639SERBSF10,636

639SERBSF10,636

Site Name (Subject):	UNION OIL CO. SE TERM
Site ID (Document ID):	NCD000609974
Document Name (DocType):	Contractor Report (CONTR)
Report Segment:	
Description:	FIT Report: Screening Site Inspection, Phase I
Date of Document:	7/5/1990
Date Received:	
Box: *Enter SF and # with no spaces*	SF10,636
Access Level:	PUBLIC
Division:	WASTE MANAGEMENT
Section:	SUPERFUND
Program (Document Group):	SERB (SERB)
Document Category:	FACILITY

Print Report for Record | **Go to New Blank Record** | **Go to New Record - (default to last record values)** | **Delete Record**

FIT REPORT
NCD 000 609 974 GUILFORD
UNION OIL SE TERMINAL
GREENSBORO, NC

NUS CORPORATION
1927 LAKESIDE PARKWAY
SUITE 614
TUCKER, GEORGIA 30084
404-938-7710

C-586-7-0-2

July 5, 1990

CERCLA

Mr. A. R. Hanke
Site Investigation and Support Branch
Waste Management Division
Environmental Protection Agency
345 Courtland Street, N. E.
Atlanta, Georgia 30365

Date: _____
Site Disposition: _____
EPA Project Manager: _____

Subject: Screening Site Inspection, Phase I
Union Oil Company, S.E. Terminal
Greensboro, Guilford County, North Carolina
EPA ID No. NCD000609974
TDD No. F4-8911-76

Dear Mr. Hanke:

FIT 4 conducted a Phase I Screening Site Inspection at Union Oil Company, S.E. Terminal in Greensboro, Guilford County, North Carolina. The inspection included a review of EPA and state file material, completion of a target survey, and a drive-by reconnaissance of the facility and surrounding area.

Union Oil Company, S.E. Terminal, is located at 6801 West market Street in Greensboro, North Carolina. The facility is in a heavy industrial area; a trailer park is located across the street (Ref. 1).

Union Oil Company, S.E. Terminal, began operations in 1929, and in 1980 was purchased by Gulf Oil Company (Ref. 2). In 1985, the facility was purchased by Standard Oil of Ohio (Ref. 2). Prior to 1989, Standard Oil of Ohio sold the facility to its current owner, British Petroleum Oil (Refs. 1, 2).

Union Oil Company has four tanks with a 185,000-barrel capacity, and Gulf Oil has seven tanks with a 331,000-barrel capacity. The Union Oil Company receives oil from Colonial Pipelines and distributes it to truck and tank cars (Ref. 3).

Union Oil Company, S.E. Terminal, has maintained onsite, underground storage tanks for American Petroleum Institute (API) separator sludge (Ref. 2). The waste produced included API separator sludge, API separator slop oil, and leaded tank bottoms (Refs. 2, 4). Onsite disposal of tank sludges and petroleum additives probably occurred from 1929 to 1980 (Ref. 2). In 1982, Troy C. Griffin Oil, Inc. of Jefferson, Georgia, handled the cleanup of the tank bottoms, which were hazardous based on their ignitability (Ref. 3).

The Union Oil Company, S.E. Terminal, first entered the North Carolina RCRA system on August 14, 1980 (Ref. 5). The facility filed a Part A application for a Hazardous Waste Permit on November 7, 1980 (Ref. 4). Union Oil Company was deleted as a treater, storer, and disposer under RCRA on March 4, 1982 (Ref. 6). The facility withdrew from interim status (Ref. 5). Union Oil Company was in

full compliance with generator standards during a compliance inspection on March 23, 1982 (Ref. 7). A Part B was not filed (Ref. 8). On March 30, 1984, the facility's interim status was terminated (Ref. 8). A generator inspection revealed no waste at the facility and no violation as of October 11, 1987 (Ref. 9). The facility is currently listed as a generator under RCRA (Ref. 5). The facility also was granted a National Pollutant Discharge Elimination System permit, which expired June 30, 1981 (Ref. 4).

Union Oil Company, S.E. Terminal, is located within the Carolina State Belt of the Piedmont Physiographic Province (Refs. 10; 11, p. 76). The area is characterized by gently rolling topography with moderately steep slopes along the drainage ways (Ref. 12). This region has a temperate climate (Ref. 13, pp. 7, 11). Total annual precipitation averages about 45 inches with a net annual precipitation of 4 inches (Refs. 14, pp. 3, 17; 15). The 1-year, 24-hour rainfall is 3 inches (Ref. 16).

The geology of the slate belt consists of folded and fractured metamorphic bedrock overlain nearly everywhere by residual material termed saprolite (Refs. 10, pp. 77, plate 1, 14, p. 3; 17). The saprolite ranges in thickness from a few feet near rock outcrops to more than 100 feet in interstream areas with an average thickness of 30 feet on most hills and ridges (Refs. 13, p. 38; 14, p. 3). Metamorphic rock types in the area include highly altered granite, gabbro, and diorite (Refs. 9; 10, p. 77, plate 1).

The saprolite and bedrock act as a single hydrologic system and there is no confining layer present between them. In the saprolite, groundwater occurs within intergranular pore spaces (Ref. 14, p. 4). In the bedrock, groundwater occurs primarily within joints, fractures, and other secondary openings (Ref. 10, plate 1). The frequency, size, and interconnection of both joints and fractures diminishes with depth (Ref. 14, p. 4). There are few open fractures at depths greater than 400 feet (Ref. 13, p. 12).

The saprolite has a hydraulic conductivity of less than 10-7 cm/sec and acts as a reservoir which slowly feeds water into the underlying bedrock (Refs. 14, pp. 3, 6; 18). It is also the unit from which most domestic water supplies in the region are obtained (Ref. 10, pp. 23, 77-78). The water is supplied to both dug and bored wells that are completed within the saprolite at, and just below, the water table (Ref. 10, pp. 77-78). The depth to the water table in the site area is about 15 feet below land surface (Ref. 13, pp. 7, 59).

Surface water drains 1,000 feet southwest into a pond. Although there is no surface water pathway continuing from the pond, there may be an outlet which drains into another pond. This pond is located 200 feet southwest of the first pond and drains west into an unnamed tributary. The tributary flows 2 miles to the East Fork Deep River, then it goes into the High Point Lake. It continues 6 miles to the Deep River to complete the 15-mile migration pathway (Ref. 19).

The city of High Point obtains its water supply from an intake located in the Deep River just below the High Point Lake dam (Ref. 20). High Point serves the population of 62,000 (300,000 connections) within the city limits and is branching out to serve other areas between High Point and Greensboro (Ref. 19). The intake for this facility is 6 miles downstream from the facility (Ref. 18).

The Jamestown Water Department obtains its water from Oakdale treatment facility on the Deep River. This intake is located 5 miles downstream from the facility and serves 1,000 residents and 150 businesses (Ref. 21). Lake Brant and High Point Lake are known for the fishing and recreation (Ref. 22). There is no flood plain near the facility (Ref. 23).

The city of Greensboro and nearby areas receive municipal water from the Guilford County Water Department (GCWD). GCWD serves about 66,000 accounts. The water is obtained from Lake Townsend, Lake Higgins, and Lake Brandt. Guilford County has two raw water lines. Water from Lakes Brandt and Higgins is treated at Mitchell, and water from Lake Townsend is treated at Townsend. After the treatment, the different water lines are connected (Ref. 24). These lakes are not affected by the facility's surface water drainage. Residents not served by municipal water receive water from private wells. A house count on a topographic map of the study area revealed about 139 homes that use private wells within 3 miles of the facility. There are an additional 90 homes between 3 and 4 miles that utilize private wells. The actual house count may be larger considering the ages of the topographic maps (Ref. 19). Most wells in the Greensboro area are approximately 150 feet deep (Ref. 24). The nearest well is located approximately 100 feet from the facility in a trailer park on West Market Street. The nearest resident is 50 feet from the facility. There are about seven trailers in the park that use the community well (Ref. 1).

Union Oil Company, S.E. Terminal, is surrounded by many other oil companies. The facility's tanks are diked. The Union Oil Company is not accessible because it is surrounded by a 6-foot fence with barbed wire. There is a railroad track facing West market Street, a guarded gate, and posted warning signs (Ref. 1). The population within 1 and 4 miles of the facility is approximately 318 and 30, 243, respectively (Refs. 25, 26). There are no day-care centers or schools near the area (Ref. 1). There are no sensitive environments within the 4-mile radius (Ref. 19). The plant Nestronia (Nestronia umbellula) and the Greensboro burrowing crayfish (Cambarus catagius) are state-designated threatened species found in Guilford County (Ref. 27).

Based on the results of this evaluation and the presence of two surface water intakes, FIT 4 recommends that a Phase II SSI be conducted at Union Oil Company, S.E. Terminal on a medium-priority basis. If you have any comments or questions about this Phase I SSI, please contact me at NUS Corporation.

Very truly yours,

Approved:

Simonia Delaine
Project Manager

SD/gwn

Enclosures

cc: Kelly Cain

MISSING

#23

REFERENCES

1. NUS Corporation Field Logbook No. F4-1878 for Union Oil Corporation, S.E. Terminal, TDD No. F4-8911-76. Documentation of facility reconnaissance, December 11, 1989.

2. EPA General Information (EPA Form 3510-1) and Hazardous Waste Permit Application (EPA Form 3510-3) for Union Oil Corporation, S.E. Terminal, Greensboro, North Carolina. Filed by R.E. Wohlgemuth, Vice President, Northern Region, November 7, 1980.

3. RCRA Inspection Report for Union Oil Corporation, S.E. Terminal, Greensboro, North Carolina. Filed by J.H. Deakins, District Sanitarian, August 25, 1982.

