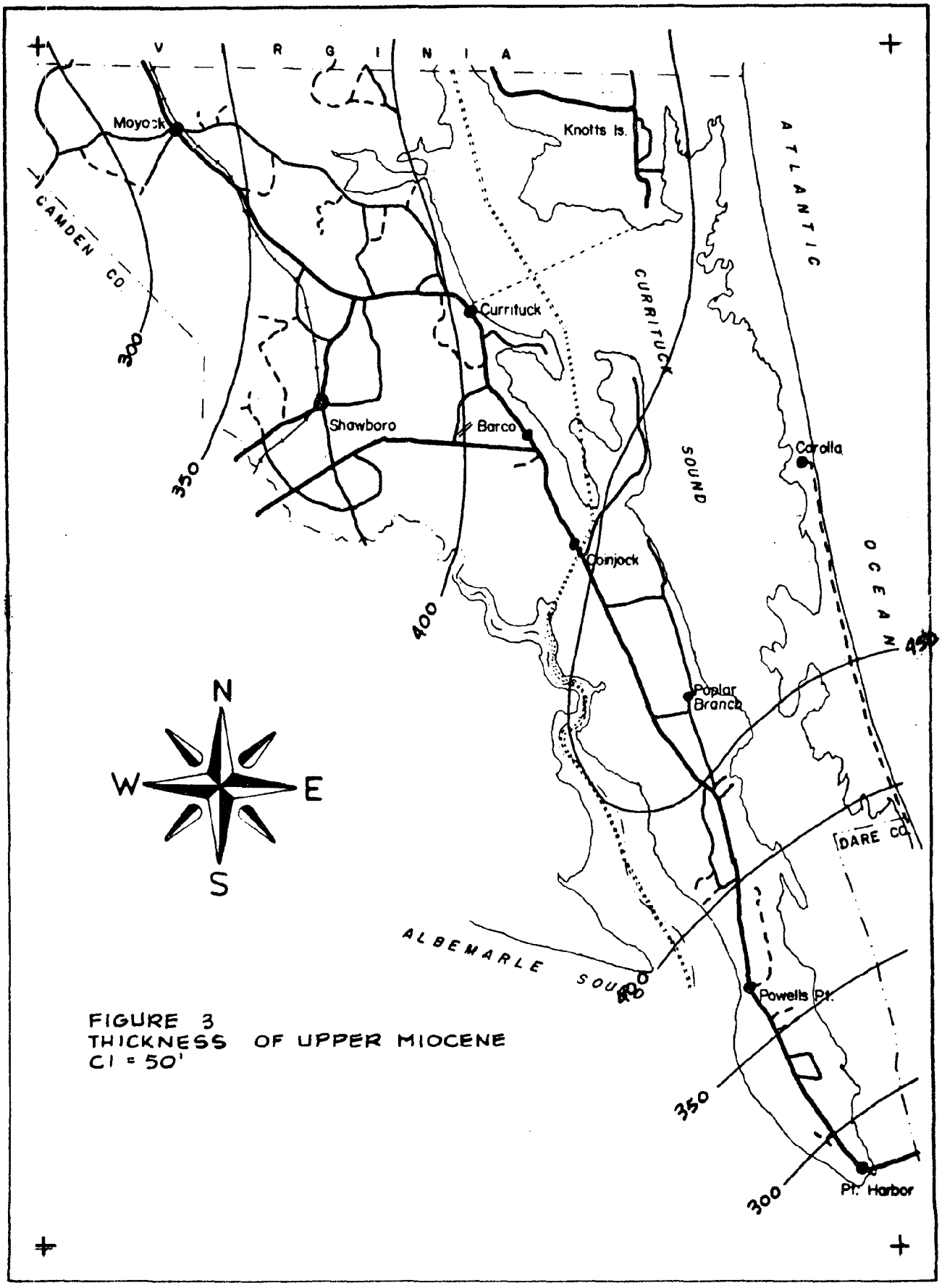



FIGURE 3
THICKNESS OF UPPER MIOCENE
CI = 50'

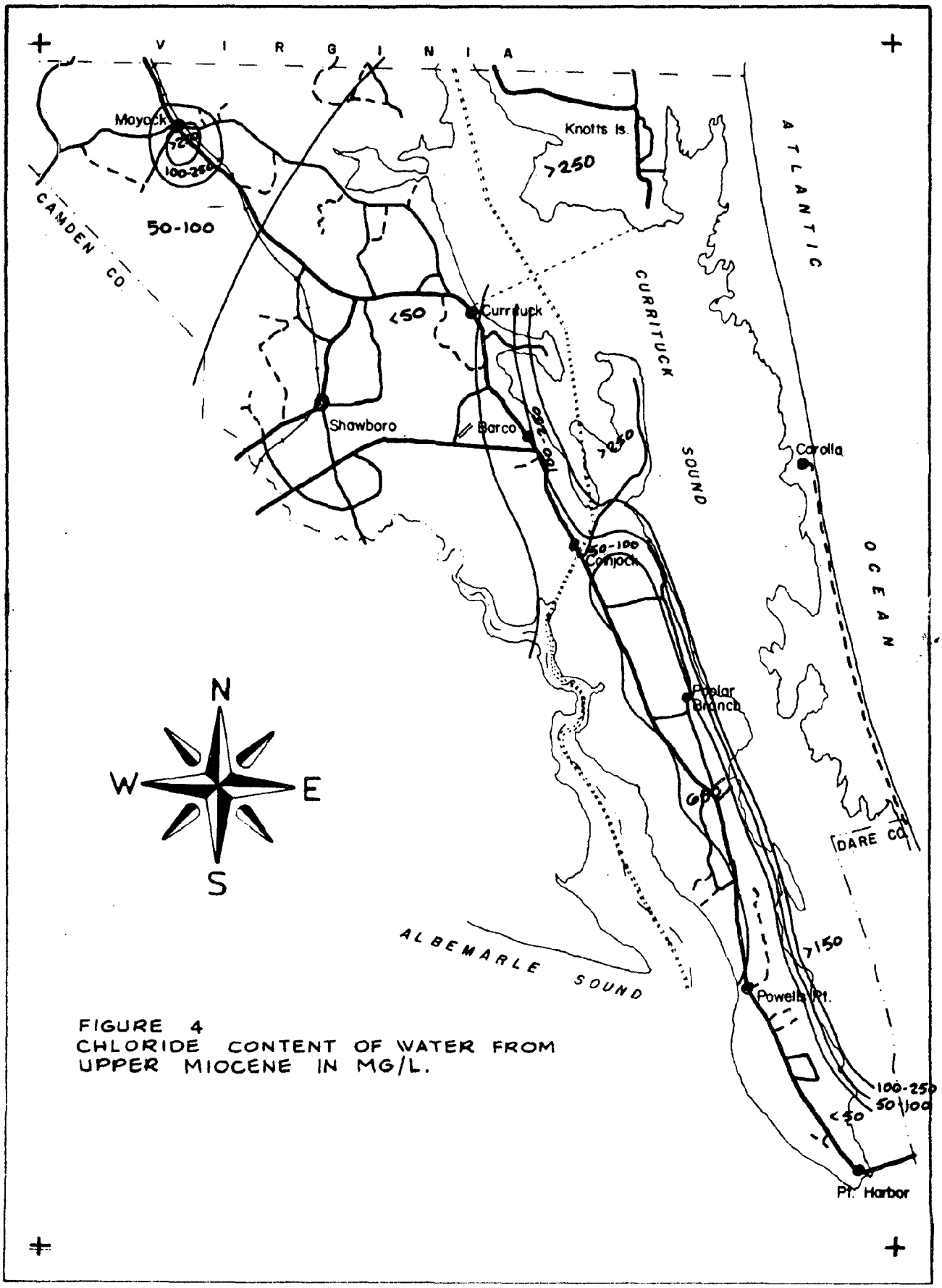



FIGURE 4
CHLORIDE CONTENT OF WATER FROM UPPER MIOCENE IN MG/L.

pumping can force saltwater upward and contaminate the pumping wells. The most desirable area to develop wells, from the standpoint of saltwater encroachment, would be in the west-central part of the county.

Water in the Yorktown formation is under artesian conditions. That is, the water will rise above the top of the aquifer that contains it. A Potentiometric surface is the height to which water will rise in an aquifer. Figure 5 is a map of the potentiometric surface of the Yorktown aquifer in the county. The high contours in the northwest are near the recharge area associated with Great Dismal Swamp. Another high closure occurs in the southeast where local recharge, previously discussed, takes place. The low closure near Moyock results from pumpage which has lowered the water levels. The potentiometric surface through the central part of the county is between 5 and 10 feet above mean sea level.

A section was prepared from the previous illustrations to show conditions along a line from Moyock to Poplar Branch through the central part of the county. As may be seen in Figure 6, wells in the central part of the county, 100-300 feet deep would top the Yorktown aquifers where the chloride content of water is less than 50 mg/l and where the specific capacity of wells is the highest. Based upon the above, it is recommended that the well field be located in the area between U.S. Hwy. 158 and NC Hwy. 168 in the western half of the county.

The well field should be constructed in a line, along one or both highways mentioned above, rather than in a grid system. This will help minimize

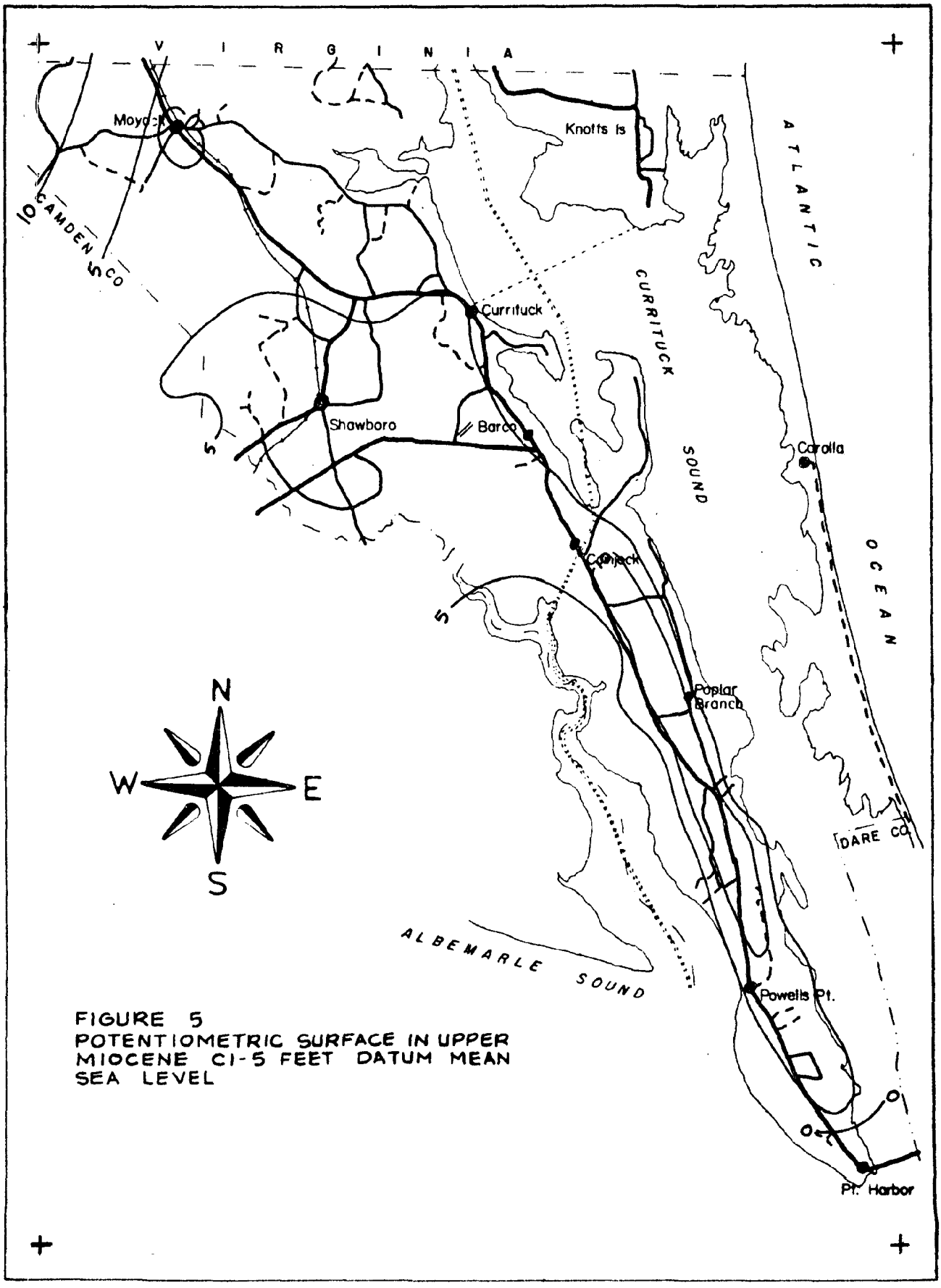



FIGURE 5
POTENTIOMETRIC SURFACE IN UPPER MIOCENE CI-5 FEET DATUM MEAN SEA LEVEL

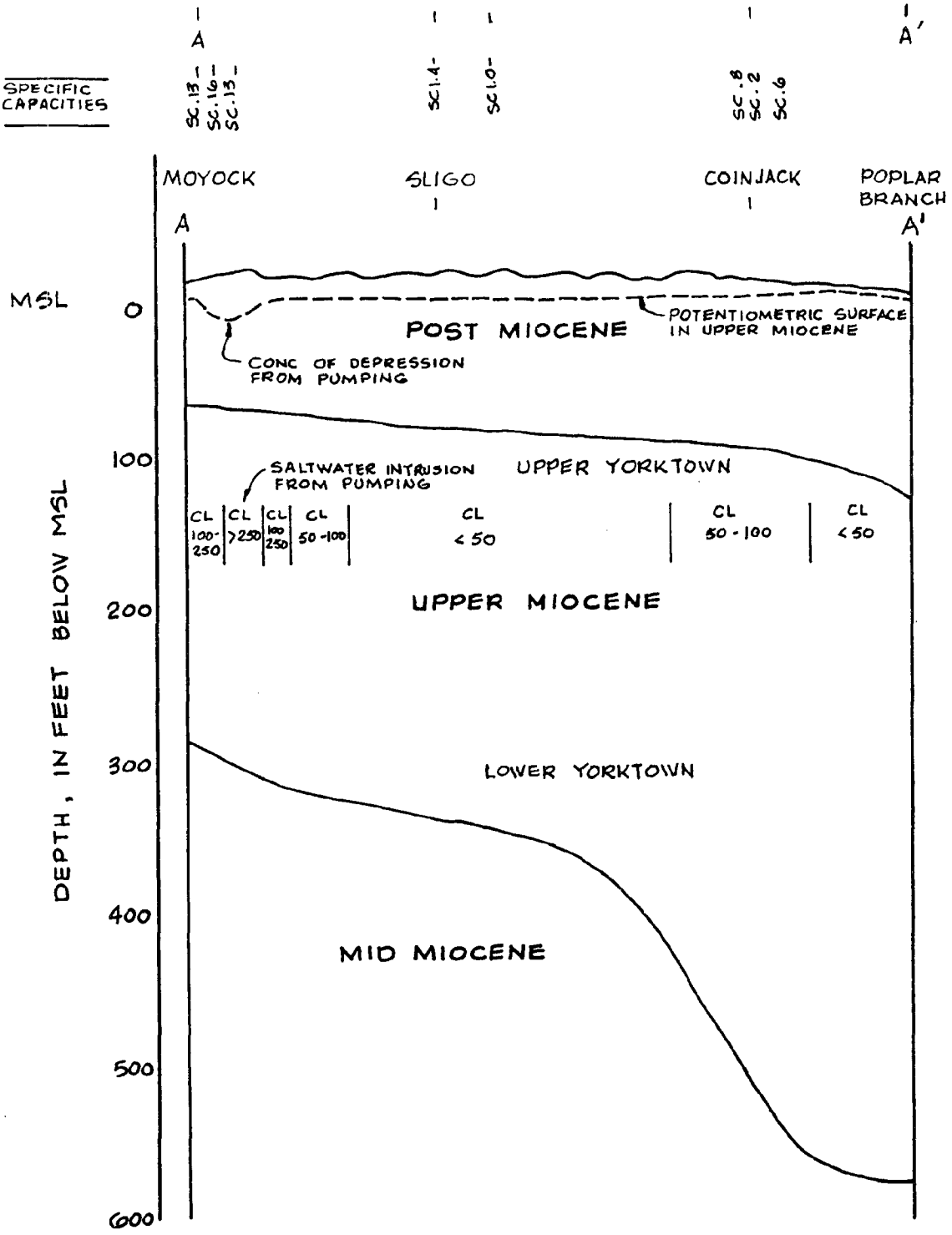



FIGURE 6

SECTION A-A' SHOWING DEPTH AND THICKNESS OF UPPER MIOCENE UNIT AND CHLORIDE CONTENT IN MG/L OF WATER AND SPECIFIC CAPACITIES OF WELLS

the draw down effects of one well upon another. The main objective in designing the well field should be to obtain the required amount of water without causing salt-water encroachment into the well field by creating excessive drawdown.

The well design should be based upon the construction of one or two test holes which can be completed as supply wells. The wells should be multiple-screen gravel-packed wells that tap both upper and lower Yorktown aquifers. After construction and testing of the test wells, the remainder of the wells and well field may be designed and constructed. It is anticipated that the field will require between 6 and 12 wells to meet current water needs.

B. Water Supply Outer Banks

The Outer Banks Area of Currituck County is a narrow strip of land bounded on the east by the Atlantic Ocean and on the west by Currituck Sound. The Outer Banks are composed primarily of sands that are constantly in motion except when stabilized with vegetation. The topography is generally of beach dunes, plain and marsh. Both the marsh and the primary dunes are areas that are extremely sensitive to development pressures. Vegetation is of primary importance as it is the only effective stabilizing force on the shifting dunes and the marsh. The normal grid type development is detrimental to the delicate balance of nature existing on the Outer Banks. In order to prevent irretrievable damage to the Outer Banks System it is necessary that certain precautions be followed in developments. Construction should not be allowed on the primary dunes and marshlands. Precautions should be made to prevent

pedestrian and vehicular traffic from destroying the vegetation in the primary dunes by providing access at predetermined locations. It is felt that this can be accomplished by utilizing planned unit development in place of the normal grid type of development. The planned unit development (PUD) will include open space for wells and sub-surface disposal fields, as well as keeping construction away from the ecologically sensitive area of primary dunes and marshland.

1. Sources of Water Supply

Groundwater is that water below the land surface within the zone where all pore spaces are filled with water. The top of this zone is called the "water table". An aquifer is a rock or sand layer, or group of layers, that are water-bearing and capable of transmitting usable quantities of water to wells or springs. Where groundwater does not completely fill a permeable formation, its surface (the water table) is free to rise and fall in response to recharge and discharge to and from the aquifer. Such groundwater, is said to occur under non-artesian, or water table conditions if groundwater completely fills a permeable formation that is overlain by a relatively impermeable bed, or aquiclude, its surface is confined and is not free to rise and fall. Such water is said to occur under artesian conditions.

All fresh groundwater in the area is derived from local precipitation and occurs in the upper and lower lithologic units, hereafter referred to as the upper and lower aquifers. According to data collected by the U.S. Geological Survey, aquifers that extend beneath the Outer Banks from the Mainland all contain saltwater.

Fresh groundwater in the Currituck Outer Banks area occurs in a lens-shaped body lying above saltwater. Excessive withdrawal of the freshwater will result in the encroachment of saltwater into the aquifer being pumped. The extent of encroachment depends mainly upon the elevation of the water table relative to mean sea level. The elevation of the water table is greatly influenced by the amount and distribution of the withdrawals. The possibility of saltwater encroachment among other factors must be considered in determining the amounts of water that may be safely withdrawn from an aquifer, and the location and design of well fields.

Water in the upper aquifer occurs under water table conditions, which means that water levels in wells penetrating this aquifer represent the top of the zone of saturation or the water table. The water table rises in response to recharge from precipitation and falls in response to discharge into the ocean and sound, leakage to the lower aquifer, loss by evapotranspiration, and pumping.

The upper aquifer has an average thickness of about 35 feet throughout the area of investigation. The saturated thickness ranges between 25 and 30 feet, and no saltwater was found in this aquifer in the area.

Tests performed by Moore, Gardner & Associates, Inc. at Nags Head-Kill Devil Hills Area in October, 1971, indicate that the upper aquifer has a coefficient of transmissibility of about 10;000 GPD/Ft. and a storage coefficient of about 0.3. According to a pumping test made in 1958 by

the U.S. Geological Survey near Nags Head, the coefficient of transmissibility and storage of the upper aquifer are 15,000 GPD/Ft and 0.3, respectively.

Mr. Edwin O. Floyd, Groundwater Hydrologist at the time for Moore, Gardner & Associates, Inc., who was in charge of the Nags Head-Kill Devil Hill investigation, has observed the Currituck Outer Banks Area and indicates that similar results would be anticipated.

The most costly chemical constituent to remove from water is chlorides. Water having a chloride content of greater than 250 ppm is considered as unfit for public water supplies by the U.S. Public Health Service. Other constituents such as iron and hardness-causing minerals can be undesirable in excessive amounts, but they can be economically removed with the proper treatment facilities.

Analyses of water samples taken from the test wells indicate that the quality of groundwater in the area is such that no treatment other than chlorination will be necessary in order to provide water acceptable for public water supply.

"Safe Yield" in coastal areas is usually defined as the maximum rate at which a well or group of wells may be pumped on a continuous basis without causing saltwater encroachment. Saltwater encroachment can occur in the proposed well field if long-term pumping exceeds the available recharge to the upper aquifer. If the system is thus unbalanced by artificial discharge, saltwater will begin moving toward the well field from the sound, ocean and from the underlying saltwater aquifers.

The data obtained from the pumping test indicate the aquifer can transmit 15 GPM of water to wells 400 feet apart without causing excessive stress on the system so far as the transmitting and storing characteristics are concerned. However, the water withdrawn from the aquifer must be replaced from local precipitation if the system is to remain in balance. The average annual precipitation for Currituck Outer Banks is about 47 inches per year.

Of this amount, approximately 33 inches is lost by evapotranspiration. The balance of about 14 inches per year reaches the water table. Some of this water is lost to natural discharge from the aquifer, and a small part cannot be released to wells because of the cohesion between the water and sand grains. Optimistically, we can assume that retention by cohesion is negligible for our purposes, and that a part of the natural discharge can be salvaged if the pumping effects are extensive enough. Assuming that there is a total of 8,000 acres on the Outer Banks available for surface recharge, this would make available approximately 5.95 MGD. This would allow approximately 20,000 dwelling units to be placed on a closed system on the Outer Banks if wells could be located to withdraw uniformly from the aquifer.

In order that the actual effects of pumping from the well field can be measured, and in order to have a method of detecting the early evidence of saltwater encroachment, a system of observation wells is to be provided. Water samples and water level measurements should be taken from each observation well at least weekly during the pumping season. Graphs showing the changes in chloride concentration and water levels should be kept on a current basis.

There is a slight possibility that freshwater is available in deep aquifers beneath the Outer Banks. The upper Yorktown Aquifer, which furnishes freshwater on the Mainland, may be located beneath the Outer Banks. However, the aquifer has a downward trend as it proceeds easterly. It is highly desirable that a deep test well be provided on the Outer Banks Area.

Surface water is available in a few small freshwater ponds, but is not available in sufficient quantities to be considered for a major water system. The waters of Currituck Sound, although considered fresh, contain levels of chlorides which would require removal by reverse osmosis or electrodialysis, both of which are high in initial cost and expensive to operate, and should not be considered before other means proved uneconomical.

2. General Recommendations

The surficial aquifer should be the initial source of supply for the Outer Banks. Shallow, 4 inch diameter wells, or horizontal wells, will be pumped at 15 gpm for 12 hours per day to supply the average day demand. Wells should be located a minimum of 500 feet west of the high tide line at the Ocean Side of the Banks. Every effort will be made to locate the wells as close to the central part of the land area as possible. Adjacent wells should be located a minimum of 400 feet center to center to minimize drawdown and saltwater intrusion. Well field areas should not require fencing, but will have to be provided with a 100 foot radius of protection, which may include up to one-half of the right-of-way width. Water quality is such that no treatment, other than chlorination should be required to provide a high quality potable water supply.

# SECTION III

# PROPOSED FACILITIES

## A. Project Description

The project proposed herein is based on the Engineer's sincere effort to provide a plan which is technically sound and economically most feasible. The goal of providing water on a county-wide basis is best accomplished by phasing projects. The initial phase, as described herein, is recommended for construction in 0 to 5 years; the second phase in 5 to 10 years; and, the third phase in 10 to 20 years. The first phase is proposed to provide water to currently the most densely populated areas of the county. Subsequent phases are based on providing water to additional areas where sufficient development is anticipated in the future to make extensions of lines economically feasible. Phases II and III, being based on anticipated development, should be viewed as a tool for planning that can be adjusted to respond to changes in development patterns in the County. Exhibit 1 in the appendix presents the proposed projects for all three phases.

Based on the magnitude of providing water on a county-wide basis, Phase I is divided into two parts, Part 1 and Part 2. Part 1 covers the area north of the Intracoastal Waterway and Part 2 covers the area south of the Intracoastal Waterway.

### 1. Phase I, Part 1

#### a. Raw Water System

The water resource section of this report recommended that the well field be located in the western half of the county between U.S. Highway 158 and NC Highway 168 for the best quality and yield. A

feasible location for initial construction appears to be east of and adjacent to the Southern Railroad, north of Shawboro. The wells would be lined up no closer than 1,000 feet apart. A spacing of 1,500 feet is recommended for initial consideration.

It is estimated that the wells in this area will produce 50 to 100 gallons of water per minute. For the purpose of estimating the number of wells required in the initial phase, it is assumed the average well will yield 100 gpm. The number of wells required are calculated as follows:

$$\frac{568{,}627 \text{ gals/day}}{1440 \text{ minutes/day}} = \frac{395 \text{ GPM}}{100 \text{ GPM/per Well}} = 3.95 \text{ Wells}$$

North Carolina Public Law 93-523 states that the combined yield of all wells of a water system shall be sufficient to provide the average daily demands in not more than 12 hours pumping time. Based on this criteria it is estimated that 8-10 wells will be required in the initial phase.

It is emphasized, as previously discussed, that prior to construction of the supply wells pumping tests should be performed on test holes. It is recommended, therefore, that one or two test holes be constructed which could be completed as supply wells. Data from these test holes would be very useful in determining the actual number, location and spacing of the supply wells which would be required.

b. Water Treatment Plant

In the initial phase, it is recommended that the treatment plant be designed with a capacity of 1.0 MGD with simple modification to expand to 2.0 MGD in the ultimate phase (year 2000). The treatment plant site would be located to the north of Shawboro off NC Highway 168. The groundwater quality is such that the treatment will require aeration, settling, filtration, disinfection and softening. Preliminary process design is as follows: raw water pumped from wells to aerator at head of settling basin; chemical feed for oxidation and flocculation after aeration; settling; settled water pumped through pressure filters and softeners, disinfected and released to 500,000 ground storage reservoir; high service pumps deliver water to distribution system as needed; system to be automated. The ground storage tank is to act as a buffer for smooth uniform plant operation. It will also provide emergency storage and will keep the distribution system in balance during periods when the plant is not in operation.

c. The Distribution System

Phase I, Part 1 of the distribution system will provide service to the north and west portion of the county's mainland, above the Intracoastal Waterway. The distribution system for Part I includes three (3) 100,000 gallons elevated storage tanks. The tanks will be located in the following areas: adjacent to NC 168 and north of Ranchland Subdivision; at the intersection of NC 34 and State Road 1222; and, near the community of Barco. High service pumps at the treatment plant will boost water into the tanks near Ranchland and

the intersection of NC 34 and SR 1222. A booster pump station will be installed between the tanks at the above stated intersection and the tank near Barco to boost water into the Barco tank.

The major distribution lines begin with a 12 inch water main at the treatment plant which runs along NC Highway 168 to the intersection of NC Highway 168 and NC Highway 34 at Sligo. A 10-inch main connected to the 12 inch main will continue from this point and run northwest along NC 168 to the elevated tank. An 8 inch main along US 168 will run from the tank to the community of Moyock.

A 12 inch main will run from Sligo along NC 34 to the elevated tank at the intersection of SR 1222 and NC 34. An 8 inch main will run northwest on SR 1222 and tie back to the system at Moyock. From the intersection of NC 34 and SR 1222 a 10 inch main will run south along NC 34 to a booster pump stationed at the community of Maple. From this point an 8 inch line will run south along NC 34 to the tank near Barco. From the tank at Barco an 8 inch line will run east along US 158 for approximately 12,000 feet and a 10 inch line will run south along US 158 to the Intracoastal Waterway Bridge in Coinjock. The remainder of the distribution lines will consist of 6 inch, 4 inch, 3 inch and 2 inch mains as illustrated in Exhibit 1 in the Appendix. Construction of water lines in subdivisions is proposed as discussed in Section III.C.1.d of this report.

Water mains will be located in road right-of-ways. Easements may be required for sections of line from the treatment plant and tanks to adjacent roads depending on the location of these facilities. Property will be acquired for the water storage tanks and booster pump station.

2. Phase I, Part 2

Part 2 will consist of a distribution system which will connect to the "Part 1" system at Coinjock, making the crossing of the Intracoastal Waterway with a 12 inch submerged main. This part of the project consists of two (2) 100,000 gallons elevated storage tanks and one (1) 500,000 gallons ground level storage. The elevated tanks are located near the community of Grandy, and the community of Mamie. The ground level water storage will be located north of the intersection of NC Highway 158 and NCSR 1140. Two booster pump stations will be required, one located beside the ground storage tank and the other located near Powells Point.

The 10 inch main, (12" under the waterway) after crossing the Intracoastal Waterway will run south along US 158 to the ground level storage tank. An 8 inch main will tie into this 10 inch main at the intersection of NCSR 1142 and run northeast along NCSR 1142 to Waterlilly. An 8 inch main will tie into the ground level storage tank and run south along US 158 to the elevated tank at Mamie. An 8 inch line will also run along the roads from Aydlett to Grandy and tie into the 8 inch line along US 158. The remainder of the distribution lines will consist of 6 inch, 4 inch, 3 inch and 2 inch mains as illustrated in Exhibit 1 of the Appendix. Construction of water lines in subdivisions is proposed as discussed in Section III.C.1.d of this report.

As with Phase I, Part 1 water mains will be constructed in road right-of-ways. Property will be acquired for the pumps and storage tanks. Easements may be required, depending on the location of the storage tanks, to tie these facilities into the mains running along the adjacent roads.

3. Knotts Island Project

Construction of water facilities on Knotts Island is recommended for Phase II construction. The project is described below and cost estimates are given in a subsequent section as an aid to the County in its consideration of this project. Several factors should influence the decision as to which phase this project should be assigned. Among these factors are: (1) the economic feasibility of the project; (2) the collective desires of the Board of Commissioners; (3) the magnitude of the project with respect to Farmers Home Administration's involvement in financing; and (4) raw water supply projections based on pumping tests.