4. Potential Hazardous Waste Site Preliminary Assessment (EPA Form 2070-12) and attachments for Union Oil Corporation, S.E. Terminal. Filed by Lee Crosby and D. Mark Durway, North Carolina Department of Human Resources, January 22, 1985.

5. Jim Edwards, Compliance Officer telephone conversation with Joan Dupont, NUS Corporation, March 14, 1990. Subject: RCRA information.

6. O.W. Strickland, Head, Solid and Hazardous Waste Management Branch, Environmental Health Section, letter to B.L. Swinney of the Gulf Oil Corporation, March 4, 1982. Subject: RCRA information.

7. J.H. Deakins, Waste Management Inspector, memorandum to O.W. Strickland, Head, Solid and Hazardous Waste Management Branch, March 23, 1984. Subject: RCRA information for Union Oil Corporation, S.E. Terminal.

8. O.W. Strickland, Head, Solid and Hazardous Waste Management Branch, Environmental Health Section. Letter to John T. Ross of Union Oil Corporation, S.E. Terminal, March 13, 1984. Subject: Permit information.

9. Generator Inspection Form Part 262, Union Oil Corporation, S.E. Terminal, Greensboro, North Carolina. Inspection date: October 17, 1989; obtained from state files.

10. The North Carolina Geological Survey and John M. Parker, III in accordance with the State Geologic Map Advisory Committee, Geologic Map of North Carolina, (1985).

11. M.J. Mundorff, Geology and Groundwater in the Greensboro Area, North Carolina, Bulletin Number 55, (Raleigh: USGS, 1948), pp. 23, 76-78, plate 1.

12. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Guilford County, North Carolina, December 1977), p. 1.

13. Charles C. Daniel, III and N. Bonar Sharpless, Groundwater Supply Potential and Procedures for Well Site Selection, Upper Cape Fear River Basin, (USGS, 1983), pp. 7, 11-12, 38, 59.

14. Edwin O. Floyd and Richard R. Peach, An Appraisal of the Groundwater Resources of the Upper Cape Fear River Basin North Carolina, Groundwater Bulletin Number 20, (USGS and the North Carolina Office of Water and Air Resources, 1974), pp. 3-4, 6, 17).

15. U.S. Department of Commerce, Climatic Atlas of the United States (Washington, D.C.: GPO, June 1968) Reprint: 1983, National Oceanic and Atmospheric Administration, p. 63.

16. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper No. 40 (Washington, D.C.: GPO, 1961).

17. Charles C. Daniel, III, Statistical Analysis Relating Well Yield in Construction Practices and Siting of Wells in the Piedmont and Blue Ridge Provinces of North Carolina, Water Resources Investigations Report 86-4132, (Washington, D.C.: GPO, 1987), pp. 9-10.

18. U.S. Environmental Protection Agency, Uncontrolled Hazardous Waste Site Ranking System: A Users Manual (HW-10), originally published in the July 16, 1982, Federal Register (Washington, D.C.: GPO, 1984), p. 15.

19. U.S. Geological Survey, 7 5 minute series Topographic Quadrangle Maps of North Carolina: Greensboro, North Carolina 1951 (Photorevised 1968), Lake Brandt, North Carolina 1951 (PR 1968), Summerfield, North Carolina 1969, Guilford, North Carolina 1951 (PR 1968), scale 1:24,000.

20. Wayne Slayton, Water and Sewer Supervisor, telephone conversation with Michael Profit, NUS Corporation, May 3, 1988. Subject: Water and intakes in the High Point area.

21. John Frezell, Town Manager, telephone conversation with Eric Corbin, NUS Corporation, May 18, 1989. Subject: Water and intakes in the High Point area.

22. Fishing Information for North Carolina City Lake Fishing in the Central Piedmont, North Carolina Wildlife Resources Commission, Revised September 1985.

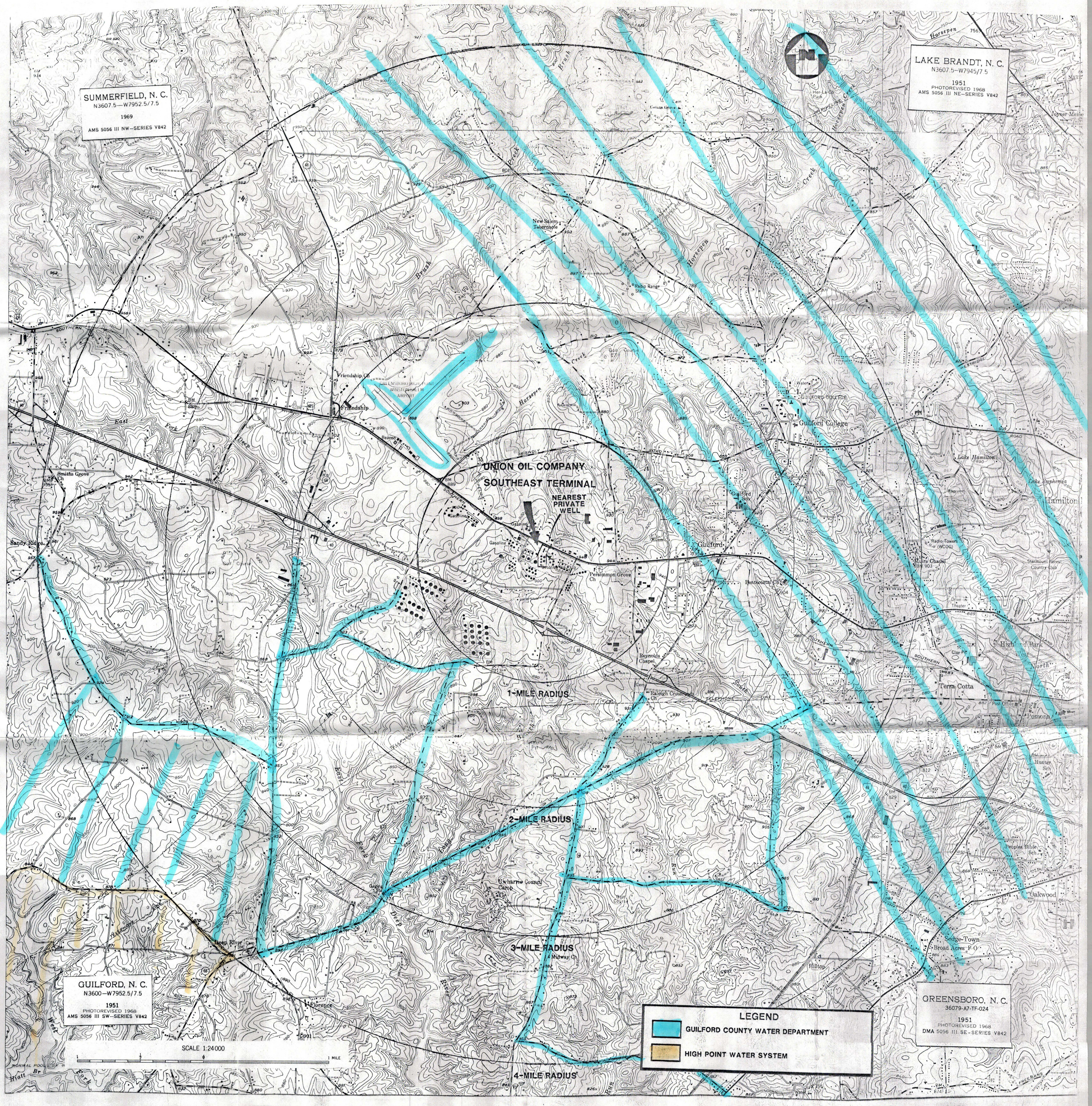
23. Federal Emergency Management Agency, Flood Insurance Rate Map City of Greensboro, North Carolina, Community-Panel Number 375351 0009C, revised September 30, 1988.

24. Don Grubbs, Guilford County Water Department, Greensboro, North Carolina, telephone conversation with Joan Dupont, NUS Corporation, May 9, 1988. Subject: Water information.

25. U.S. Bureau of the Census, Estimates of Households for Counties: July 1, 1985, Current Population Reports, Series P-23, No. 156 (Washington, D.C.: GPO, 1988).

26. U.S. Environmental Protection Agency, Graphical Exposure Modeling System (GEMS) Data Base, compiled from U.S. Bureau of the Census data (1980).