The project consists of constructing a horizontal well, raw water pump station, package type water treatment plant, and an 8 inch finished water feeder main along NC 615. A 100,000 gallon elevated storage tank is proposed for construction off NCSR 1255 between its intersection with NCSR 1256 and 1258. A 6 inch distribution main is proposed to run along the entire length of NC 615 south of its junction with NCSR 1255. The remaining lines are 4 inch, 3 inch and 2 inch.

As with the raw water facilities proposed on the mainland, it is recommended that pumping tests be run prior to construction of the horizontal well.

Water mains will be located in road right-of-ways. Property will be acquired for the well site, water treatment plant and elevated storage tank.

4. Phases II and III

Phases II and III are not described in detail herein other than the Knotts Island Project (previous section) but are illustrated in Exhibit 1 of the Appendix. These projects are recommended for construction when sufficient development makes them feasible.

Phase II construction on the mainland is recommended for the following areas:

-along NCSR 1248, 1249, 1250, 1251, 1252 and 1253 at the mid-northern part of county bordering the Virginia line;
-along NCSR 1227 near Moyock to Universal Trailer Park off NCSR 1218;
-along NCSR 1214 southeast of Moyock;
-along NCSR 1238 northwest of Currituck;
-along NCSR 1234 northwest of Currituck;
-along NCSR 1142 at the tip end of Church Island;
-along NCSR 1246 and US 158 to close the loop south of Maple;
-along NCSR 1147, 1148, NC 168 and US 158 south of Shawboro;
-along NCSR 1241 north of Maple;
-along NC 3 southeast of Poplar Branch;
-along NCSR 1129 at Grandy;
-along NCSR 1125, 1126 and 1127 northeast of Jarvisburg:

-along NCSR 1118 between Jarvisburg and Powells Point;

-along NCSR 1116 and 1114 between Powells Point and Mamie;

-along NCSR 1111 and 1107 between Mamie and Harbinger;

-along NCSR 1106 and 1105 between Harbinger and Point Harbor.

Phase III Construction on the mainland is recommended for the following areas:

-along NCSR 1250 at the mid-northern part of the county bordering the Virginia line;

-along NCSR 1231 east of Moyock;

-along NCSR 1216 and 1217 southwest of Moyock;

-along NCSR 1202, 1210, and 1212 west of Sligo;

-along NCSR 1140 west of Adylett;

-along US 158 south of Shawboro;

-along NCSR 1123, 1124, and 1125 west of Jarvisburg;

-along NCSR 1112 southwest of Mamie.

Phase III construction on the Outer Banks is recommended for North Swan Beach, Swan Beach, Whalehead Club, Ocean Sands, Carova Beach, and the tie between Swan Beach and Whalehead Club. The water supply facilities are also recommended for Phase III construction and are projected to consist of a 12-inch water main which runs from a new booster pump station on the mainland to a point on the Outer Banks between Whalehead Club and Ocean Sands. The new booster pump station on the mainland would be located adjacent to the ground level storage tank west of Aydlett. The crossing of Currituck Sound would be by submerged water main.

B. Hydraulic Analysis

The Phase I project, previously described, evolved from detailed hydraulic analyses. The Engineers made concerted efforts to minimize the cost of the project while maintaining dependable and adequate service to the potential customers.

The major tool used in performing the hydraulic analyses was the Kentucky Pipe computer program. This computer program uses the Hardy Cross method for determining water pressures at designated points, or nodes, in a distribution system based on instantaneous demands. The Engineers assigned an instantaneous demand of 1 gallon per minute (gpm) to all possible connections along the routes of the Phase I mains except schools and the prison unit off NCSR 1246. The schools were assigned demands based on the number of students and the prison unit was assigned a demand based on the number of inmates. This method of assigning demands using the maximum number of connections and using an instantaneous demand of 1 gpm per connection, in the Engineer's opinion, helps insure that the distribution system will be able to produce reasonable pressures at all points in the system through Phase III development. Though future development cannot be projected with exactness, the Engineers believe the system proposed has the hydraulic integrity to minimize future problems associated with system expansion.

Based on the computer analyses and manual calculations the proposed system is designed to provide a minimum of 30 psi to all points in the system. This minimum pressure is recommended by Rules Governing Public War Supplies of the North Carolina Administrative Code for systems not

designed to carry fire flows. It is noted in this respect that the system proposed herein is not designed to carry fire flows to all points in the system; however, hydrants are proposed at 4500 and 5000 foot intervals for lines 6 inches or larger. In many areas, especially near tanks, sufficient flows will be available to fill tank trucks for fire fighting purposes.

## C. Cost Estimates

### 1. General

The construction costs presented herein are based on the preliminary layouts of the proposed facilities for Phase I. The unit costs are based on a study of current statistical data, including records of costs of local construction projects of a similar nature. Unit costs reflect the current market. Updated cost estimates will be needed in the future when project design and advertising for bids take place; however, it is believed the cost estimates presented here are adequate to develop financing for Phase I.

### 2. Estimated Project Costs

The following sections itemize the estimated project costs for Phase I construction. The costs for constructing systems in subdivisions is included in the project costs; however, it may be that developers and/or subdivision residents will construct the distribution systems in the subdivisions. In addition the cost for the project in Knotts Island is itemized. The Engineers recommend this project for Phase II construction due to the fact that it is not as feasible at this time as Part 1 and Part 2. It may be the County's desire however, to construct this project in Phase I and cost estimates are given as an aid in making this decision.

a. Raw Water Supply and Water Treatment Plant

RAW WATER SUPPLY:

| Quantity | Description | Unit Price | Cost |
|---|---|---|---|
| 10,500 LF | 8" Raw Water Line | $6.00/LF | $ 63,000 |
| 1,600 LF | 10" Raw Water Line | $8.00/LF | $ 12,800 |
| 8 | Wells, Raw Water Pumps, Pump House Site Work | $40,000 each | $320,000 |
| 1 | Meter Vault | $12,000 each | $ 12,000 |
| | Appurtenances | | $ 54,200 |
| | SUBTOTAL | | $462,000 |
| Construction Contingency | | | 30,000 |
| Total Construction Cost | | | $492,000 |
| Land & Right-of-Way | | | 10,000 |
| Legal & Administrative | | | 5,000 |
| Technical Services: | Engineering Design | | 35,000 |
| | Construction Observation | | 15,000 |
| | Surveying | | 6,000 |
| | Testing | | 5,000 |
| Interest During Construction | | | 60,000 |
| Project Contingency | | | 17,000 |
| TOTAL PROJECT COST | | | $645,000 |

WATER TREATMENT PLANT

| Description | Cost |
|---|---|
| Aerator | $ 18,000 |
| Mix Basin | 24,000 |
| Plant Building (3,400 SF @ $35/SF) | 119,000 |
| Pumps, Valves, Miscellaneous (2 Filter Pumps & 2 High Service Pumps) | 35,000 |
| Piping, In Plant | 25,000 |
| Valves & Fittings | 15,000 |
| Filters & Softners | 100,000 |
| Chlorine Equipment | 14,000 |
| Lab Furniture | 12,000 |
| Lab Equipment | 8,000 |
| Miscellaneous Tanks | 15,000 |
| Chemical Pumps | 10,000 |
| Meter Vault | 12,000 |
| Holding Tank | 10,000 |
| Sand Beds/Pump Station | 13,000 |
| Electrical/Instrumentation | 150,000 |
| Mechanical/Plumbing | 80,000 |
| Yard Piping | 30,000 |
| Site Improvements | 20,000 |
| 500,000 Gallons Ground Level Storage Tank | 125,000 |
| Construction Cost | $835,000 |
| Construction Contingency | 54,000 |
| Total Construction Cost | $ 889,000 |

| | | |
|---|---|---|
| Land & Right-of-Way | | 18,000 |
| Legal & Administrative | | 9,000 |
| Technical Services: | Engineering Design | 62,000 |
| | Construction Observation | 27,000 |
| | Surveying | 9,000 |
| | Testing | 8,000 |
| Interest During Construction | | 108,000 |
| Project Contingency | | 31,000 |
| TOTAL PROJECT COST | | $1,161,000 |

b. Phase I, Part 1 Distribution System

| Quantity | Description | Unit Price | Cost |
|---|---|---|---|
| 54,500 LF | 2" Water Main | $3.00/LF | $ 163,500 |
| 35,000 LF | 3" Water Main | $3.25/LF | 113,750 |
| 78,400 LF | 4" Water Main | $3.50/LF | 274,400 |
| 58,000 LF | 6" Water Main | $4.50/LF | 261,000 |
| 99,000 LF | 8" Water Main | $6.00/LF | 594,000 |
| 57,000 LF | 10" Water Main | $8.00/LF | 456,000 |
| 26,000 LF | 12" Water Main | $10.00/LF | 260,000 |
| 56 | 2" Gate Valve & Box | $200 Each | 11,200 |
| 18 | 3" Gate Valve & Box | $225 Each | 4,050 |
| 46 | 4" Gate Valve & Box | $250 Each | 11,500 |
| 77 | 6" Gate Valve & Box | $300 Each | 23,100 |
| 57 | 8" Gate Valve & Box | $400 Each | 22,800 |
| 27 | 10" Gate Valve & Box | $500 Each | 13,500 |
| 14 | 12" Gate Valve & Box | $600 Each | 8,400 |
| 47 | 6" Fire Hydrant | $500 Each | 23,500 |
| 60 LF | 6" Steel Casing | $45/LF | 2,700 |
| 120 LF | 10" Steel Casing | $50/LF | 6,000 |
| 60 LF | 12" Steel Casing | $55/LF | 3,300 |
| 60 LF | 16" Steel Casing | $70/LF | 4,200 |
| 400 LF | Stream Crossing | $50/LF | 20,000 |
| 3 | 100,000 Gallon Elevated Storage Tank with Foundation | $150,000 Each | 450,000 |
| 1 | 400 gpm Pump Station | $50,000 Each | 50,000 |
| 4 | 2" Meter & Meter Box | 500 Each | 2,000 |
| 2 | 4" Meter & Meter Box | $ 4,000 Each | 8,000 |

| | | | | |
|---|---|---|---|---|
| *1509 | Service Connections | $ | 225 Each | 339,525 |
| 34,000 lbs. | D. I. Fittings | $ | 1.00 lb. | 34,000 |
| | Stone, Pavement Patching, Concrete, Driveway Repair, Silt Fencing and Other Appurtenances | | | $ 224,575 |

| | |
|---|---|
| CONSTRUCTION COST | $3,385,000 |
| Construction Contingency | 225,000 |
| Total Construction Cost | $3,610,000 |
| Land & Right-of-Way | 7,000 |
| Legal & Administrative | 37,000 |
| Technical Services: | |
| Engineering Design | 223,000 |
| Construction Observation | 83,000 |
| Surveying | 5,000 |
| Interest During Construction | 230,000 |
| Project Contingency | 148,000 |
| TOTAL PROJECT COST | $4,343,000 |

* This number, 1509, consists of 1503 benefitted users and 6 non-benefitted users. Service to the non-benefitted users does not require an increase in line size relative to what would be required to serve the "benefitted" users alone.

c. Phase I, Part 2 Distribution System

| Quantity | Description | Unit Price | Cost |
|---|---|---|---|
| 41,800 LF | 2" Water Main | $3.00/LF | $ 125,400 |
| 21,000 LF | 3" Water Main | $3.25/LF | 68,250 |
| 103,000 LF | 4" Water Main | $3.50/LF | 360,500 |
| 35,000 LF | 6" Water Main | $4.50/LF | 157,500 |
| 127,000 LF | 8" Water Main | $6.00/LF | 762,000 |
| 6,000 LF | 10" Water Main | $8.00/LF | 48,000 |
| 40 | 2" Gate Valve & Valve Box | $200 Each | 8,000 |
| 11 | 3" Gate Valve & Valve Box | $225 Each | 2,475 |
| 56 | 4" Gate Valve & Valve Box | $250 Each | 14,000 |
| 67 | 6" Gate Valve & Valve Box | $300 Each | 20,100 |
| 64 | 8" Gate Valve & Valve Box | $400 Each | 25,600 |
| 3 | 10" Gate Valve & Valve Box | $500 Each | 1,500 |
| 35 | 6" Fire Hydrant | $500 Each | 17,500 |
| 250 LF | 10" Intracoastal Waterway Submerged Crossing | $400/LF | 100,000 |
| 2 | 100,000 Gallon Elevated Storage Tanks with Foundation | $150,000 Each | 300,000 |
| 1 | 500,000 Gallon Ground Level Storage Tank | $125,000 Each | $ 125,000 |
| 1 | 150 gpm Pump Station | $ 35,000 Each | $ 35,000 |
| 1 | 300 gpm Pump Station | $ 40,000 Each | $ 40,000 |
| 2 | 2" Meter & Meter Box | $ 500 Each | $ 1,000 |
| *1580 | Service Connections | $ 225 Each | $ 355,500 |

| | | | | |
|---|---|---|---|---|
| 28,000 lb. | D. I. Fittings | $ | 1.00/Lb. | $ 28,000 |
| | Stone, Pavement Patching, Concrete, Driveway Repair, Silt Fencing and Other Appurtenances | | | $ 204,675 |
| Construction Cost | | | | $2,800,000 |
| Construction Contingency | | | | 182,000 |
| Total Construction Cost | | | | 2,982,000 |
| Land & Right-of-Way | | | | 10,000 |
| Legal & Administrative | | | | 30,000 |
| Technical Services: | Engineering Design | | | 184,000 |
| | Construction Observation | | | 70,000 |
| | Surveying | | | 5,000 |
| Interest During Construction | | | | 207,000 |
| Project Contingency | | | | 117,000 |
| TOTAL PROJECT COST | | | | $3,605,000 |

*This number, 1580, consists of 1578 benefitted users and 2 non-benefitted users. Service to the non-benefitted users does not require an increase in line size relative to what would be required to serve the "benefitted" users alone.

d. Subdivision Systems

Three subdivisions adjacent to the proposed distribution system have existing distribution systems in place. They are Tulls Bay Colony, Wedgewood Lakes and Walnut Island. Four subdivisions will be served by virtue of the houses being lined up adjacent to proposed routes of the water mains. Twenty-six subdivisions exist which can easily tie into the proposed system but which do not currently have their own system. They are Moyock Subdivision, Camelia Acres, Ranchland, Beechwood Shores, Sleepy Hollow, Tulls Bay Acres, Buckskin Creek, Equestrian Acres, Baxter Estates, Currituck-on-the-Sound, Taylors Waterview, Bell Isle, Belle Island Farms, Bells Island, Island Acres, S.W. Parker, Waterview Shores, Peach Tree Beach, Albemarle Sound Beach, North River Shores, North River Orchards, Newberns Landing, White Acres, Point Harbor, Griggs-Singletary and Old Oak Estates. The total cost for constructing distribution systems in these twenty-six subdivisions is included in the total project costs for Parts 1 and 2 of the distribution system in Phase I.

e. Knotts Island

RAW WATER SUPPLY AND WATER TREATMENT PLANT:

| Description | Cost |
|---|---|
| 100,000 gpd Water Treatment Plant @ LS | $250,000 |
| 1,000 LF Horizontal Well with Pump Station | 50,000 |
| 2,000 LF of 8 inch Finished Water Transmission Main @ $6.00/LF | 12,000 |

| | |
|---|---|
| 100 gpm Booster Pump Station @ LS | 30,000 |
| Appurtenances | 6,000 |
| Construction Cost | $348,000 |
| Construction Contingency | 22,000 |
| Total Construction Cost | $370,000 |
| Land and Right-of-Way | 12,000 |
| Legal and Administrative | 4,000 |
| Technical Services: | |
| Engineering Design | 31,000 |
| Construction Observation | 17,000 |
| Surveying | 5,000 |
| Testing | 5,000 |
| Interest During Construction | 30,000 |
| Project Contingency | 13,000 |
| Total Project Cost | $487,000 |