27. North Carolina Natural Heritage Program Element List for Guilford County, June 21, 1989).


SUMMERFIELD, N. C.
N3607.5—W7952.5/7.5
1969
AMS 5056 III NW—SERIES V842
LAKE BRANDT, N. C.
N3607.5—W7945/7.5
1951
PHOTOREVISED 1968
AMS 5056 III NE—SERIES V842
GUILFORD, N. C.
N3600—W7952.5/7.5
1951
PHOTOREVISED 1968
AMS 5056 III SW—SERIES V842
GREENSBORO, N. C.
36079-A7-TF-024
1951
PHOTOREVISED 1968
DMA 5056 III SE—SERIES V842
UNION OIL COMPANY
SOUTHEAST TERMINAL
NEAREST PRIVATE WELL
1-MILE RADIUS
2-MILE RADIUS
3-MILE RADIUS
4-MILE RADIUS
LEGEND
GUILFORD COUNTY WATER DEPARTMENT
HIGH POINT WATER SYSTEM
SCALE 1:24000
1 MILE
Friendship
Guilford College
Guilford
Lake Hamilton
Lake Euphemia
Hamilton
Terra Cotta
Fomona
Oakwood
Sedge-Town
Broad Acres P.O.
Hilltop
Florence
Deep River
Sandy Ridge
Smiths Grove
Persimmon Grove Ch
Pentecostal Ch
Reynolds Chapel
Raleigh Crossroads Ch
Uwharrie Council Camp
Midway Ch
Muirs Chapel
Starmount Forest Country Club
Radio Towers (WCOG)
Radio Range Sta
New Salem Tabernacle
Greensboro High Point Winston-Salem Airport
Gasoline
Golf Course
Drive-in Theater
Clay Pit
Post Office
Hunter Sch
Peoples Bible Sch
Joyner Meno
Her-La-Co Park
Cedar Grove Cem
Deep River Cem
Hiatt Br
West Fork
Deep River
East Fork
Brush Creek
Horsepen Creek
Bull Run
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Butt Creek
Southern
Friendly
Pipeline
Telephone Line
Westridge
Freemans Mill
Normal Pool Elev 61

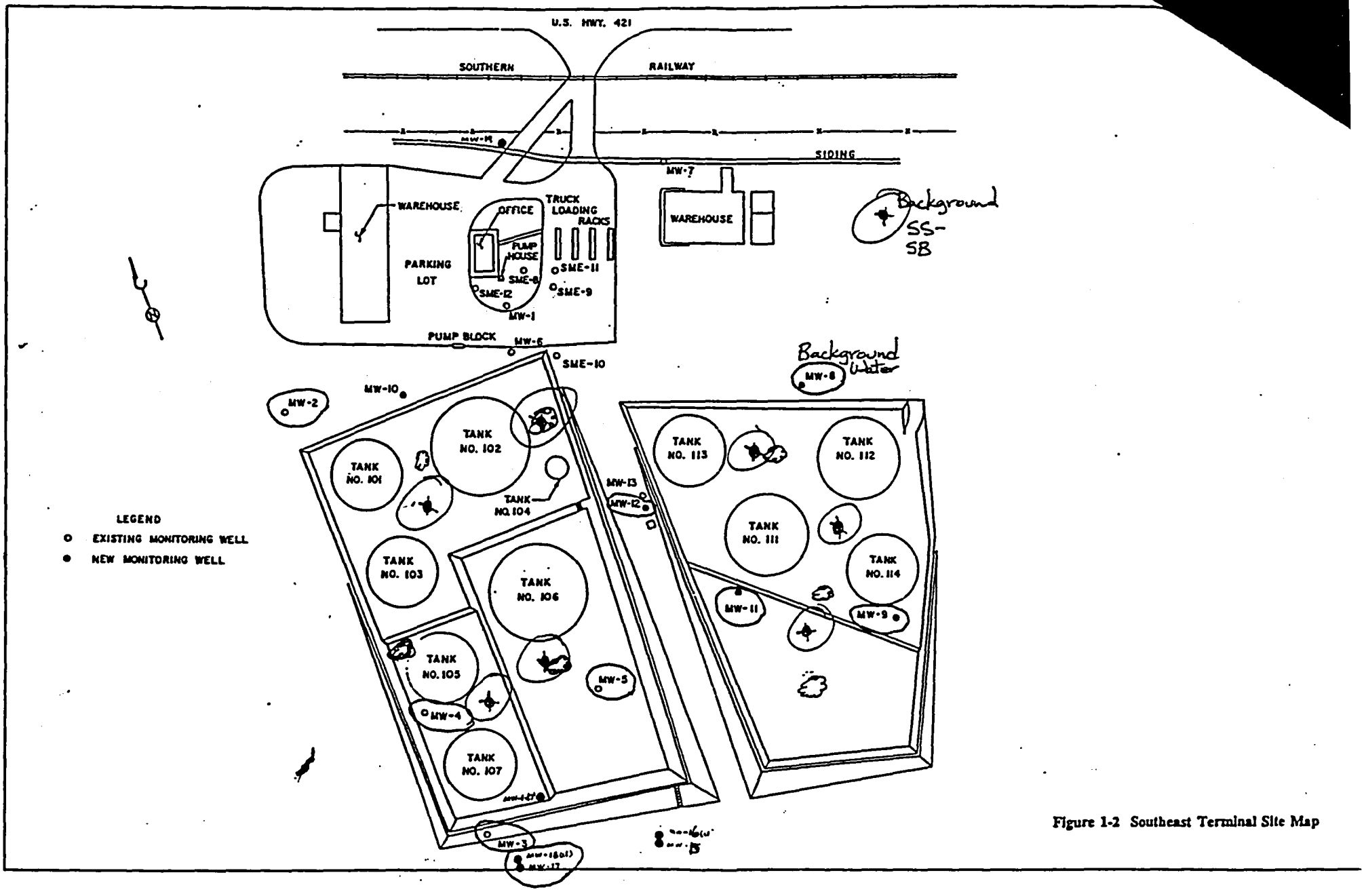
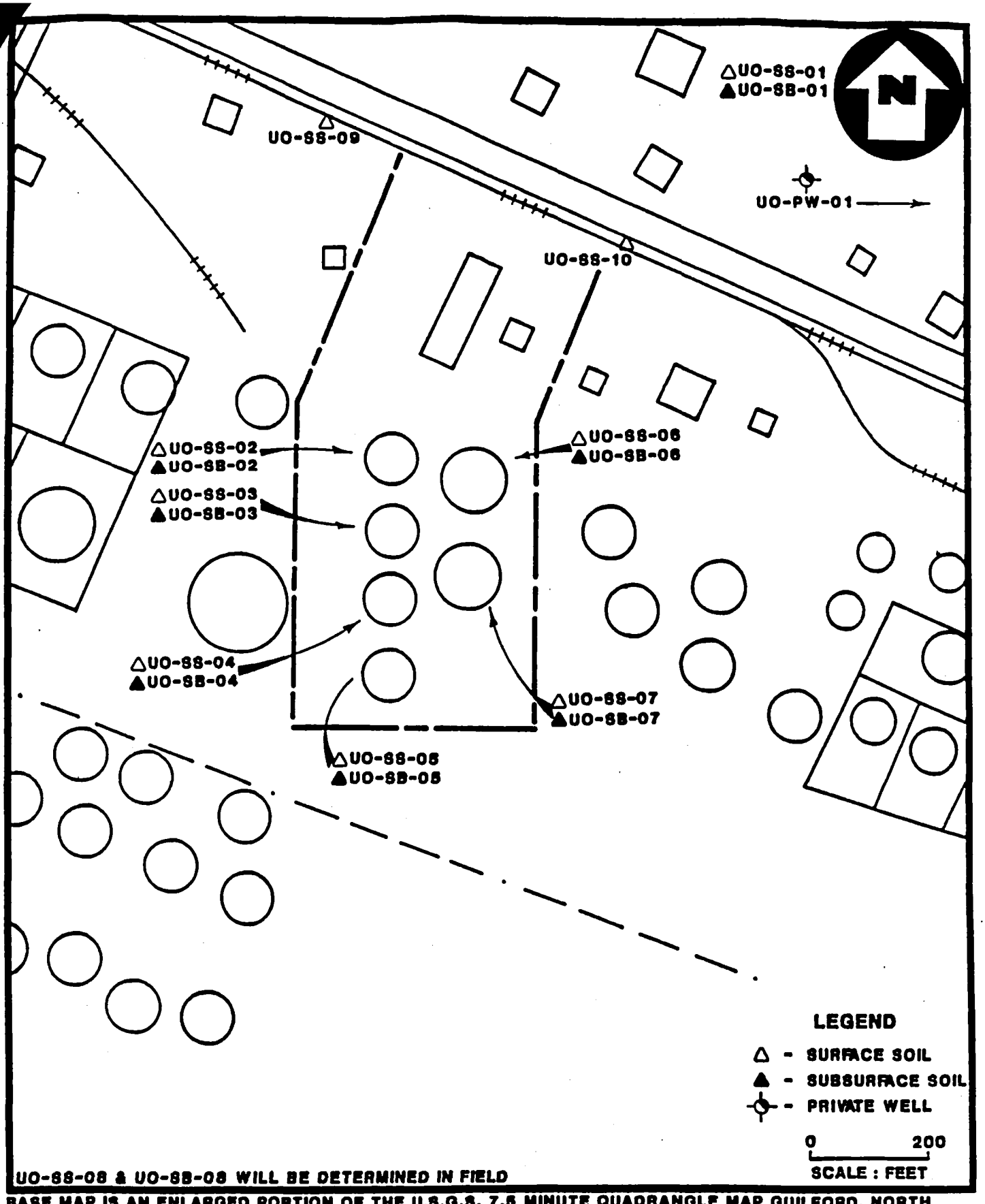


Figure 1-2 Southeast Terminal Site Map



BASE MAP IS AN ENLARGED PORTION OF THE U.S.G.S. 7.5 MINUTE QUADRANGLE MAP GUILFORD, NORTH CAROLINA, 1968.

SAMPLE LOCATION MAP
UNION OIL S.E. TERMINAL
GREENSBORO, GUILFORD COUNTY,
NORTH CAROLINA

FIGURE 3

NUS CORPORATION

Reference 1

a product of

J. L. DARLING CORPORATION

TACOMA, WASHINGTON 98421 U.S.A.

76

"Rite in the Rain."

WEATHERPROOF

LEVEL

NOTEBOOK NO. 311

F4-1878

Union Oil Co. S.E. Terminal

Greensboro, Guilford County, NC

Simonia O. DeLaine, Project Manager

TDD No. 74-8911-76

Dec 11, 1989

LOGBOOK REQUIREMENTS
REVISED - NOVEMBER 29, 1988

NOTE: ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

1. Record on front cover of the Logbook: TDD No., Site Name, Site Location, Project Manager.
2. All entries are made using ink. Draw a single line through errors. Initial and date corrections.
3. Statement of Work Plan, Study Plan, and Safety Plan discussion and distribution to field team with team members' signatures.
4. Record weather conditions and general site information.
5. Sign and date each page. Project Manager is to review and sign off on each logbook daily.
6. Document all calibration and pre-operational checks of equipment. Provide serial numbers of equipment used onsite.
7. Provide reference to Sampling Field Sheets for detailed sampling information.
8. Describe sampling locations in detail and document all changes from project planning documents.
9. Provide a site sketch with sample locations and photo locations.
10. Maintain photo log by completing the stamped information at the end of the logbook.
11. If no site representative is on hand to accept the receipt for samples, an entry to that effect must be placed in the logbook.
12. Record I.D. numbers of COC and receipt for sample forms used. Also record numbers of destroyed documents.
13. Complete SMO information in the space provided.

I have read and understand the work Plan for this Recon.

Simonia Delaine
Simonia Delaine

Margo Westmoreland
Margo E. Westmoreland

Sheri Parnabalkar
Sheri Parnabalkar

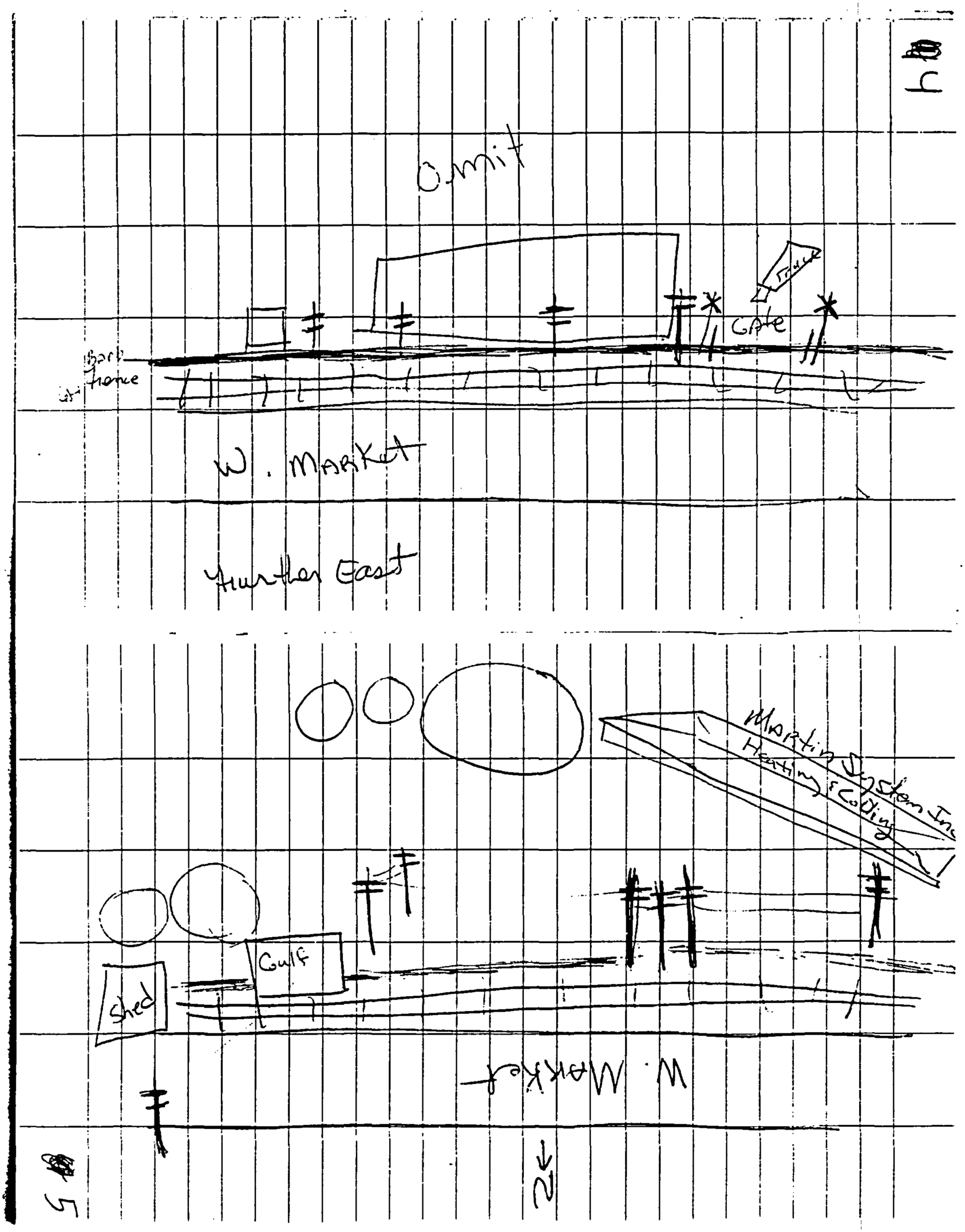
#2

The weather is cold, 35°.
There is snow on the
ground. Very cloudy day.
Nearest Resident with a well is across
the street 500 ft from the site
Mr. Lackey 6706 William Buchholz W. Market St.
There are seven trailers in the Park.
The fence has 4 ft
posted no trespassing
sign which is in
good condition. It is
also barb wire. The
is one gate, no good
gate.

Amanda Dodson
12/11/89

4 ft

#3


#5
W. Market
Shed
Gulf
Martin System Inc
Heating & Cooling
Further East
W. MARKET
Omit
Gate
Tower
Barb
Fence

6

Tanks are diked and good condition. Drums are located on the east side. Drum are not on crates.

500ft in the Airport.

Mobile Home Park. Mr. William

Buchholz 6706 W. Market St.

Drainage ditch runs parallel to W. Market.

Alert is active, no air emission sources

12/11/89

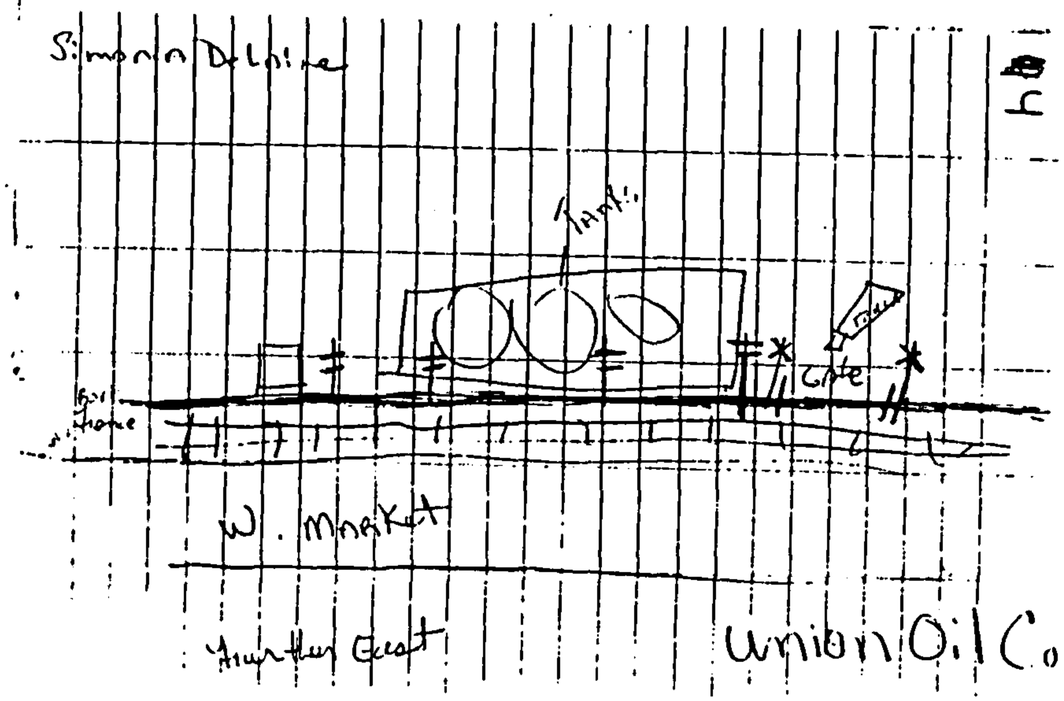
there industry and modesent hazards in the area.

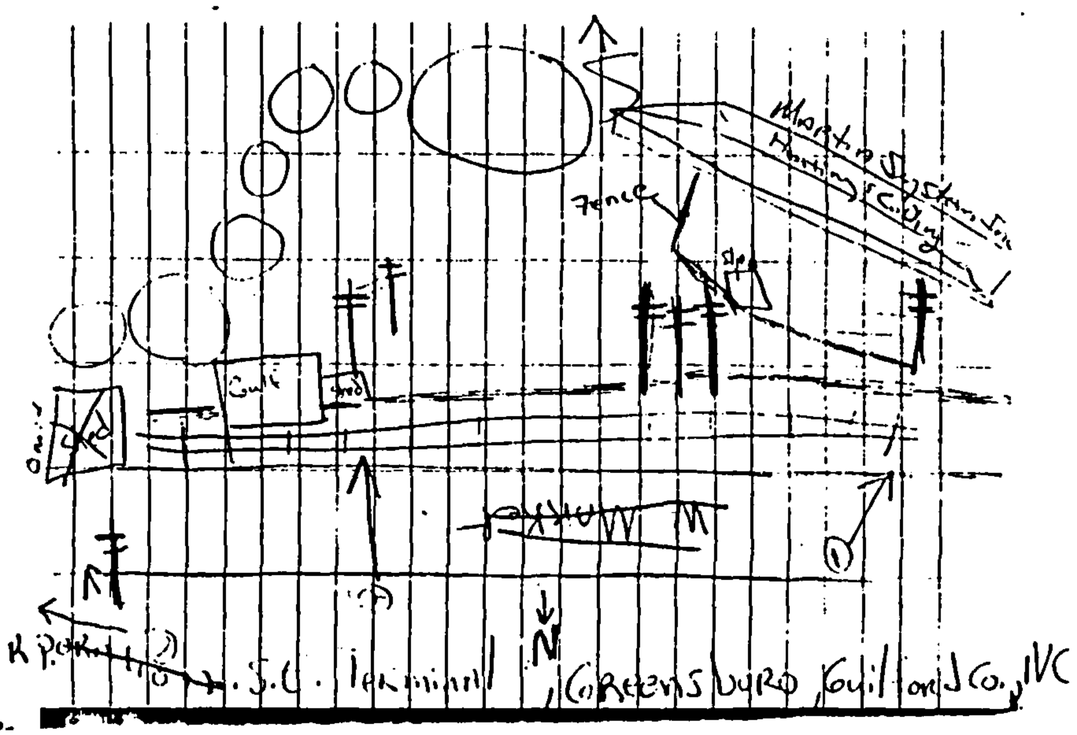
The dikes are sanitary.