DISTRIBUTION SYSTEM:

| Quantity | Description | Unit Price | Cost |
|---|---|---|---|
| 5,000 LF | 2" Water Main | $3.00/LF | $15,000 |
| 10,000 LF | 3" Water Main | $3.25/LF | 32,500 |
| 13,800 LF | 4" Water Main | $3.50/LF | 48,300 |
| 21,600 LF | 6" Water Main | $4.50/LF | 97,200 |
| 6 | 2" Gate Valve & Box | $200 Each | 1,200 |
| 7 | 3" Gate Valve & Box | $225 Each | 1,575 |
| 11 | 4" Gate Valve & Box | $250 Each | 2,750 |
| 17 | 6" Gate Valve & Box | $300 Each | 5,100 |
| 6 | 6" Fire Hydrant | $500 Each | 3,000 |

| | | | |
|---|---|---|---|
| 60 LF | 10" Steel Casing | $50/LF | 3,000 |
| 1 | 100,000 gal. Elevated Storage Tank w/ Foundation | | 150,000 |
| 232 | Service Connections | $225 Each | 52,200 |
| | Appurtenances | | 33,275 |
| Construction Cost | | | $445,100 |
| Construction Contingency | | | 28,900 |
| Total Construction Cost | | | $474,000 |
| Land & Right-of-Way | | | 6,000 |
| Legal & Administrative | | | 5,000 |
| Technical Services; | | | |
| Engineering Design | | | 33,000 |
| Construction Observation | | | 20,000 |
| Surveying (Easements) | | | 6,000 |
| Testing | | | 2,000 |
| Interest During Construction | | | 37,000 |
| Project Contingencies | | | 17,000 |
| Total Project Cost | | | $600,000 |

f. Project Costs Summary

The following tables present the project cost summary based on the figures in the preceding sections.

| Description | Total Project Cost |
|---|---|
| Phase I, Part 1: | |
| Raw Water Supply | $ 645,000 |
| Water Treatment Plant | 1,161,000 |
| Distribution System | 4,343,000 |
| Subtotal | $6,149,000 |
| | |
| Phase I, Part 2: | |
| | |
| Distribution System | $3,605,000 |
| | |
| Total Estimated Cost for Phase I | $9,754,000 |

3. Operating & Maintenance Costs

Currituck County must make provisions for operating and maintaining the proposed facilities. The following estimates are based on the actual cost of operating and maintaining similar systems in eastern North Carolina.

| Description | Estimated Annual Cost |
|---|---|
| Salaries | $ 69,000.00 |
| Payroll Taxes & License | 5,500.00 |
| Office Expenses (Supplies, Postage, Electricity, Telephone, etc.) | 4,000.00 |
| Utilities | 22,000.00 |
| Vehicle O & M and Travel | 10,000.00 |
| Insurance | 9,000.00 |

| | |
|---|---|
| Legal & Audit | 3,500.00 |
| Supplies | 32,000.00 |
| Miscellaneous | 17,000.00 |
| Total Operation & Maintenance | $172,000.00 |

D. Financing

1. General

The construction of a project of this magnitude should have a financing plan that will be in the best interest of the County. The County should seek the advice from their legal advisors, North Carolina Local Government Commission, the Institute of Government, and other concerns that may be available to aid in implementing the project.

There are several methods and resources available to the County in implementing the project. These include the use of general obligation bonds, revenue bonds, federal grants and state grants.

General obligation bonds are available upon the approval by the Voters of the County. These bonds are the most commonly employed, and, based on the available market and the lower interest rates are recommended by the Engineers.

The issuance of revenue bonds is also an approach the County can take in financing the proposed project. These bonds can be sold on the open market but normally entail higher interest rates than general obligation bonds.

Also available to the County for this project, as discussed below, are federal and state grant assistance programs that may be helpful in alleviating a portion of the capital cost.

The United States Government under many programs in previous years has aided local government units in providing essential services such as those previously outlined in this study. Within recent years, however, many of the programs which had been available are being dropped by the federal government. Present federal grant programs for water facilities programs include Revenue Sharing and Farmers Home Administration Grants. For the purpose of this report, the Engineers assume a maximum of 50% of the eligible portions will be made available from these sources; however, grants must be sought and secured before plans for financing can be finalized.

Revenue sharing funds for this project, whether assisted or not under a categorical grant from the federal government, may be used to offset capital costs of said project as approved for financing by the local government under the rules and regulations set out for use of such funds. The County does not at this time know whether such funds will be used and/or in what quantity they might be used; and the suggestion for using this source will have to be weighed against other alternate ways to determine the best course of action to follow. Revenue Sharing Funds can be used by the County and can be introduced at their discretion.

The State of North Carolina, through action of the 1977 General Assembly, has set up the machinery, and the citizens of the state did in June 1977 vote to issue $230,000,000 in state bonds to assist in grant programs for water and wastewater projects. For the purpose of this report, it is assumed that these grant funds will be available to assist the County in implementing the project, as detailed in the following sections.

2. Projected Annual Costs

The annual cost of the water facilities are predicated upon payment of the debt service on bonds and upon operation and maintenance costs. The projected annual cost upon construction of Phase I of the project is detailed in Table 1 with the consideration of three levels of grant assistance. The levels of grant assistance are given in percentages. The amount of grant is equal to the percentage multiplied by the eligible project cost (total project cost minus land and right-of-way and interest during construction). Financing is assumed to be by the Farmers Home Administration at an 11.375% annual interest rate, for a term of 40 years, and with 2 years deferred principal payment.

3. Revenues and Budget

Proposed water rate schedules were developed by the Engineers for each grant level with the objective of producing the needed income for maintenance and operation of the system, plus produce sufficient revenue to retire the indebtedness of the system. Should the proposed rates be judged unrealistic, the rate schedule should be set as high as possible without causing undue burden on the Water customer. Furthermore, other sources of revenues should be established to make up the deficit. These

Table 1: Estimated Annual Cost Relative to Different Levels of Grant Assistance for Phase I Construction

| | Level of Grant Assistance 0% | 25% | 50% |
|---|---|---|---|
| Total Project Cost, TPC | $9,754,000 | $9,754,000 | $9,754,000 |
| *Amount of Grant | -0- | 2,276,000 | 4,552,000 |
| Proceeds from Tap on Fees | 54,058 | 54,058 | 54,058 |
| Amount of TPC to be Financed (Local Share) | $9,699,942 | $7,423,942 | $5,147,942 |
| Number of Connections at 80% of Potential | 3,089 | 3,089 | 3,089 |
| **Annual Debt Service Costs | $1,122,089 | $ 858,802 | $ 595,514 |
| Annual Operation & Maintenance | 172,000 | 172,000 | 172,000 |
| Total Annual Cost | $1,294,089 | $1,030,802 | $ 767,514 |

*Based on given % times eligible project cost ($9,104,000). Eligible project cost is equal to TPC less land and right-of-way costs and interest during construction.

**Based on 11.375% interest, 40 year term and 2 year deferred payment on principal.

other sources could include acreage fees, fees in lieu of assessment and other charges as may be made to those benefitting from the use of the system. Based on discussions with local officials this report assumes a $35 per connection tap-on fee, half of which will go to help defray capital costs and half applied to the first years operation and maintenance costs.

Assuming that 80% of the potential customers along the proposed mains becomes customers of the County Water System, Table 2 presents the projected breakdown of customers into user brackets. This breakdown is based on the Engineers best judgment and experience with water use patterns for other county systems.

A review of Table 2 illustrates that 6,178,000 gallons per month (3089 customers x 2000 gallons per month) are projected for the minimum use bracket. Table 3 presents the rate structure and the projected revenues for three levels of grant assistance based on useage as detailed above. The revenues are broken into benefitted and non-benefitted (connections with meters larger than 3/4") since non-benefitted customers cannot benefit from grants.

The Engineers recommend that a water rate structure be adopted with a minimum charge for the first 2000 or less gallons per month and a fixed rate per 1000 gallons for all use over 2000 gallons.

Table 2: Projected Breakdown of Customers Based on 80% Signup

| User Bracket In Gal./Mn. (Average Use) | Benefitted Projected Number of Customers | Benefitted Monthly Consumption in 1000 Gal. | Non-Benefitted Projected Number of Customers | Non-Benefitted Monthly Consumption in 1000 Gal. |
|---|---|---|---|---|
| 0-2000 (2000 Minimum) | 936 | 1,872 | 0 | 0 |
| Next 3000 (3,500) | 1,552 | 5,432 | 0 | 0 |
| Next 5,000 (7,500) | 450 | 3,375 | 0 | 0 |
| Next 10,000 (15,000) | 111 | 1,665 | 0 | 0 |
| Next 30,000 (35,000) | 27 | 945 | 0 | 0 |
| Next 50,000 (75,000) | 5 | 375 | *** 2 | 150 |
| Next 50,000 (125,000) | -0- | -0- | * 4 | 500 |
| Next 100,000 (225,000) | -0- | -0- | + 1 | 225 |
| All Over 250,000 (340,000) | -0- | -0- | **1 | 340 |
| TOTAL | 3,081 | 13,664 | 8 | 1,215 |

*3 elementary and 1 junior high school

+1 high school

**prison camp

**2 shopping centers

Table 3: Projected Revenues From Water Sells at 80% Signup

| Level of Grant Assistance | Rate For: Minimum Usage | Rate For: Ea. 1000 Gal Over 2000 | Benefitted Monthly Revenues From: Mininum Usage | Benefitted Monthly Revenues From: Usage Over Minimum | Non-Benefitted Monthly Revenues From: Minimum Usage | Non-Benefitted Monthly Revenues From: Usage Over Minimum | Total Monthly Revenue | Total Annual Revenue |
|---|---|---|---|---|---|---|---|---|
| 0% | $29.00 | $2.10 | $89,349 | $15,754 | $ 232 | $2,518 | $107,853 | $1,294,236 |
| 25% | *$22.00 | *$2.05 | $67,782 | $15,379 | $ 232 | $2,518 | $ 85,911 | $1,030,932 |
| 50% | *$16.00 | *$1.60 | $49,296 | $12,003 | $ 232 | $2,518 | $ 64,049 | $ 768,588 |

*These rates apply to benefitted users only since non-benefitted customers cannot benefit from grants. The rates for non-benefitted usage is fixed at the 0% level of grant assistance.

The revenues projected in Table 3 are presented as guides in order to off-set the projected expenditures. The following data presents the budget summaries for each grant level based on estimated revenues and expenditures as previously detailed.

| | |
|---|---|
| No Grant | |
| Total Annual Revenues | $1,294,236 |
| Total Annual Expenditures | 1,294,089 |
| Surplus | $ 147 |
| 25% Grant | |
| Total Annual Revenues | $1,030,932 |
| Total Annual Expenditures | 1,030,802 |
| Surplus | $ 130 |
| 50% Grant | |
| Total Annual Revenues | $ 768,588 |
| Total Annual Expenditures | $ 767,514 |
| Surplus | $ 1,074 |

# SECTION IV

# SUMMARY AND RECOMMENDATIONS

The Engineers recognize that the water facility projects described herein are large in magnitude. Implementing the ground work to provide for construction of the project(s) will require the sincere and concerted efforts of all county officials as well as interested citizens. In addition, the implementation of the project will require the best thoughts of the county's legal, political, economic and technical advisors, and the assistance of the North Carolina Department of Human Resources, Division of Health Services, the North Carolina Local Government Commission, Farmers Home Administration of the US Department of Agriculture, the Currituck County Agricultural Extension Service and perhaps others.

Though implementing the project will require a great deal of effort and coordination, the benefits of the project are substantial. The water system would provide the County citizens with a safe, potable, and dependable water supply. In addition the water system will provide an important link in the plans of the county to provide service for its citizens.

In the past, the general rule has been that delaying the construction of projects will decrease their feasibility.

The Engineers believe that this rule applies here even though the current economic and political atmosphere makes speculation difficult. Construction costs are the lowest they have been for several years but interest rates are higher and grants from Farmers Home Administration are not as easily acquired as in the past. It is not known when construction costs

will begin to rise again nor when, or if, interest rates will fall. As mentioned before, the County officials need to use their best economic, political and technical resources in order to make sound decisions with regard to the construction of a water system.

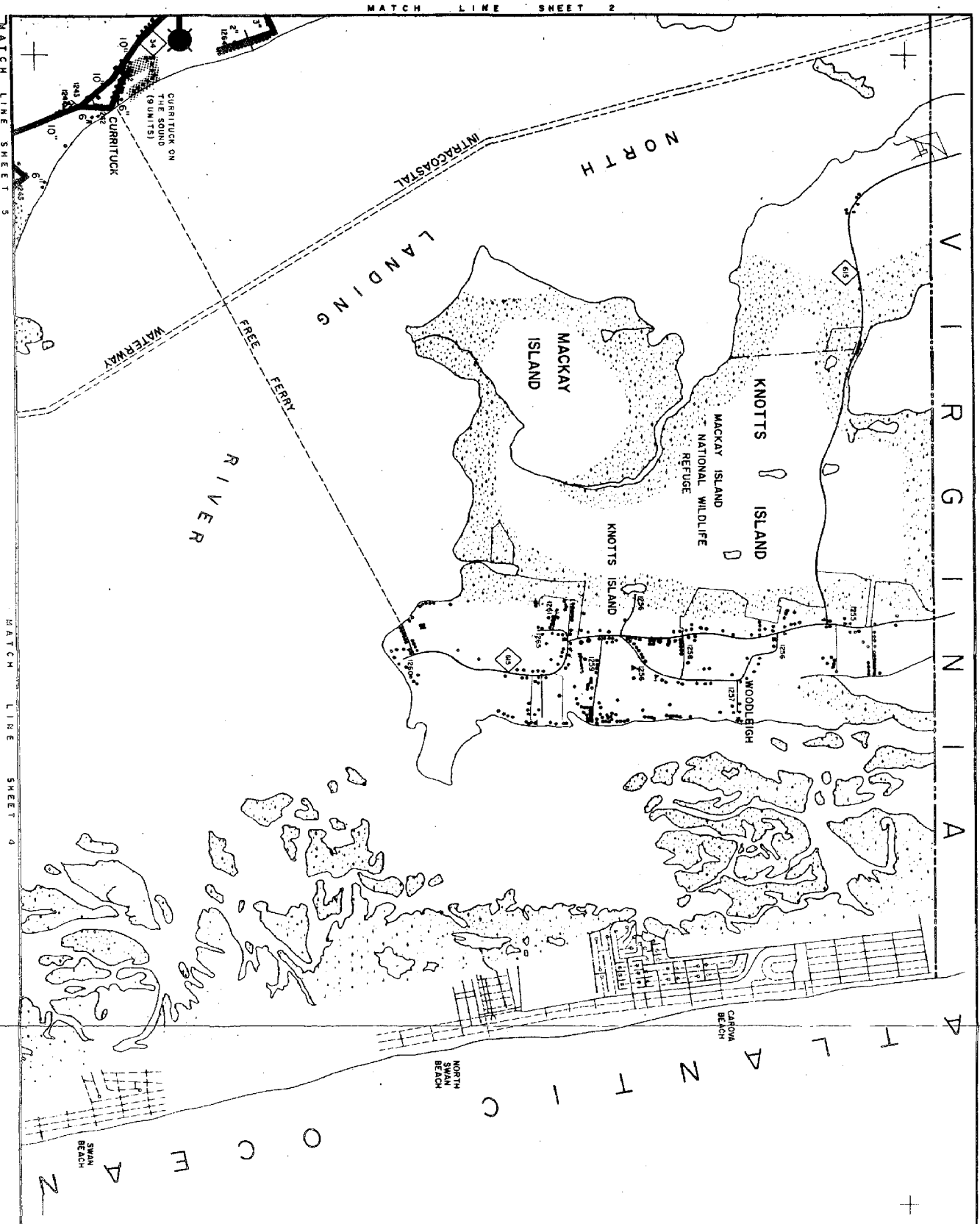
The Engineers have made a sincere effort herein to layout and to estimate the feasibility of constructing a water system which will provide the county with a safe, potable and dependable water supply. Emphasis needs to be placed on two conditions which should be met prior to project construction. First of all the County needs to have pumping tests run on at least two test holes to provide a better estimate of the yields of wells in the Shawboro area. Secondly, the County needs to be satisfied that the number of customers projected herein will actually hook up to and remain on the system once it is constructed. In review, the Engineers based their annual budget estimates on 80% of the potential customers hooking on to the system (approximately 3,089 for Phase I). As a guide for making this determination, experience by the Engineer has shown that a 50% to 60% sign up prior to construction will lead to an actual sign-up of around 80% within two years after construction.