There are no schools or daycares in the area.

8

Simonin Delaine





Mr. Lackey said there are about 7 trailers in the park They all drink from it, and have never had a problem.

10:00 went to City Tax Office

11:00 went to County Office for Deed information.

1971 Pure Oil ~~and~~ sold as Union Oil

1990 Owner is British Petroleum Oil Union Oil under the Gulf Oil Company name since 1929

[signature]
12/11/89

Reference 4

Fill-in areas are spaced for elite type, i.e., 12 characters/inch).

OMB No. 158-R0175

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

9 9 7 4

Ref 2

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

ICTIONS

en provided, affix Review the inform- is incorrect, cross correct data in the ow. Also, if any of nt *(the area to the ts the information that should* e provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.

SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	MARK 'X' YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)	X		NO *	D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		YES	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP ~~GULF OIL CORPORATION~~ / UNION OIL CO SOUTHERN TERMINAL

V. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
2 ROSS JOHN T PLANT MANAGER	919 292 3211

FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 P O BOX 11335

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 GREENSBORO	NC	27409

FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 6801 W MARKET STREET

B. COUNTY NAME

GUILFORD

* NPDES PERMIT EXPIRATION 6-30-81

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
6 GREENSBORO	NC	27409	

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST	B. SECOND
5171 (specify) PETROLEUM BULK STATION	7 (specify)
C. THIRD	**D. FOURTH**
(specify)	7 (specify)

VIII. OPERATOR INFORMATION

A. NAME: SOUTHEAST TERMINALS

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☒ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

P (specify) PRIVATE

D. PHONE (area code & no.): A 919 299 2611

E. STREET OR P.O. BOX: P O BOX 11007

F. CITY OR TOWN: GREENSBORO

G. STATE: NC

H. ZIP CODE: 27409

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water): 9 N NC0026247	**D. PSD** (Air Emissions from Proposed Sources): 9 P
B. UIC (Underground Injection of Fluids): 9 U	**E. OTHER** (specify): 9 (specify)
C. RCRA (Hazardous Wastes): 9 R	**E. OTHER** (specify): 9 (specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

REDISTRIBUTION TERMINAL FOR PETROLEUM PRODUCTS

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
R. E. WOHLGEMUTH VICE PRESIDENT-NORTHERN REGION	R E Wohlgemuth	NOV. 07 1980

COMMENTS FOR OFFICIAL USE ONLY

C

...s are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-80004

RCRA

EPA

ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F N C T 0 0 0 6 0 9 9 7 4

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(Place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

C	YR.	MO.	DAY
8	29	12	00

[ ] 2. NEW FACILITY *(Complete item below.)*

FOR NEW FACILITIES PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

YR.	MO.	DAY

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

[ ] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code*(s)* in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.

1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C				DUP							1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	B. 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	B. 2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S02	600	G		5				
X-2	T03	20	E		6				
1	S01	0 TO 3,200	G		7				
2	S02	0 TO 2,000	G		8				
3	T01	0 TO 2,000	G		9				
4					10				

(enter "A", "B", "C", etc. behind the "3" to identify photocopied pages)

Continued from the front.

II. PROCESSES *(continued)*

. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

DESIGN CAPACITY

2 - API SEPERATORS 2,000 GALLONS/DAY EACH

2 - API SEPERATOR SLOP OIL TANKS 1,000 GALLONS EACH

DRUM STORAGE OF LEADED TANK SLUDGE 2,000 GALLONS

SEE ATTACHMENT FOR OPERATION PLAN

V. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER — Enter the four—digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four—digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste*(s)* that will be handled which possess that characteristic or contaminant.

UNIT OF MEASURE — *For each quantity entered in column B enter the unit of measure code.* Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

PROCESSES

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non—listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — *Hazardous wastes* that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K054	900	P	T03 D80	
X-2	D002	400	P	T03 D80	
X-3	D001	100	P	T03 D80	
X-4	D002				included with above

from page 2.
Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)		FOR OFFICIAL USE ONLY	
WNCT000609974	T/A C 1	W DUP	T/A C 2 DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	K049	0 TO 2000	G	S02 T01	SLOP OIL FROM API SEPERATOR
2	K051	0 TO 1000	G	S01 S02	TEMPORARY DRUM STORAGE OF API SEPERATOR SLUDGE
3	K052	0 TO 2000	G	S01	TEMPORARY DRUM STORAGE OF LEADED TANK BOTTOMS
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

5

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTES (Continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

EPA I.D. NO. (enter from page 1)

F N C T 0 0 0 6 0 9 4 7 4 T/A 6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground–level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)
3 5 1 6 3 7 N	0 8 0 5 5 5 3 W

VIII. FACILITY OWNER

☐ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)
E GULF OIL CORPORATION	8 0 4 - 3 5 8 - 8 4 0 6

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F P. O. Box 11287	G RICHMOND	V A	2 3 2 3 0

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
R. E. WOHLGEMUTH VICE PRESIDENT-NORTHERN REGION	R E Wohlgemuth	NOV. 07 1980

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME (print or type)	B. SIGNATURE	C. DATE SIGNED

OPERATION PLAN

The problems with this facility that are covered by RCRA are the disposal of leaded tank sludge, the disposal of API separator sludge, the disposal of chemical additive residue inside steel drums, the temporary storage of leaded tank sludge and/or API Separator sludge in steel drums, and the temporary storage of steel drums that have chemical additive residue inside them.

Leaded Tank Sludge - Due to the release of a recent EPA Regulation Information Memorandum (RIM) the storage tanks are not considered to be storage facilities for leaded tank sludge. In the event a tank is removed from service and requires the removal of leaded tank sludge, the leaded tank sludge will be:

A. If hazardous carrier services are available and an approved disposal site is available, the leaded tank sludge will be shipped to the disposal site in accordance with RCRA provisions.

B. If either hazardous carrier services or an approved disposal site is not available, the leaded tank sludge will be placed in steel drums for temporary storage until the requirements for off-site permanent disposal can be fulfilled. These drums will be stored on the "temporary storage" area on-site and above ground.

API Separator Sludge - The sludge from the API separator will be handled in the same manner as the leaded tank sludge.

The recovered product from the API separator is temporarily stored in a 1,000 gallon underground tank. Because surface active agents are kept from the API separator, there is never an emulsion of oil and water formed. This makes the recovery of product from the API separator very easy. The recovered product is blended into the next pipeline receipt of the appropriate product.

Temporary Storage Site - A temporary storage site will be provided on-site for drums containing either leaded tank sludge, API separator sludge, and/or drums with chemical residue. All drums will be stored above grade. Every effort will be made to store them in a manner that will prevent deterioration of the drums.

RCRA Inspection Report

Reference 3

1) Facility Information

Union Oil Company Southeast Terminal
6801 W. Market Street
Greensboro, N.C. 27419

2) Facility Contact

J.H. Kimball, Jr., Terminal Foreman

3) Survey Participants

J.H. Kimball, Jr., Terminal Foreman
Robert Shifflet, Guilford County Health Department
J.H. Deakins, District Sanitarian

4) Date of Inspection

August 25, 1982

5) Applicable Regulations

40 CFR, Part 262, Standards for Generators

6) Scope of Survey

RCRA Interim Status Inspection

7) Facility Description

Union Oil Company is a fuel storage and distribution depot. The facility handles gasoline, fuel oil and heating oil. This facility handles Union and Gulf Oil products. Union Oil has 4 tanks with 185,000 barrel capacity and Gulf Oil has 7 tanks with 331,000 barrel capacity. The facility receives oil from Colonial Pipeline and distributes to trucks and tank cars. Hazardous waste from the operation is tank bottoms based on ignitability. The bottoms are cleaned by a private contractor and handled by Troy L. Griffin Oil, Inc., RFD 2, Jefferson, GA, 30549, ID#GAD991275934. This facility was in compliance with RCRA standards for generators on the date of this inspection.

8) Site Deficiencies

Reference 2

EPA

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NC	D000609974

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site)	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
Union Oil Co. Southeast Terminal	P.O. Box 11007 (6801 West Market Street)

03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST
Greensboro	NC	27409	Guilford	41	06

09 COORDINATES LATITUDE	LONGITUDE
35° 16' 37". N	080° 55' 53" W

10 DIRECTIONS TO SITE (Starting from nearest public road)

Located at 6801 West Market Street which is approx. 2 mi. SW of Guilford College, and approx. 0.4 mi. W of Persimmon Grove Church on the left-hand side of W. Market Street.

III. RESPONSIBLE PARTIES

01 OWNER (If known)	02 STREET (Business, mailing, residential)
Gulf Oil Corp.	P.O. Box 11287

03 CITY	04 STATE	05 ZIP CODE	06 TELEPHONE NUMBER
Richmond	VA	23230	(804) 254-0200

07 ~~OPERATOR~~ (Owner as of 3-1-85)	08 STREET (Business, mailing, residential)
Standard Oil Co. of Ohio	P.O. Box 7117

09 CITY	10 STATE	11 ZIP CODE	12 TELEPHONE NUMBER
Atlanta	GA	30357	(404) 897-7825

13 TYPE OF OWNERSHIP (Check one)

☒ A. PRIVATE ☐ B. FEDERAL: _____ (Agency name) ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL

☐ F. OTHER: _____ (Specify) ☐ G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE (Check all that apply)

☒ A. RCRA 3001 DATE RECEIVED: 11 / 7 / 80 (MONTH DAY YEAR) ☐ B. UNCONTROLLED WASTE SITE (CERCLA 103 c) DATE RECEIVED: / / (MONTH DAY YEAR) ☐ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION

☐ YES DATE / / (MONTH DAY YEAR)

☒ NO

BY (Check all that apply)

☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☐ D. OTHER CONTRACTOR

☐ E. LOCAL HEALTH OFFICIAL ☐ F. OTHER: _____ (Specify)

CONTRACTOR NAME(S): _____

02 SITE STATUS (Check one)

☒ A. ACTIVE ☐ B. INACTIVE ☐ C. UNKNOWN

03 YEARS OF OPERATION

1929 (BEGINNING YEAR) | _____ (ENDING YEAR) ☐ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED

Leaded tank sludges and miscellaneous petroleum additives were potentially buried on site.

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION

According to Mike Jennings (see sources), on-site disposal of tank sludges probably occured between the period 1929 to 1980. Facility maintains an underground storage tank for API seperator sludge.

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION (Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)

☐ A. HIGH (Inspection required promptly) ☐ B. MEDIUM (Inspection required) ☒ C. LOW (Inspect on time available basis) ☐ (No further action needed, complete current disposition form)

VI. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NUMBER
J. H. Kimbell	Union Oil Co. - Greensboro	(919) 299-2611

04 PERSON RESPONSIBLE FOR ASSESSMENT	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NUMBER	08 DATE
Lee Crosby / D. Mark Durway	NC DHR	S&HW	(919) 733-2178	1 / 22 / 85 (MONTH DAY YEAR)

EPA FORM 2070-12 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER
NC	D000609974

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)

- ☐ A. SOLID
- ☐ B. POWDER, FINES
- ☒ C. SLUDGE
- ☐ D. OTHER _____ (Specify)
- ☐ E. SLURRY
- ☒ F. LIQUID
- ☐ G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)

TONS Unknown

CUBIC YARDS _____

NO. OF DRUMS _____

03 WASTE CHARACTERISTICS (Check all that apply)

- ☒ A. TOXIC
- ☐ B. CORROSIVE
- ☐ C. RADIOACTIVE
- ☒ D. PERSISTENT
- ☐ E. SOLUBLE
- ☐ F. INFECTIOUS
- ☐ G. FLAMMABLE
- ☒ H. IGNITABLE
- ☐ I. HIGHLY VOLATILE
- ☐ J. EXPLOSIVE
- ☐ K. REACTIVE
- ☐ L. INCOMPATIBLE
- ☐ M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE	Unknown		
OLW	OILY WASTE	Unknown		
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS	Unknown		

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION
K049	Slop Oil Solids	-		Unknown	
K051	API Separator Sludge		Potential on-site	"	
K052	Leaded Tank Bottoms		burial prior to 1980	"	

V. FEEDSTOCKS (See Appendix for CAS Numbers)

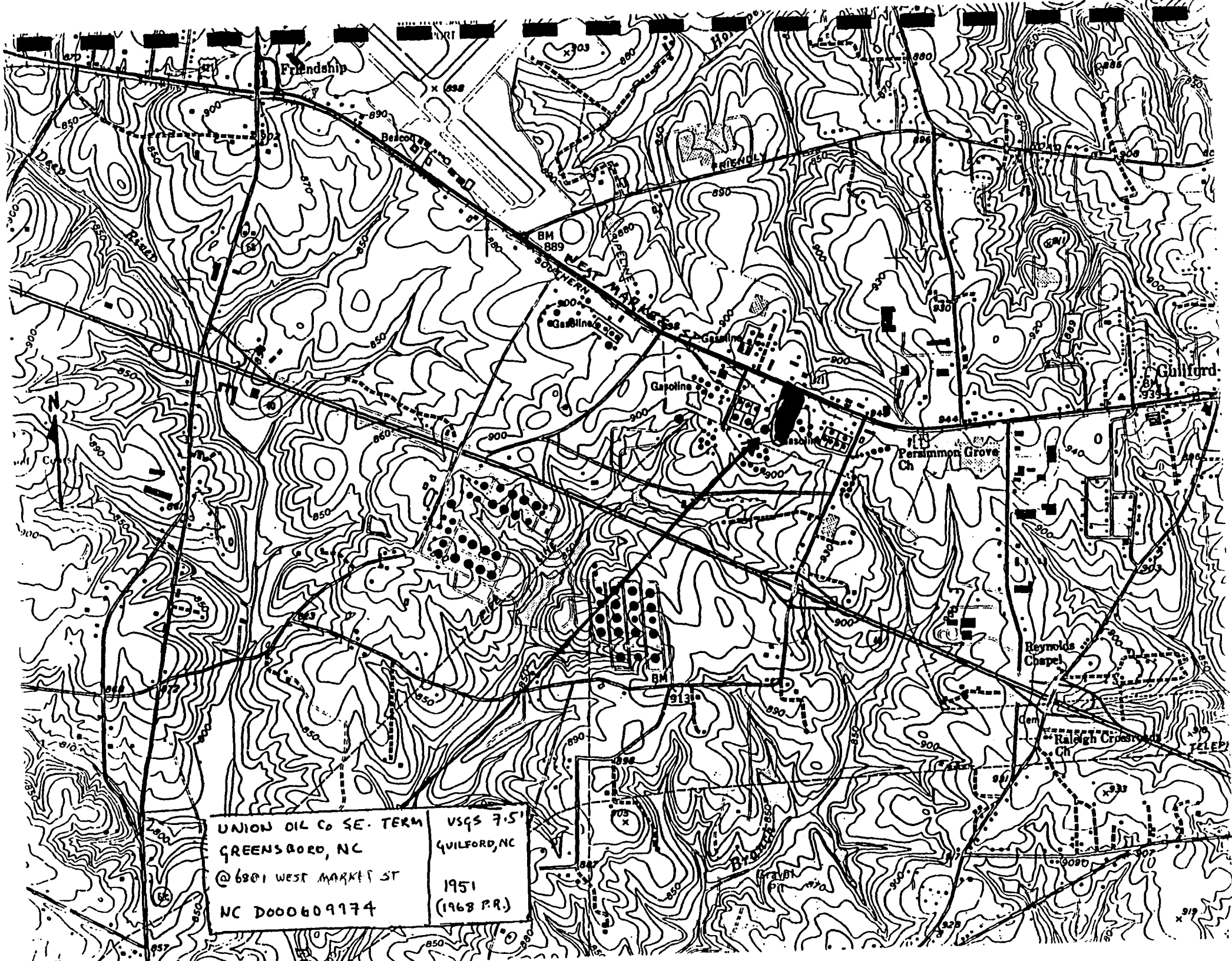
CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS	N/A		FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

1. RCRA, Part A, 11-7-80
2. RCRA inspection report, 4-18-84.
3. Mike Jennings @ Gulf Oil Corp., Richmond, Va, telephone conversation, 1-14-85. (Operations Mgr.)

EPA FORM 2070-12 (7-81)

2


Friendship
Beacon
BM 889
SOUTHERN
WEST MARKET ST
Gasoline
Gasoline
Gasoline
Gasoline
Guilford
Persimmon Grove Ch
Reynolds Chapel
Raleigh Crossroads Ch
BM 913
N
UNION OIL Co SE. TERM
GREENSBORO, NC
@ 6801 WEST MARKET ST
NC D000609974
USGS 7.5'
GUILFORD, NC
1951
(1968 P.R.)

NUS CORPORATION AND SUBSIDIARIES

Reference 5

TELECON NOTE

CONTROL NO.	DATE: March 14, 1990	TIME: 9:45 a.m.

DISTRIBUTION: Union Oil Co. SE Terminal

BETWEEN: Jim Edwards, Compliance Officer	OF: N.C. Hazardous Waste Compliance Program Raleigh, N.C.	PHONE: (919) 733-2178

AND: Joan Dupont, NUS Corporation

Joan F. Dupont

DISCUSSION:

Union Oil Co. SE Terminal
Greensboro, Guilford Co.
NCD00609974

The Union Oil Co. SE Terminal first entered North Carolina's RCRA system on August 14, 1980. The facility filed a Part A application in 1980. The facility withdrew from interim status, but the termination date was not listed in Mr. Edwards' database. The facility is currently classified as a generator under RCRA.