The cost presented herein are based on conditions in today's market. The Engineers recommend that the County re-evaluate the cost estimates at such time as they decide to pursue actual construction of the project.

We trust the information in this report will be helpful to the officials of Currituck County in their consideration of this project. Moore, Gardner & Associates, Inc. stands ready to continue its assistance to the County when called upon.

# APPENDIX

EXHIBIT 1




N

0 500 1000 2000 3000 4000 5000 6000
SCALE IN FEET

NORRIS, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

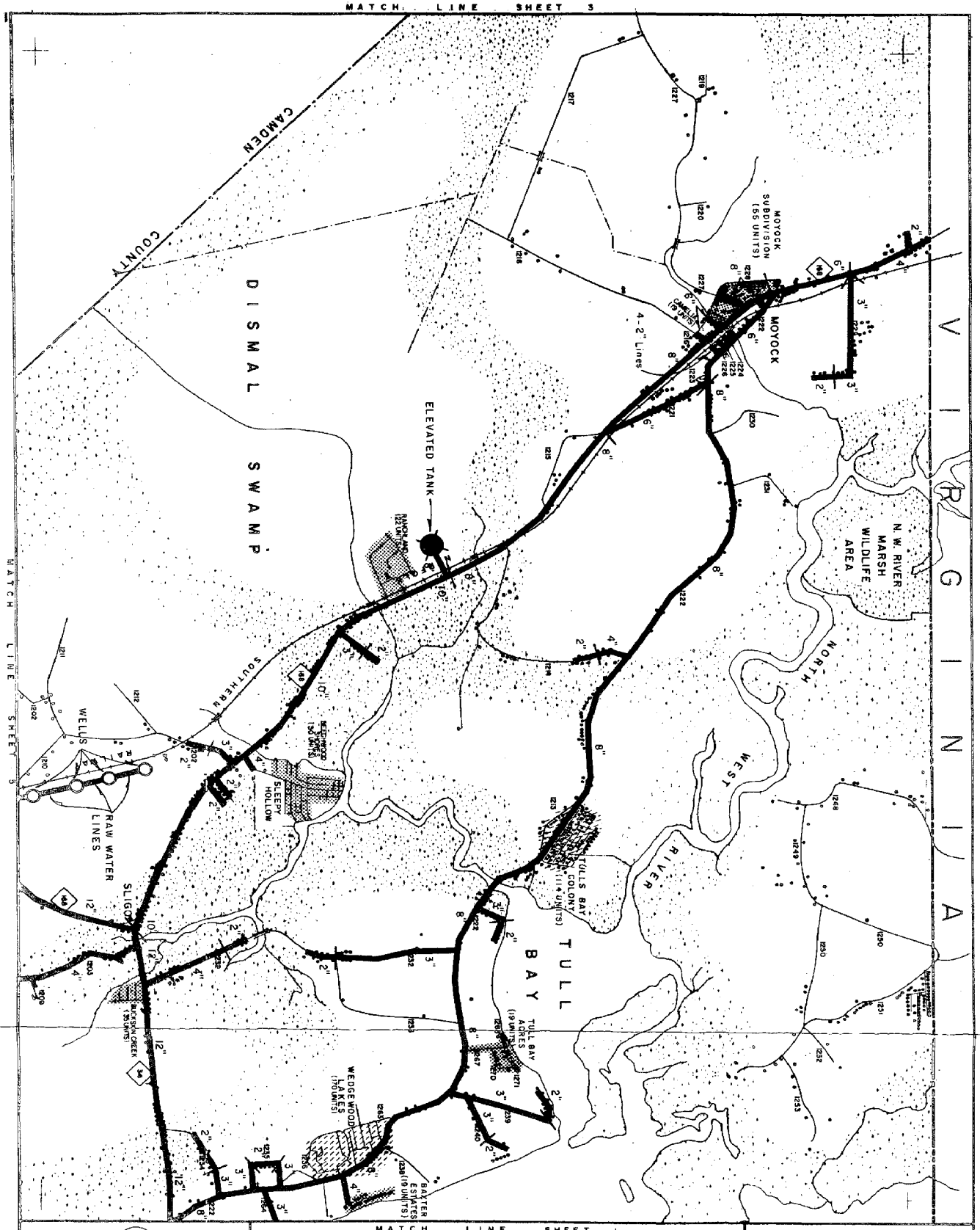
## WATER FACILITIES PLAN

WATER LINES
GROUND STORAGE
ELEVATED TANK
PUMP STATION

SUBDIVISION WITH WATER SYSTEM
SUBDIVISION WITHOUT WATER SYSTEM

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 1 OF 7




MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

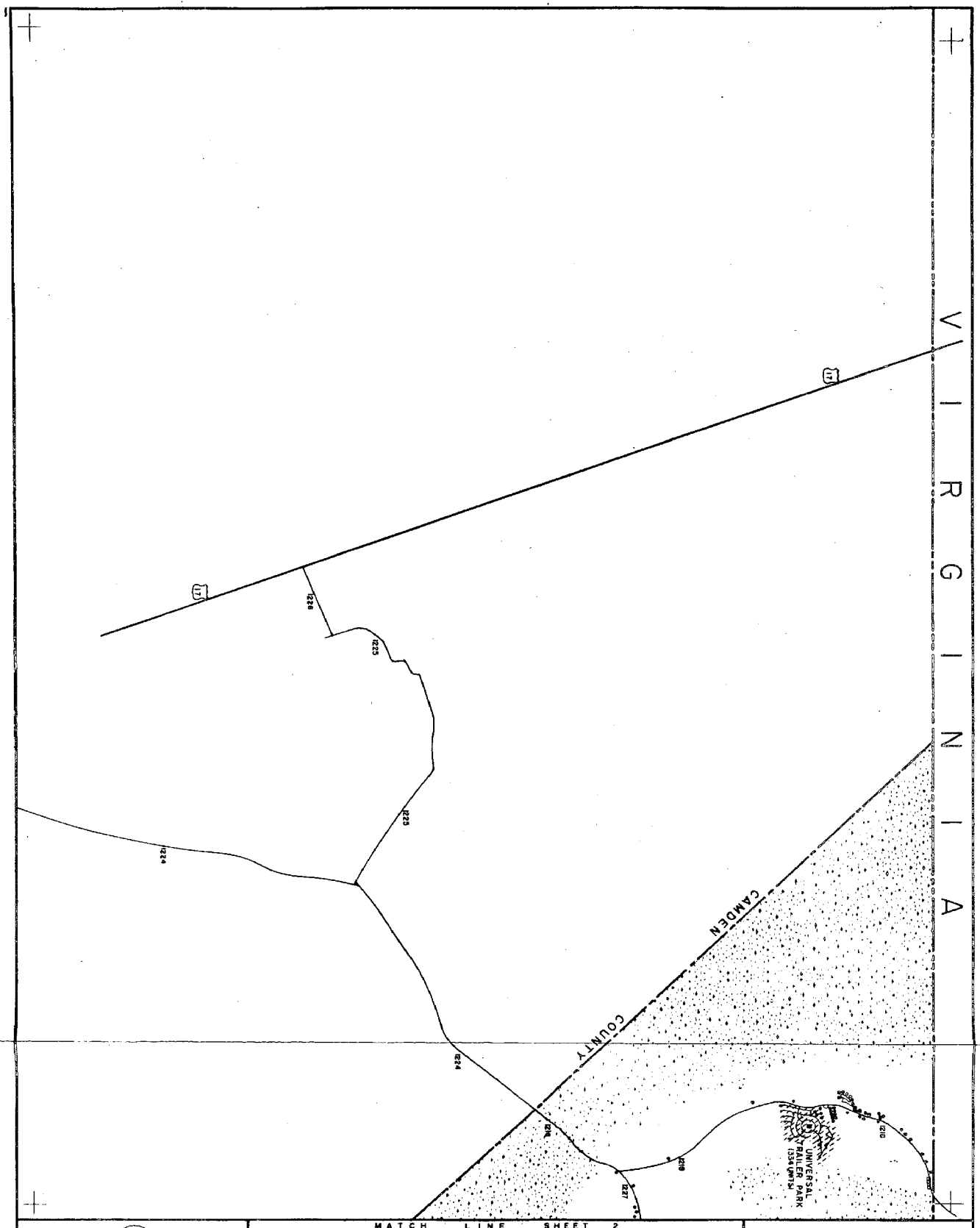
## WATER FACILITIES PLAN

WATER LINES
GROUND STORAGE
ELEVATED TANK
PUMP STATION

SUBDIVISION WITH WATER SYSTEM
SUBDIVISION WITHOUT WATER SYSTEM

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 2 OF 7




N

0 500 1000 2000 3000 4000 5000 6000
SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

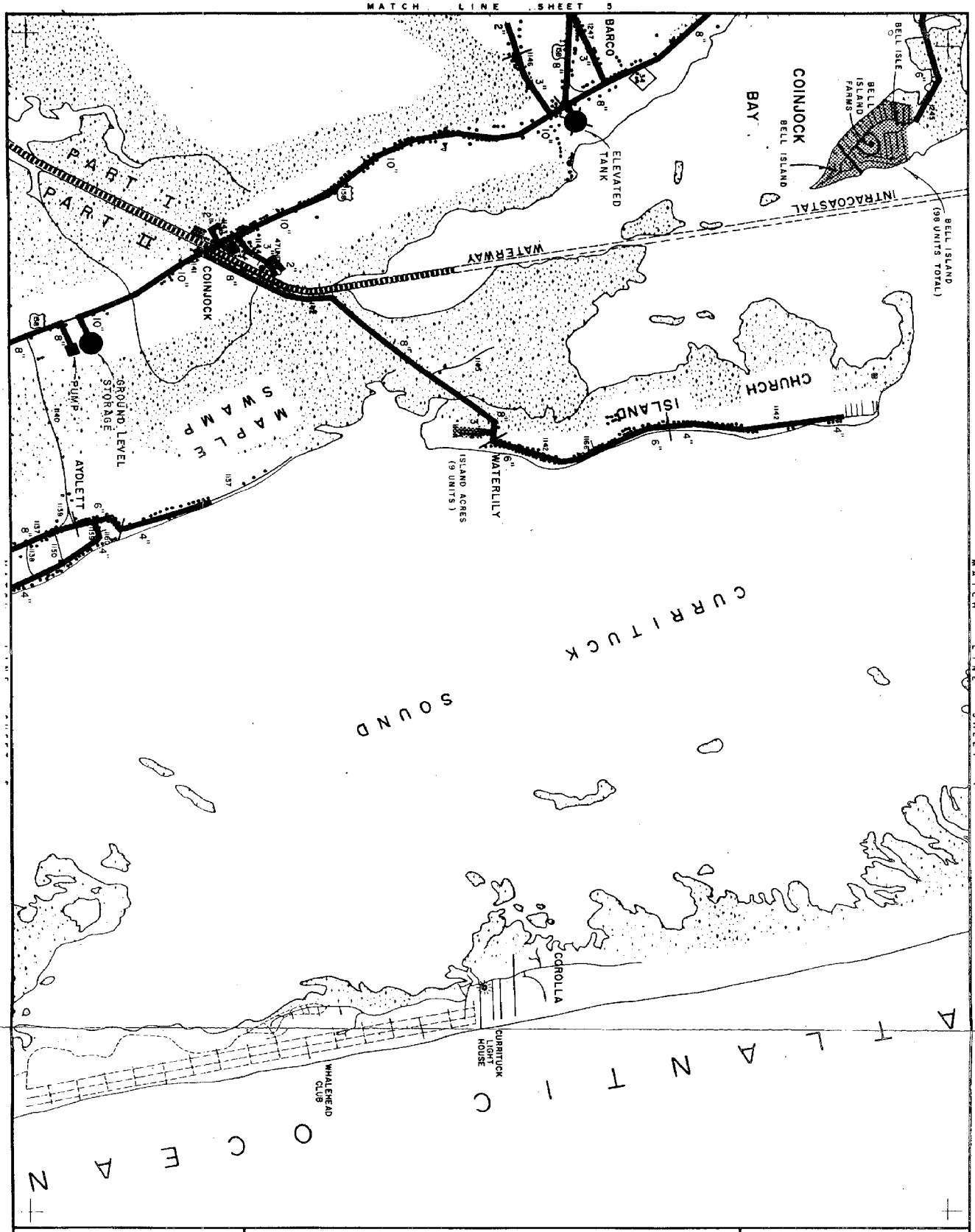
## WATER FACILITIES PLAN

WATER LINES
GROUND STORAGE
ELEVATED TANK
PUMP STATION

SUBDIVISION WITH WATER SYSTEM
SUBDIVISION WITHOUT WATER SYSTEM

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 3 OF 7




N

SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

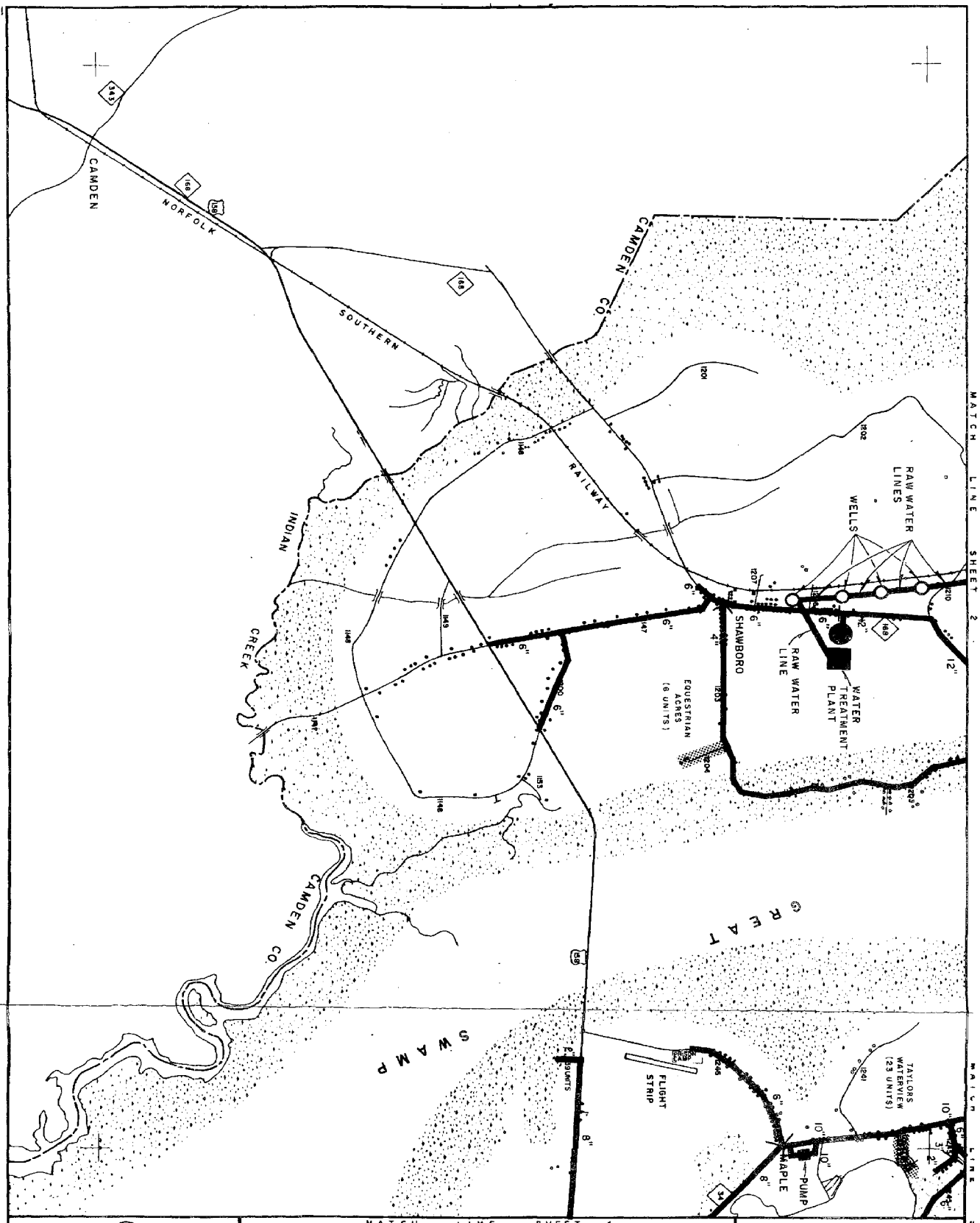
## WATER FACILITIES PLAN

WATER LINES
GROUND STORAGE
ELEVATED TANK
PUMP STATION

SUBDIVISION WITH WATER SYSTEM
SUBDIVISION WITHOUT WATER SYSTEM

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 4 OF 7




N

SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

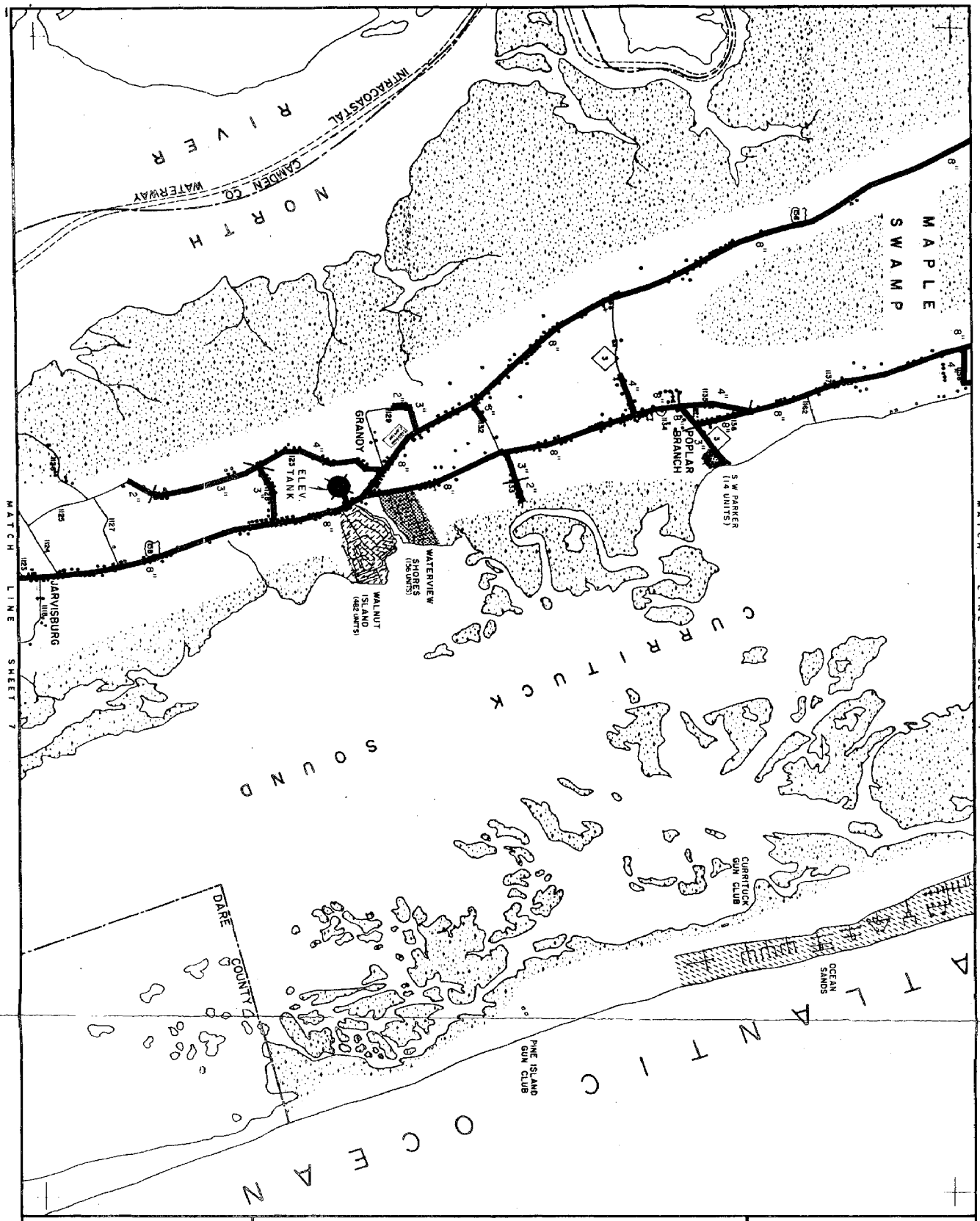
## WATER FACILITIES PLAN

WATER LINES
GROUND STORAGE
ELEVATED TANK
PUMP STATION

SUBDIVISION WITH WATER SYSTEM
SUBDIVISION WITHOUT WATER SYSTEM

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 5 OF 7




N

SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

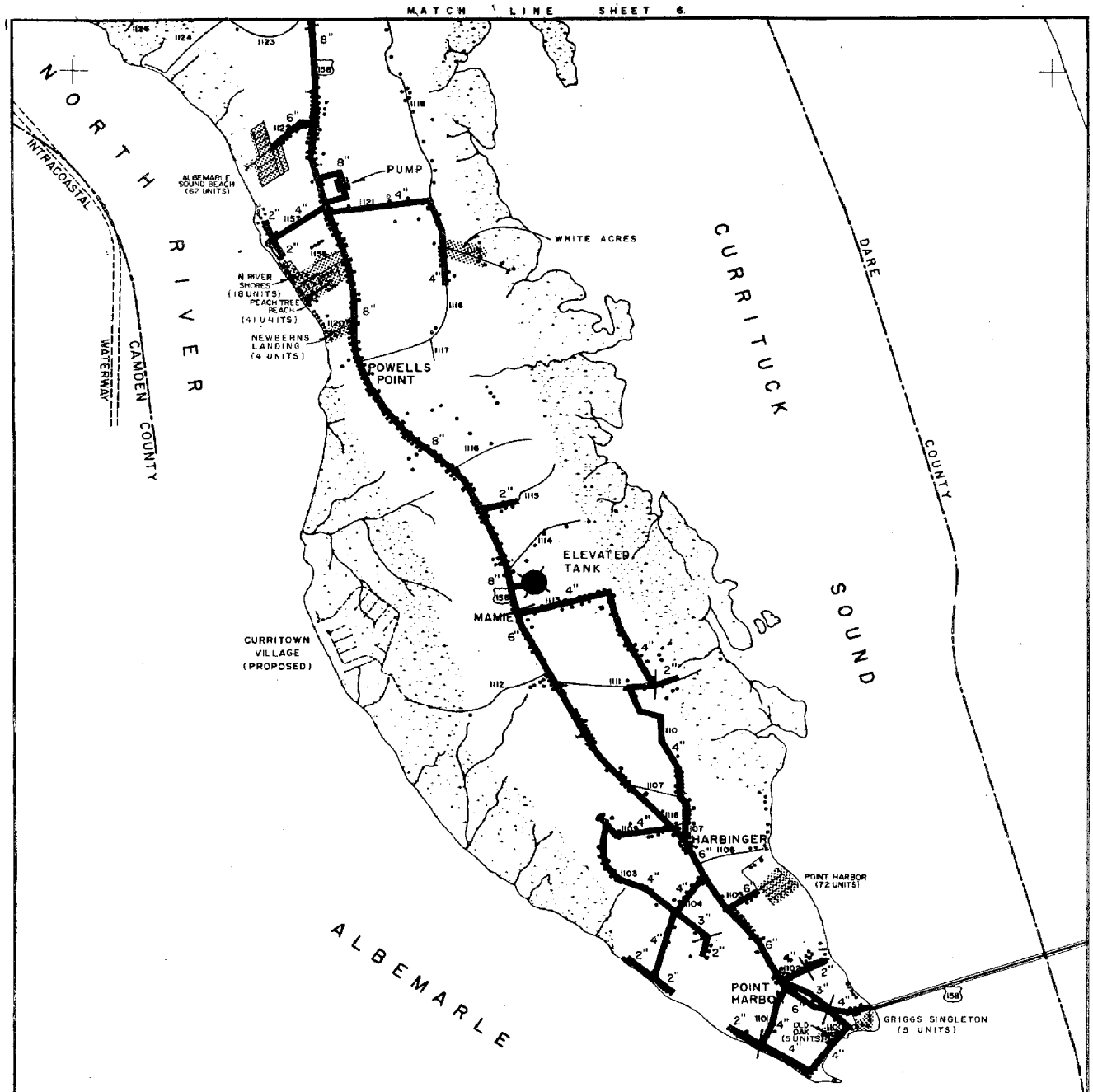
## WATER FACILITIES PLAN

WATER LINES
GROUND STORAGE
ELEVATED TANK
PUMP STATION

SUBDIVISION WITH WATER SYSTEM
SUBDIVISION WITHOUT WATER SYSTEM

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 6 OF 7




N

SCALE IN FEET

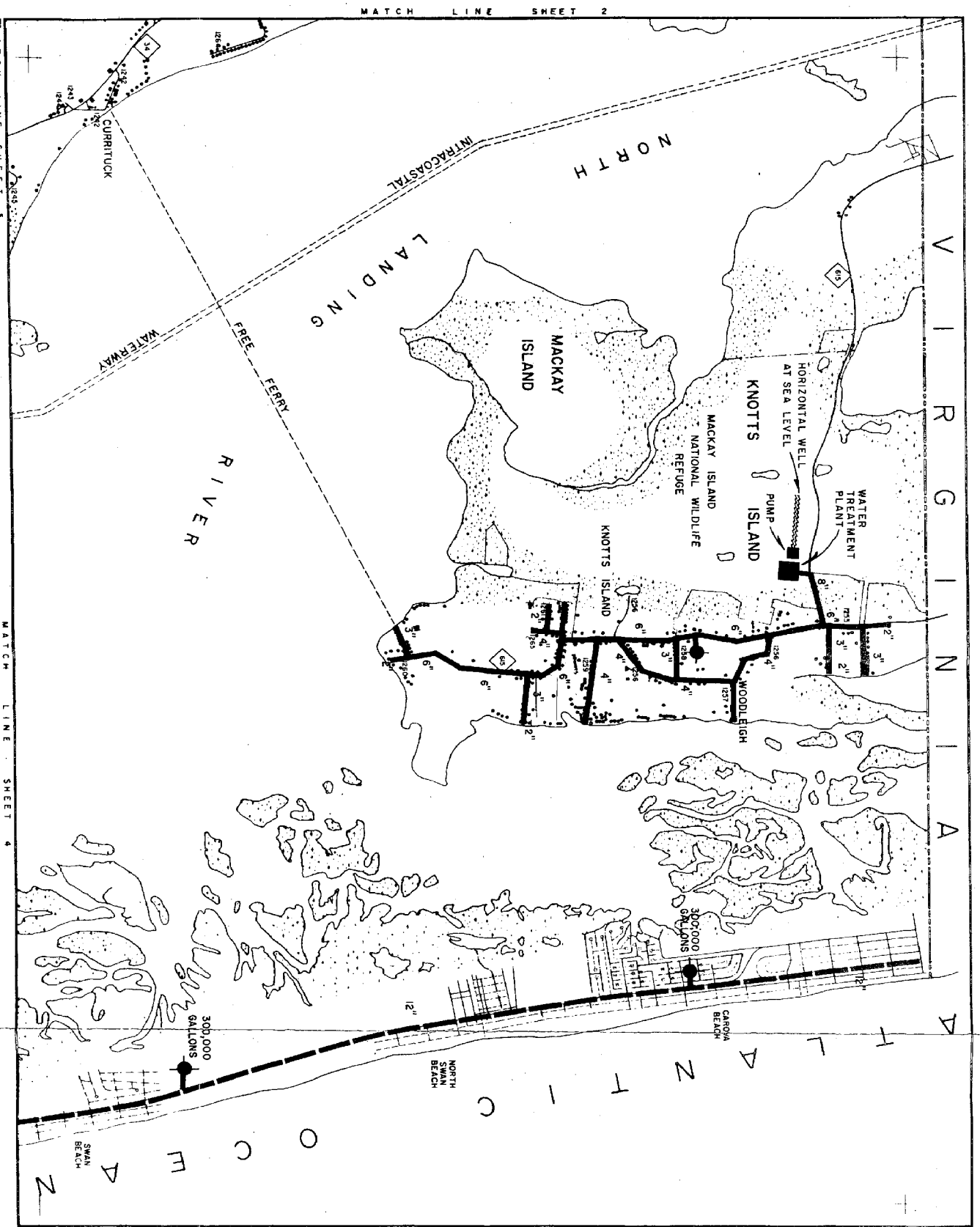
MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