DIVISION OF HEALTH SERVICES
P.O. Box 2091
Raleigh, N.C. 27602-2091

Ronald H. Levine, M.D., M.P.H.
STATE HEALTH DIRECTOR

Weith

Reference 6 (4)

Date: March 4, 1982

Mr. B. L. Swinney
Gulf Oil Corporation
P.O. Box 11287
Richmond, Virginia 23230

Re: Facility ID NO. NCT000609974

Dear Mr. Swinney:

Based on information supplied by you we have processed and accepted at the State level your request for the facility identified with the above ID number to receive the indicated change in classification under RCRA:

Add as	Delete as	
☐	☐	generator
☐	☐	transporter
☐	☒	treater
☐	☒	storer
☐	☒	disposer
☐	☐	small generator

We are advising EPA of the change in your status. Please notify us if there is any further change in your operations which would again affect your status. Your EPA ID NO. is ☐ is not ☒ being cancelled.

Cordially,

O. W. Strickland, Head
Solid & Hazardous Waste Management Branch
Environmental Health Section

OWS

cc: John Herrmann
EPA Region IV
Emil Breckling

Reference 7

Ronald H. Levi...
STATE HEALTH DIRECTOR

DIVISION OF HEALTH SERVICES
P.O. Box 2091
Raleigh, N.C. 27602-2091

RECEIVED
MAR 28 1984
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH
ENTERED
APR 2 1984
DATA PROCESSING

Date: 3-23-84

MEMORANDUM

TO: O. W. Strickland, Head
Solid & Hazardous Waste Management Branch

FROM: J. H. Deakins
Waste Mgt. Spec.

NAME: Union Oil Co. Southeast Terminal
P.O. Box 18007 (City) Greensboro, N.C. 27419

EPA ID No.: NCD006099974
Contact: J. H. Kimbell

A RCRA (✓) Generator, ( ) Transporter, ( ) Interim Status, ( ) Final Status, compliance inspection was conducted on 3-23-84 (mo/day/yr). The inspection can be classified as a ( ) annual inspection (Gen, Trans.), ( ) semi-annual inspection (TSD), (✓) follow-up inspection, ( ) other, specify _____.

The above subject company was found (✓) in full compliance ( ) in violation ( ) all previous violations existing ( ) previous violations existing along with additional ones. (Note: You should complete a check sheet to signify the additional violations).

DHS Form 3010 (Rev. 10-83)
Solid & Hazardous Waste

Ronald H. Levine, M.D., M.P.H.
STATE HEALTH DIRECTOR

DIVISION OF HEALTH SERVICES
P.O. Box 2091
Raleigh, N.C. 27602-2091

Reference 8

(7)

March 13, 1984

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. John T. Ross
Union Oil Co., S.E. Terminal
P.O. Box 11335
Greensboro, N.C. 27409

Re: NCD000609974

Dear Mr. Ross:

On November 21, 1983, in response to a formal call for part B of a permit application, an officer of your company advised this Branch that a part B application would not be filed. Following this, on January 29, 1984 and February 1, 1984, the Solid and Hazardous Waste Management Waste Management Branch of the Department of Human Resources published a legal notice in the Raleigh papers, announcing its intention to deny a permit and terminate interim status for a number of plants, including yours.

You are now advised that this plant has been denied a permit as a hazardous waste treatment, storage, or disposal facility and its interim status has been formally terminated. As of March 30, 1984, the operators of it may not treat or dispose of hazardous waste, nor store it for more than 90 days from the of accumulation.

If you have any questions about this matter, please call or write to Mr. Keith Lawson at this office.

Very sincerely,

O. W. Strickland, Head
Solid and Hazardous Waste Management Branch
Environmental Health Section

OWS/KL: tl

GENERATOR INSPECTION FORM - PART 262

Name of Site	EPA I.D.	County
Union Oil Co. Southeast Terminal	NCD006609974	Guilford
Location	**Inspection Date**	**Signature of Inspector(s)**
P.O. Box 11007, Greensboro	10-17-89	[illegible]
Compliance Date 27409		**Signature of Facility Contact** X [illegible]

An inspection of your facility has been made this date and you are notified of the violations, if any, marked below with a cross (X).

SUBPART A - GENERAL

1. Hazardous Waste Determination (262.11)
   - C Subpart D waste (b)
   - C Subpart C waste (c)(1)(2)

2. EPA Identification Numbers
   - C EPA generator number (a)
   - C EPA transporter/facility (c)

SUBPART B - THE MANIFEST

3. General Requirements (262.20)
   - C proper manifest (a)
   - C permitted facility (b)

4. Required Information (262.21)
   - C document number (a)(1)
   - C generator identification (a)(2)
   - C transporter identification (a)(3)
   - C facility identification (a)(4)
   - C D.O.T. description (a)(5)
   - C total quantity (a)(6)
   - C certification (b)

5. Number of Copies (262.22)
   - C minimum number

6. Use of the Manifest (262.23)
   - C generator handwritten signature (a)(1)
   - C transporter signature/date (a)(2)
   - C retain copy (a)(3)
   - C copies to transporter (b)

SUBPART C - PRE-TRANSPORT REQUIREMENTS

7. Packaging (262.30)
   - C D.O.T. compliance

8. Labeling (262.31)
   - C D.O.T. compliance

9. Marking (262.32)
   - C D.O.T. compliance (a)
   - C "HAZARDOUS WASTE" label (b)

10. Placarding (262.33)
    - C D.O.T. compliance

11. Accumulation Time (262.34)
    - C Subpart I; J (a)(1)
    - C accumulation date (a)(2)
    - C "Hazardous Waste" (a)(3)
    - C Subpart C; D (a)(4)*
    - C personnel training (a)(4)*

*Cite specific violations of 40 CFR 265 under remarks

SUBPART D - RECORDKEEPING AND REPORTING

12. Recordkeeping (262.40)
    - C manifest retention (a)
    - C annual/exception report (b)
    - C test/waste analysis (c)

CONTAINER/TANK INSPECTION FORM - PART 265

Union Oil Co.	NCD000609974	10-17-89
Name of Site	EPA I.D.	Inspection Date

SUBPART I - USE AND MANAGEMENT OF CONTAINERS

no waste on site

1. Condition Of Containers (265.171)
   - ___ leakage
   - ___ past leakage (evidence)
   - ___ severe rusting
   - ___ structural defect

2. Compatibility Of Waste With Containers (265.172)
   - ___ visual evidence of noncompliance (leakage, corrosion)

3. Management of Containers (265.173)
   - ___ closed (a)
   - ___ improper handling or storage (b)

4. Inspections (265.174)
   - ___ weekly (minimum)

5. Special Requirements For Ignitable or Reactive Waste (265.176)
   - ___ 15m (50 ft)

6. Special Requirements For Incompatible Waste (265.177)
   - ___ mixing (a)
   - ___ unwashed container (b)
   - ___ separation (c)

SUBPART J - TANKS N/A

1. General Operating Requirements (265.192)
   - ___ compatibility (a)(b)
   - ___ uncovered tank precautions (c)
   - ___ overflow prevention (d)

2. Waste Analysis and Trial Tests (265.193)*
   *Section not applicable to a generator only
   - ___ waste analysis/trial test

3. Inspections (265.194)
   - ___ discharge control equipment (a)(1)
   - ___ monitoring equipment (a)(2)
   - ___ waste level (a)(3)
   - ___ construction material (a)(4)
   - ___ surrounding area (a)(5)
   - ___ assessment schedule/procedures (b)

4. Closure (265.197)
   - ___ plan on-site

5. Special Requirements For Ignitable Or Reactive Waste (265.198)
   - ___ properly stored (a)(1)(2)(3)
   - ___ buffer requirements (b)

6. Special Requirements For Incompatible Wastes (265.199)
   - ___ properly stored (a)
   - ___ tank washed (b)

REMARKS: _____

DHS Form 3010 (Rev. 9-83)
SOLID & HAZARDOUS WASTE

Union Oil Co.
Greensboro
10-17-89

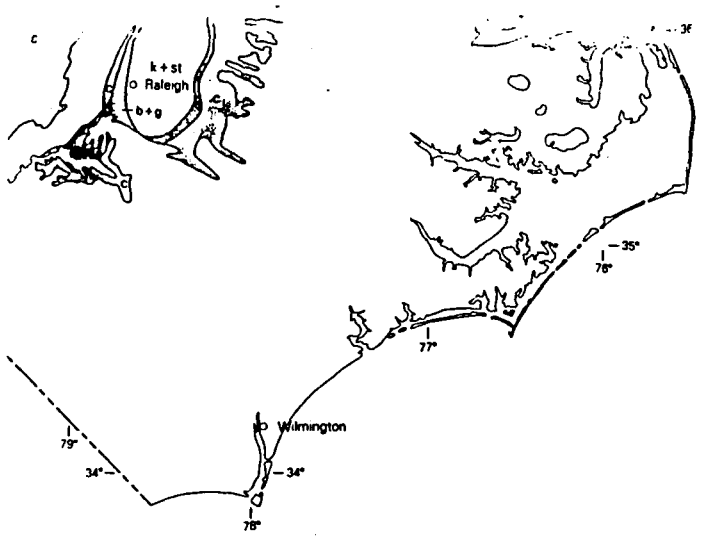
13. Annual Reporting (262.41)
C submitted (a)(1-6)
C submitted (b)

14. Exception Reporting (262.42)
C transporter contact (a)
C exception report (b)(1)(2)

REMARKS: no violation

DHS FORM 3010 (Rev. 9-83)
SOLID & HAZARDOUS WASTE

Ref. 10



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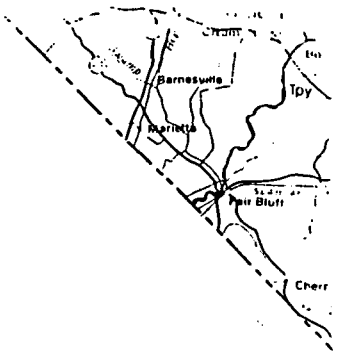
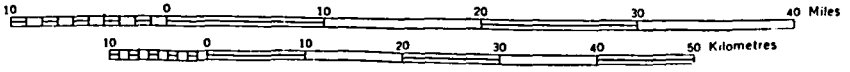