## WATER FACILITIES PLAN

WATER LINES
GROUND STORAGE
ELEVATED TANK
PUMP STATION
SUBDIVISION WITH WATER SYSTEM
SUBDIVISION WITHOUT WATER SYSTEM

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 7 OF 7




N

WATER FACILITIES PLAN

ELEVATED TANK

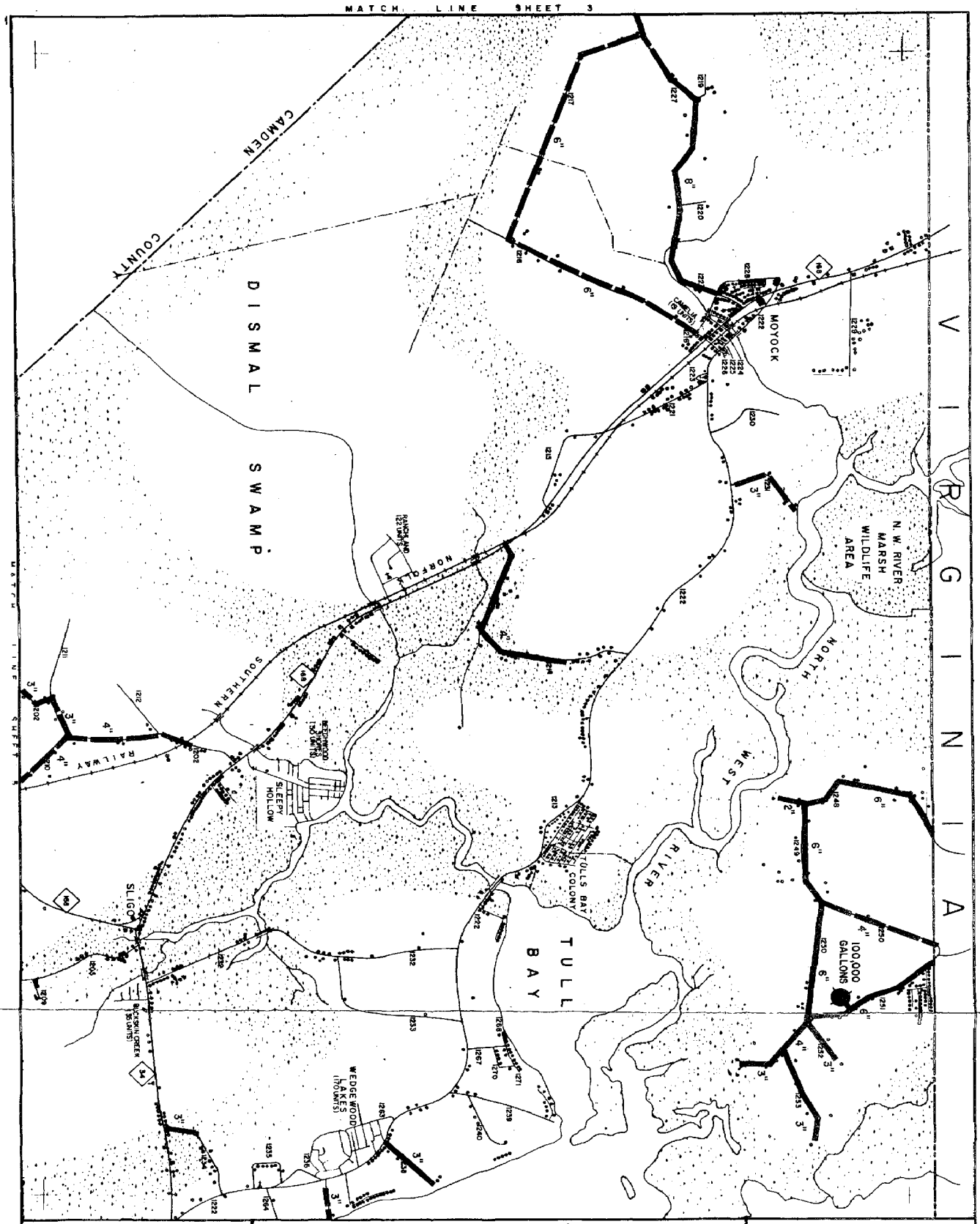
PUMP STATION

WATER LINES (PHASE 2)

WATER LINES (PHASE 3)

CURRITUCK COUNTY
NORTH CAROLINA

SHEET 1 OF 7




MATCH LINE SHEET 1

## WATER FACILITIES PLAN

ELEVATED TANK

PUMP STATION

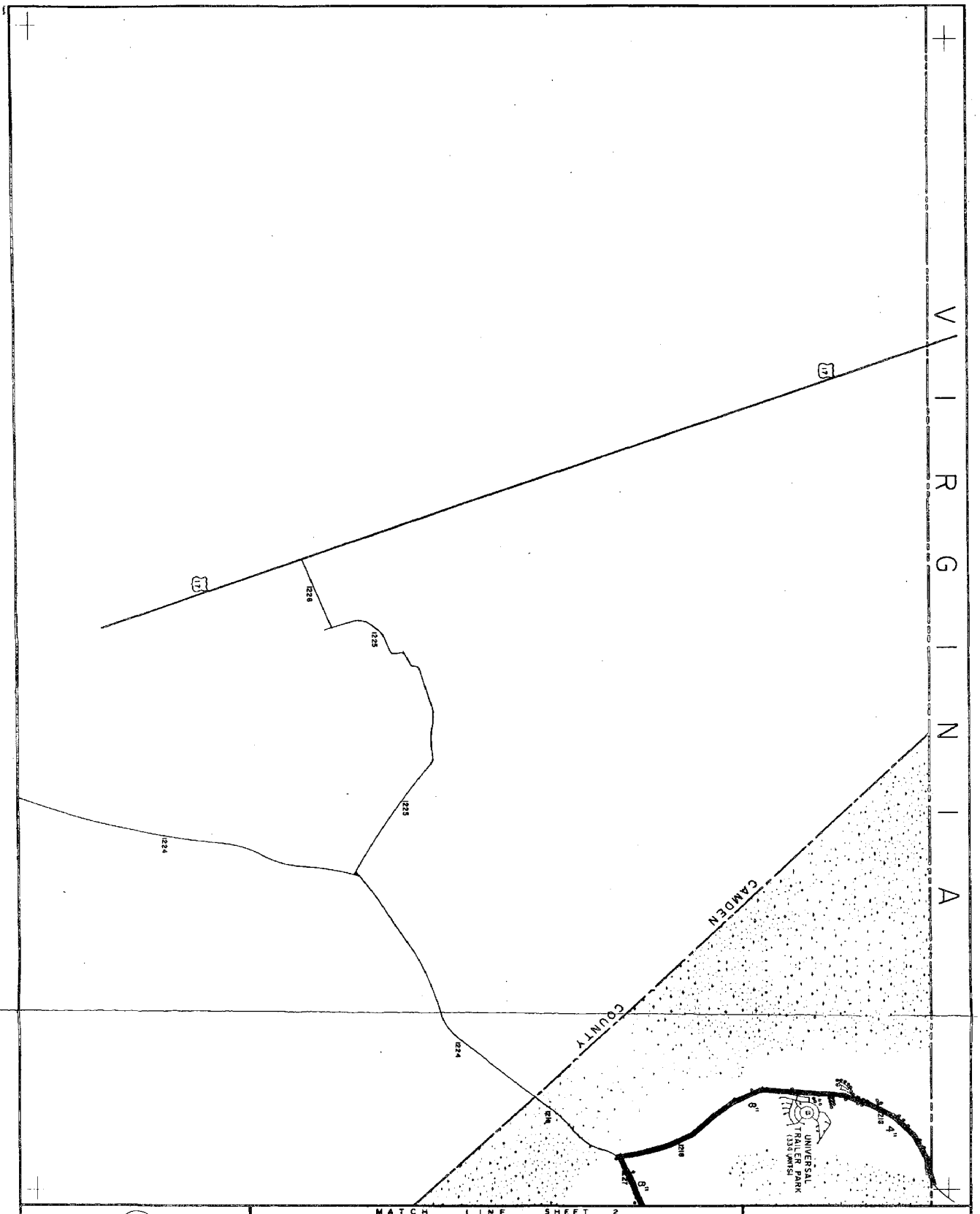
WATER LINES (PHASE 2)

WATER LINES (PHASE 3)

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 2 OF 7




N

SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

## WATER FACILITIES PLAN

ELEVATED TANK

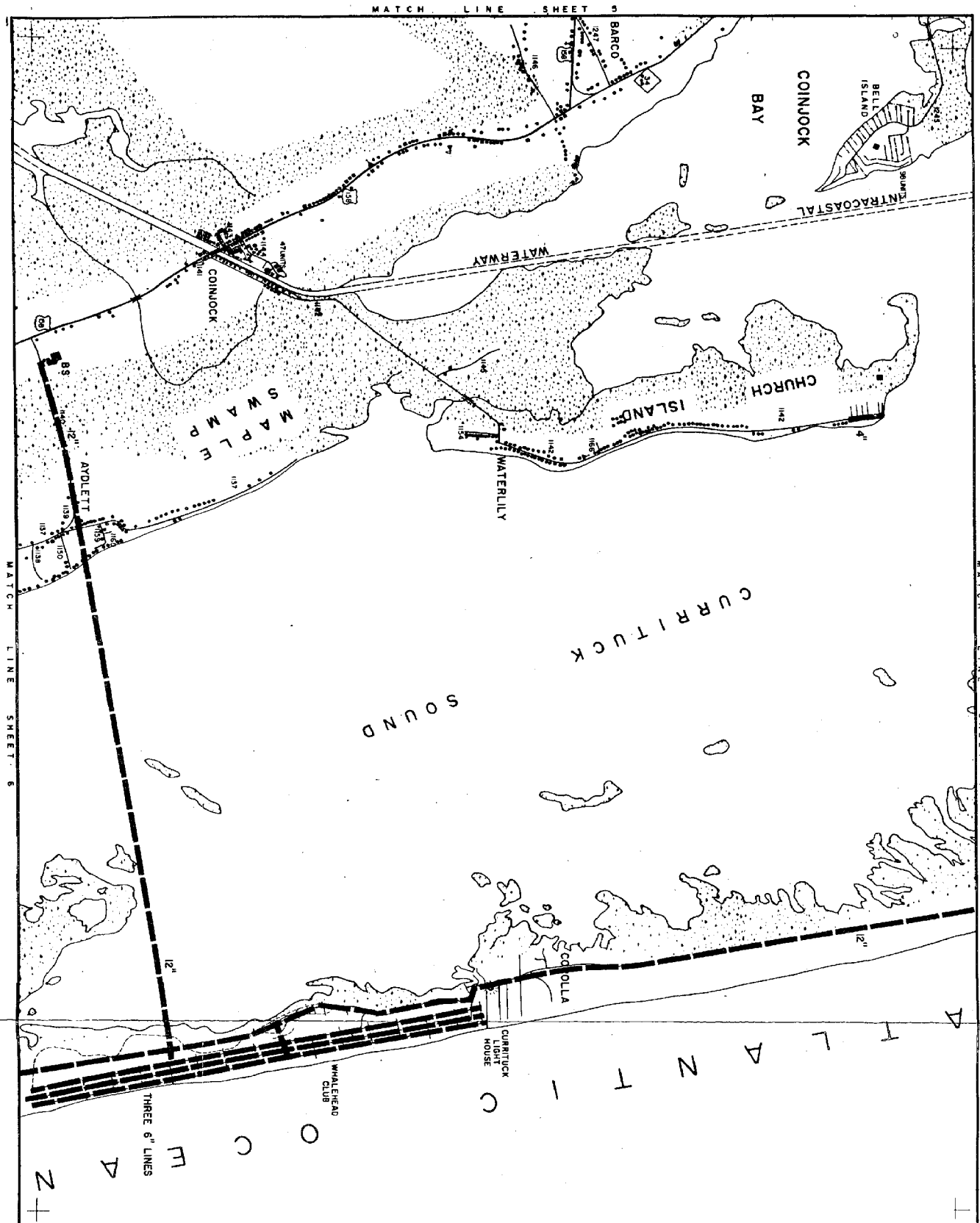
PUMP STATION

WATER LINES (PHASE 2)

WATER LINES (PHASE 3)

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 3 OF 7




N

SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

## WATER FACILITIES PLAN

ELEVATED TANK

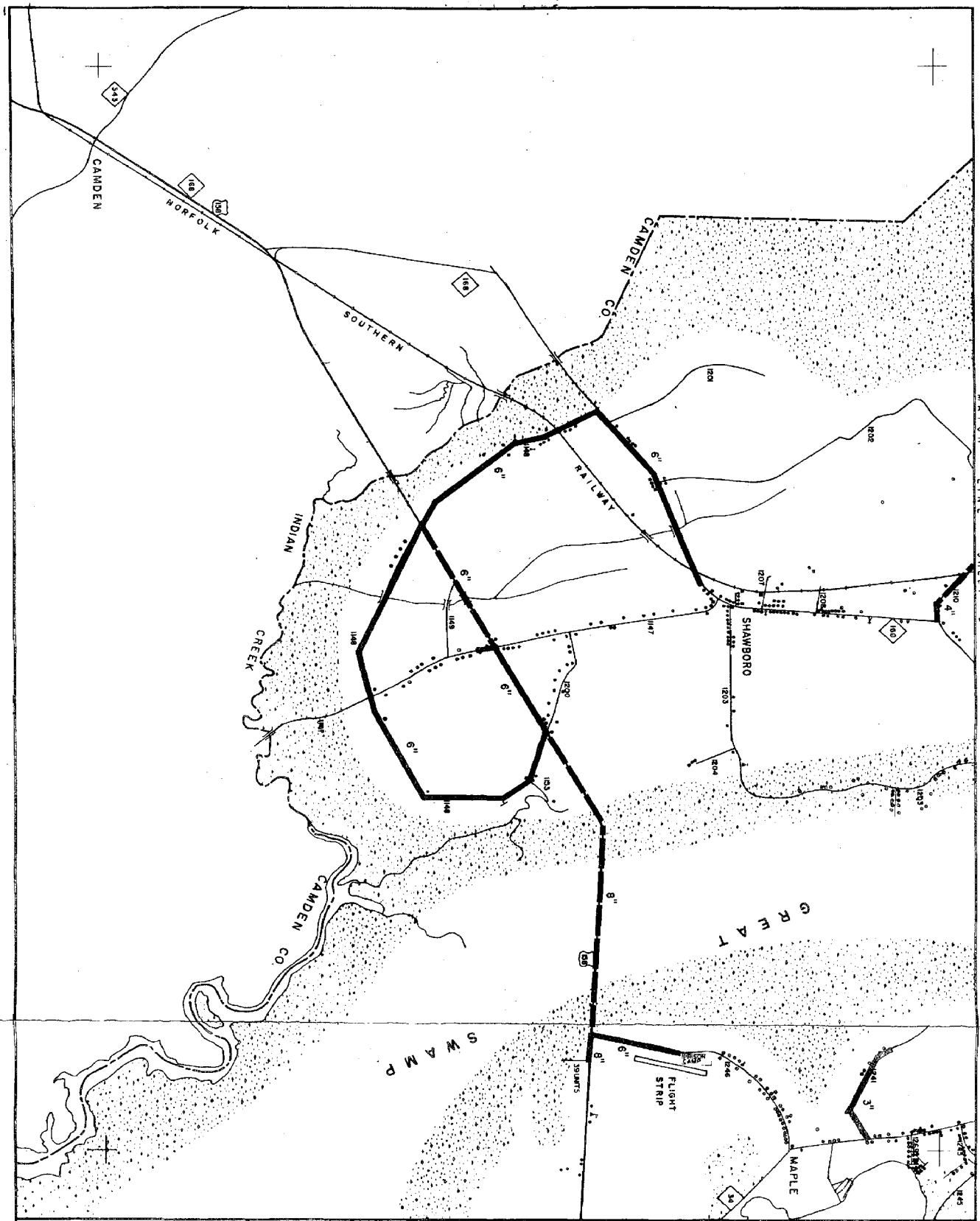
PUMP STATION

WATER LINES (PHASE 2)

WATER LINES (PHASE 3)

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 4 OF 7




N

0 500 1000 2000 3000 4000 5000 6000
SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

# WATER FACILITIES PLAN

ELEVATED TANK

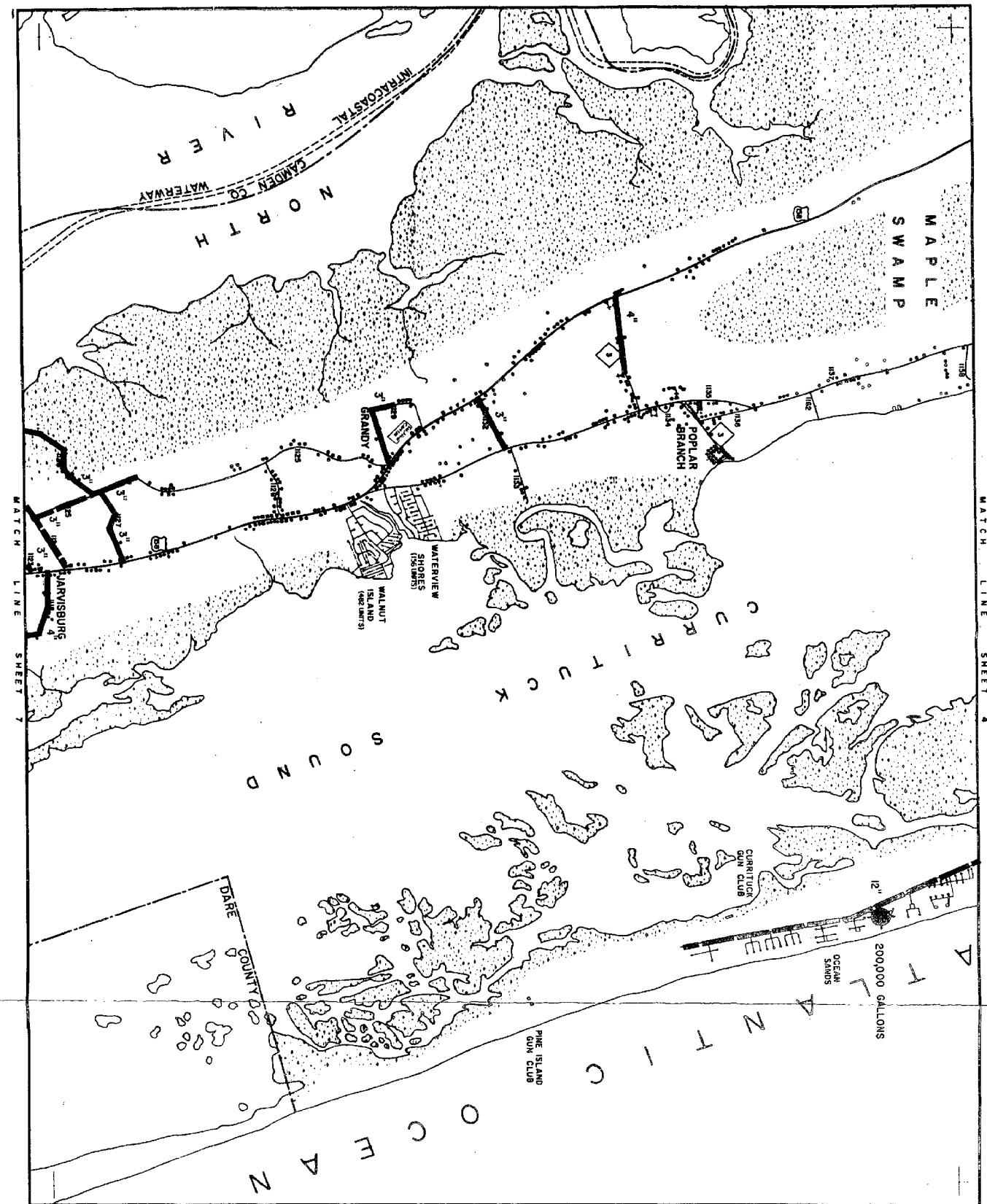
PUMP STATION

WATER LINES (PHASE 2)

WATER LINES (PHASE 3)

## CURRITUCK COUNTY
NORTH CAROLINA

SHEET 5 OF 7




N

SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

## WATER FACILITIES PLAN

ELEVATED TANK

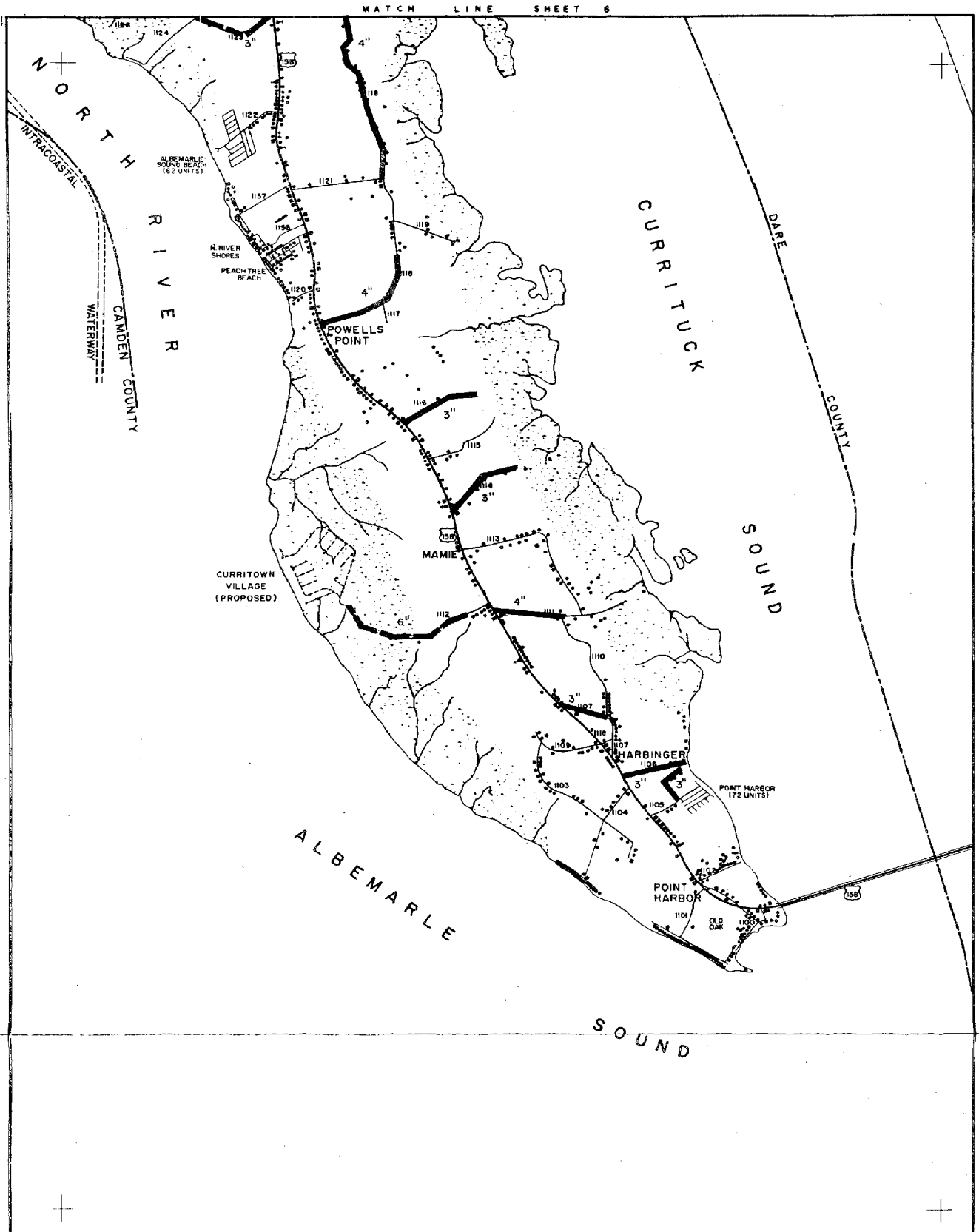
PUMP STATION

WATER LINES (PHASE 2)

WATER LINES (PHASE 3)

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 6 OF 7




N

SCALE IN FEET

MOORE, GARDNER & ASSOCIATES, INC
CONSULTING ENGINEERS

## WATER FACILITIES PLAN

ELEVATED TANK

PUMP STATION

WATER LINES (PHASE 2)

WATER LINES (PHASE 3)

# CURRITUCK COUNTY
NORTH CAROLINA

SHEET 7 OF 7

EXHIBIT 2

SUPPLEMENT TO PRELIMINARY ENGINEERING REPORT
(WATER FACILITY)

CONSTRUCTION COST ESTIMATES
(List All Major Items)

WATER SYSTEM: (See Attached Sheet)

Supply and Treatment:

| | | | |
|---|---|---|---|
| _____ | Wells | @ | _____ |
| _____ | Pumphouses | @ | _____ |
| _____ | Treatment Plant | @ | _____ |

Distribution System:

| | | | |
|---|---|---|---|
| LF 8" | _____ Pipe | @ | _____ |
| LF 6" | _____ " | @ | _____ |
| LF 2" | _____ " | @ | _____ |
| Ea. 8" | Valves | @ | _____ |
| Ea. 6" | " | @ | _____ |
| Lbs. | Fittings | @ | _____ |
| Ea. | Fire Hydrants | @ | _____ |
| Ea. | Meter Connection | @ | _____ |

Storage:

| | | | |
|---|---|---|---|
| _____ | gallon elevated tank | @ | _____ |
| | Tank Foundation | @ LS | _____ |

TOTAL CONSTRUCTION COST
(Round to nearest thousand dollars) _____

Above prices are current through Spring 1982.

SUPPLY AND TREATMENT:

| | | |
|---|---|---|
| 8 Wells & Pumphouses | @ $40,000 each | $ 320,000 |
| 10,500 LF 8" Raw Water Line | @ $6.00/LF | 63,000 |
| 1,600 LF 10" Raw Water Line | @ $8.00/LF | 12,800 |
| 1 Meter Vault | @ LS | 12,000 |
| 1 Treatment Plant | @ LS | 835,000 |
| Appurtenances | | 54,200 |

DISTRIBUTION SYSTEMS:

| | | |
|---|---|---|
| 26,000 LF 12" Water Main | @ $10.00/LF | $ 260,000 |
| 63,000 LF 10" Water Main | @ $ 8.00/LF | 504,000 |
| 226,000 LF 8" Water Main | @ $ 6.00/LF | 1,356,000 |
| 93,000 LF 6" Water Main | @ $ 4.50/LF | 418,500 |
| 181,400 LF 4" Water Main | @ $ 3.50/LF | 634,900 |
| 56,000 LF 3" Water Main | @ $ 3.25/LF | 182,000 |
| 96,300 LF 2" Water Main | @ $ 3.00/LF | 288,900 |
| 14 12" Valves & Box | @ $600.00 each | 8,400 |
| 30 10" Valves & Box | @ $500.00 each | 15,000 |
| 121 8" Valves & Box | @ $400.00 each | 48,400 |
| 144 6" Valves & Box | @ $300.00 each | 43,200 |
| 102 4" Valves & Box | @ $250.00 each | 25,500 |
| 29 3" Valves & Box | @ $225.00 each | 6,525 |
| 96 2" Valves & Box | @ $200.00 each | 19,200 |
| 82 Fire Hydrant | @ $500.00 each | 41,000 |
| 60 LF 16" Steel Casing | @ $ 70.00/LF | 4,200 |
| 60 LF 12" Steel Casing | @ $ 55.00/LF | 3,300 |
| 120 LF 10" Steel Casing | @ $ 50.00/LF | 6,000 |
| 60 LF 6" Steel Casing | @ $ 45.00/LF | 2,700 |
| 400 LF Stream Crossing | @ $ 50.00/LF | 20,000 |
| 6 2" Meter & Box | @ $ 500.00 each | 3,000 |
| 2 4" Meter & Box | @ $ 4,000 | 8,000 |
| 5 100,000 Gal. Elev. Tank with Foundation | @ $ 150,000 each | 750,000 |
| 1 400 GPM Booster Pump Station | @ LS | 50,000 |
| 1 300 GPM Booster Pump Station | @ LS | 40,000 |
| 1 150 GPM Booster Pump Station | @ LS | 35,000 |
| 1 500,000 Gal. Ground Level Tank | @ LS | 125,000 |
| 250 LF Intracoastal Waterway Crossing | @ $400/LF | 100,000 |
| 62,000 lbs. Fittings | @ $1.00/lb. | 62,000 |
| 3,089 Service Connections | @ $ 225 each | 695,025 |
| Stone, Pavement Patching Concrete & Appurtenances | @ LS | 429,250 |
| TOTAL CONSTRUCTION COST | | $ 7,482,000 |

## PROJECT COST ESTIMATE

| | |
|---|---|
| Construction | $ 7,482,000 |
| Land & Rights | $ 45,000 |
| Legal & Administrative | $ 81,000 |
| Engineering | $ 737,000 |
| Interest | $ 605,000 |
| Equipment | $ |
| Contingencies | $ 804,000 |
| TOTAL PROJECT COST | $9,754,000 |

## PROJECT FINANCING PLAN

| Cash Contrib. by Appl. | Clean Wat. Bond Grant | Other Grant* | FmHA Loan GO Bonds | Total |
|---|---|---|---|---|
| 54,058 | 2,240,692 | | 7,459,250 | 9,754,000 |

*Do not assume any FmHA Grant

## Existing Indebtedness:
(This facility only)

| Purpose | Amount Owed | Amortization Period | Amount of Installment |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

## FLOOD PLAIN INFORMATION

Is any part of project located in a flood plain area? If project is in flood area, is applicant eligible for National Flood Insurance?

## EXISTING RATE SCHEDULE

| | | | | |
|---|---|---|---|---|
| First | 2000 | gallons @ | $22.00 | Min. |
| Next | | gallons @ | | Per 1,000 gal. |
| " | | gallons @ | | " " " |
| " | | gallons @ | | " " " |
| All Over | 2000 | gallons @ | $ 2.10 | " " " |

## PROPOSED RATE SCHEDULE

| | | | | |
|---|---|---|---|---|
| First | 2000 | gallons @ | $29.00 | Min. |
| Next | | gallons @ | | Per 1,000 gal. |
| " | | gallons @ | | " " " |
| " | | gallons @ | | " " " |
| All Over | 2000 | gallons @ | $ 2.10 | " " " |

## USE AND INCOME ESTIMATES
(According to proposed rate schedule)

WATER:

Benefited Users (All users with 3/4 x 5/8 meters)

| | Existing | New | Total | | | | |
|---|---|---|---|---|---|---|---|
| | | 936 | 936 | users @ | 2,000 | gal. | $ 20,592 |
| | | 1552 | 1552 | users @ | 3,500 | gal. | $ 39,033 |
| | | 450 | 450 | users @ | 7,500 | gal. | $ 15,098 |
| | | 111 | 111 | users @ | 15,000 | gal. | $ 5,472 |
| | | 27 | 27 | users @ | 35,000 | gal. | $ 2,465 |
| | | 5 | 5 | users @ | 75,000 | gal. | $ 877 |
| | | | | users @ | | gal. | $ |
| TOTAL | | 3081 | 3081 | users @ | | gal. | $ 83,537 |

Non Benefited Users (All users with larger than 3/4 x 5/8 meters)

| | Existing | New | Total | | | | |
|---|---|---|---|---|---|---|---|
| | | 2 | 2 | users @ | 75,000 | gal. | $ 365 |
| | | 4 | 4 | users @ | 125,000 | gal. | $ 1,149 |
| | | 1 | 1 | users @ | 225,000 | gal. | $ 497 |
| | | 1 | 1 | users @ | 340,000 | gal. | $ 739 |
| TOTAL | | | | users @ | | gal. | $ 2,750 |

TOTAL = $ 86,287 x 12 = $ 1,035,444 Annually

## BUDGET FOR COMPLETED FACILITY

| | Actual (Fiscal Year Ending 19 ) | Estimated (Completed Facility) |
|---|---|---|
| **Income:** | | |
| Water Sales | | $ 1,035,444 |
| Adv. Tax | | |
| Other | | |
| TOTAL | | $ 1,035,444 |
| **EXPENSES:** | | |
| Salaries | | |
| Supt. & Clerk | | $ 28,000 |
| Labor | | 41,000 |
| Soc. Security Tax | | 5,500 |
| Office Exp. (Supplies, Postage, Heat, Electricity, Telephone, Equipment, etc.) | | 4,000 |
| Bond & Insurance | | $ 9,000 |
| Audit | | 3,500 |
| Testing-St. Reg. Agy. | | |
| Chemicals | | 20,000 |
| Transportation | | 10,000 |
| Electricity | | 22,000 |
| Supplies | | 12,000 |
| Maint. & Repairs | | 10,000 |
| Miscellaneous | | 7,000 |
| Bulk Water Purchase | | |
| Debt Service | | |
| Existing | | |
| Proposed Addition | | $ 862,886 |
| TOTAL | | $ 1,034,886 |
| BALANCE AVAILABLE | | $ 558 |