GEOLOGIC MAP OF NORTH CAROLINA

1985

Scale 1:500,000
1 inch equals approximately 8 miles



DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
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STATE OF NORTH CAROLINA

JAMES G. MARTIN, GOVERNOR

NER PIEDMONT, CHAUGA BELT, ITH RIVER ALLOCHTHON, AND TOWN MOUNTAINS ANTICLINORIUM

METAMORPHIC ROCKS

BREVARD FAULT ZONE — "Fish scale" schist and phyllonite, ; interlayered with feldspathic metasandstone, marble lenses

EISS AND SCHIST — Inequigranular, locally abundant potas- par and garnet; interlayered and gradational with calc-silicate manite-mica schist, mica schist, and amphibolite. Contains sses of granitic rock

ED BIOTITE GNEISS — Strongly foliated; minor layers of ite and muscovite schist

ST — Garnet, staurolite, kyanite, or sillimanite occur locally; nd layers of quartz schist, micaceous quartzite, calc-silicate tite gneiss, amphibolite, and phyllite

ITE AND BIOTITE GNEISS — Interlayered; minor layers and hornblende gneiss, metagabbro, mica schist, and granitic

ITE — Metamorphosed mafic extrusive and intrusive rock; hornblende gneiss, thin layers of mica schist, calc-silicate , rarely, marble. Also includes small masses of metadiorite gabbro

TIC BIOTITE GNEISS — Poorly layered to massive; mega- microcline and quartz; local mica schist, amphibolite, and eiss

— Interlayered with quartz-muscovite schist, contains , andalusite, kyanite, or sillimanite

WACKE AND MUSCOVITE-BIOTITE SCHIST — Meta- e (biotite gneiss) interlayered and gradational with muscovite- hist; minor marble and granitic rock

WACKE, AMPHIBOLITE, AND KYANITE SCHIST — Meta- e (biotite gneiss) interlayered and gradational with amphibo- yanite schist; minor ultramafic and granitic rock

WACKE — Contains quartz and microcline porphyroblasts

EISS — Interlayered with calc-silicate rock, metaconglomer- hibolite, sillimanite-mica schist, and granitic rock

ND SCHIST — Includes phyllonite and interlayered biotite

NULAR BIOTITE GNEISS — Weakly foliated to massive, con- oclase megacrysts and, rarely, larger megacrysts of quartz ar

BLASTIC GNEISS — Massive to foliated, granodioritic, mig-

CA SCHIST — Interlayered with amphibolite

NEISS (Middle Proterozoic, 1192 my; 27) — Megacrystic, in tains amphibolite

INTRUSIVE ROCKS

Dikes, gray to black

E GRANITE (Mississippian, 351 my; 20 21) — Massive to ted; contains pegmatites, lithium-bearing on east side

AD GRANITE GNEISS (Devonian to Silurian, 409 my;) — r to porphyritic, massive to well foliated; contains biotite

CHARLOTTE AND MILTON BELTS

METAMORPHIC ROCKS

CZbf — FINE-GRAINED BIOTITE GNEISS — Massive to strongly foliated; minor layers of amphibolite and muscovite schist

CZfg — FELSIC MICA GNEISS — Interlayered with biotite and hornblende gneiss and schist

CZbg — BIOTITE GNEISS AND SCHIST — Inequigranular and megacrystic; abundant potassic feldspar and garnet; interlayered and gradational with calc-silicate rock, sillimanite-mica schist, mica schist, and amphibolite. Contains small masses of granitic rock

CZv — METAVOLCANIC ROCK — Interbedded felsic to mafic tuffs and flowrock

CZmv — MAFIC METAVOLCANIC ROCK — Metamorphosed basaltic to andesitic tuffs and flows, grayish green to black. Locally includes hypabyssal intrusives and minor felsic metavolcanic rock

CZfv — FELSIC METAVOLCANIC ROCK — Metamorphosed dacitic to rhyolitic flows and tuffs, light gray to greenish gray; minor mafic and intermediate metavolcanic rock

CZq — QUARTZITE — Massive to well foliated; contains andalusite, kyanite, or sillimanite, chloritoid, and pyrite

CZph — PHYLLITE AND SCHIST — Minor biotite, pyrite, and sillimanite; includes minor quartzite

INTRUSIVE ROCKS

Jd — DIABASE — Dikes, gray to black

PIPg — GRANITIC ROCK (Pennsylvanian to Permian, 265-325 my; 11,9) — Megacrystic to equigranular. Churchland Plutonic Suite (Western group) - Churchland, Landis, and Mooresville intrusives

DSg — GRANITE OF SALISBURY PLUTONIC SUITE (Devonian to Silurian, 385-415 my; 5) — Pink, massive to weakly foliated. Gold Hill, Kannapolis, Salisbury, Southmont, and Yadkin intrusives

DSs — SYENITE OF CONCORD PLUTONIC SUITE (Silurian, 404 my; 9) — Includes the Concord ring dike

DOgb — GABBRO OF CONCORD PLUTONIC SUITE (Devonian to Ordovician, 399-479 my; 24) — Barber, Concord, Farmington, Mecklenburg, and Weddington intrusives

DOg — GRANITIC ROCK — Locally pinkish gray, massive to weakly foliated; contains hornblende

SHELTON GRANITE GNEISS (Silurian, 429 my; 21) — Poorly foliated, lineated granitic to quartz monzonitic gneiss

PzZq — METAMORPHOSED QUARTZ DIORITE — Foliated to massive

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZm — METAMORPHOSED MAFIC ROCK — Metagabbro, metadiorite, and mafic plutonic-volcanic complexes

META-ULTRAMAFIC ROCK — Metamorphosed dunite and peridotite; serpentinite, soapstone, and other altered ultramafic rock. Only larger bodies shown

CZg — METAMORPHOSED GRANITIC ROCK — Megacrystic, well foliated; locally contains hornblende

CAROLINA SLATE BELT

METAMORPHIC ROCKS

CZy — YADKIN FORMATION — Metamorphosed graywacke, volcanic sandstone, and siltstone; interbedded with mafic and intermediate metavolcanic flows and tuffs

CZmd — METAMUDSTONE AND META-ARGILLITE — Thin to thick bedded; bedding plane and axial-planar cleavage common; interbedded with metasandstone, metaconglomerate, and metavolcanic rock
- $CZmd_3$ - Floyd Church Formation
- $CZmd_2$ - Cid Formation
- $CZmd_1$ - Tillery Formation

} (southwest of Asheboro)

CZmv — MAFIC METAVOLCANIC ROCK — Metamorphosed basaltic flows and tuffs, dark green to black; interbedded with felsic and intermediate metavolcanic rock and metamudstone
- $CZmv_1$ - Cid Formation (southwest of Asheboro)

CZfv — FELSIC METAVOLCANIC ROCK — Metamorphosed dacitic to rhyolitic flows and tuffs, light gray to greenish gray; interbedded with mafic and intermediate metavolcanic rock, meta-argillite, and metamudstone
- $CZfv_2$ - Cid Formation (southwest of Asheboro)
- $CZfv_1$ - Uwharrie Formation (at Asheboro and to south)

CZiv — INTERMEDIATE METAVOLCANIC ROCK — Metamorphosed andesitic tuffs and flows, medium to dark grayish green; minor felsic and mafic metavolcanic rock

CZv — METAVOLCANIC ROCK — Interbedded felsic to mafic tuffs and flowrock

CZve — METAVOLCANIC-EPICLASTIC ROCK — Metamorphosed argillite, mudstone, volcanic sandstone, conglomerate, and volcanic rock

CZc — VOLCANIC METACONGLOMERATE — Includes metagraywacke and metamudstone

CZph — PHYLLITE AND SCHIST — Locally laminated and pyritic; includes phyllonite, sheared fine-grained metasediment, and metavolcanic rock. In Lilesville granite aureole, includes hornfels ($CZph_1$), and biotite gneiss and schist (CZbg)

INTRUSIVE ROCKS

Jd — DIABASE — Dikes, gray to black

PIPg — GRANITIC ROCK (Pennsylvanian to Permian, 265-325 my; 11) — Megacrystic to equigranular. Lilesville granite

Pgb — PEE DEE GABBRO (Pennsylvanian, 314 my; 21) — Dark gray to black, medium to fine grained, massive

PzZq — METAMORPHOSED QUARTZ DIORITE — Foliated to massive

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZm — METAMORPHOSED MAFIC ROCK — Metagabbro, metadiorite, and mafic plutonic-volcanic complexes

META-ULTRAMAFIC ROCK — Metamorphosed dunite and peridotite; serpentinite, soapstone, and other altered ultramafic rock. Only larger bodies shown

CZg — METAMORPHOSED GRANITIC ROCK (Late Proterozoic to late Cambrian, 520-650 my;) — Megacrystic, well foliated, locally contains hornblende. Chapel Hill, Chatham, Farmington, Meadow Flats, Mt. Moriah, Parks Crossroads plutons, and Roxboro and Vance County suites

AMPHIBOLI includes layered m

BIOTITE GN places co and ampl

CZms MICA SCHIS cludes le gneiss, a

CZig INJECTED G and dikes

FELSIC MIC mica-garn

LINEATED F muscovit tion and

CZph PHYLLITE A sheared f

Jr — RHYOLITE crysts of clay amy

Jd — DIABASE —

PIPg GRANITIC R crystic to

PIPmg FOLIATED 270-320 Wise and

PzZg METAMOR

META-ULTR serpentin bodies s

CZg METAMOR 520-650 blende,

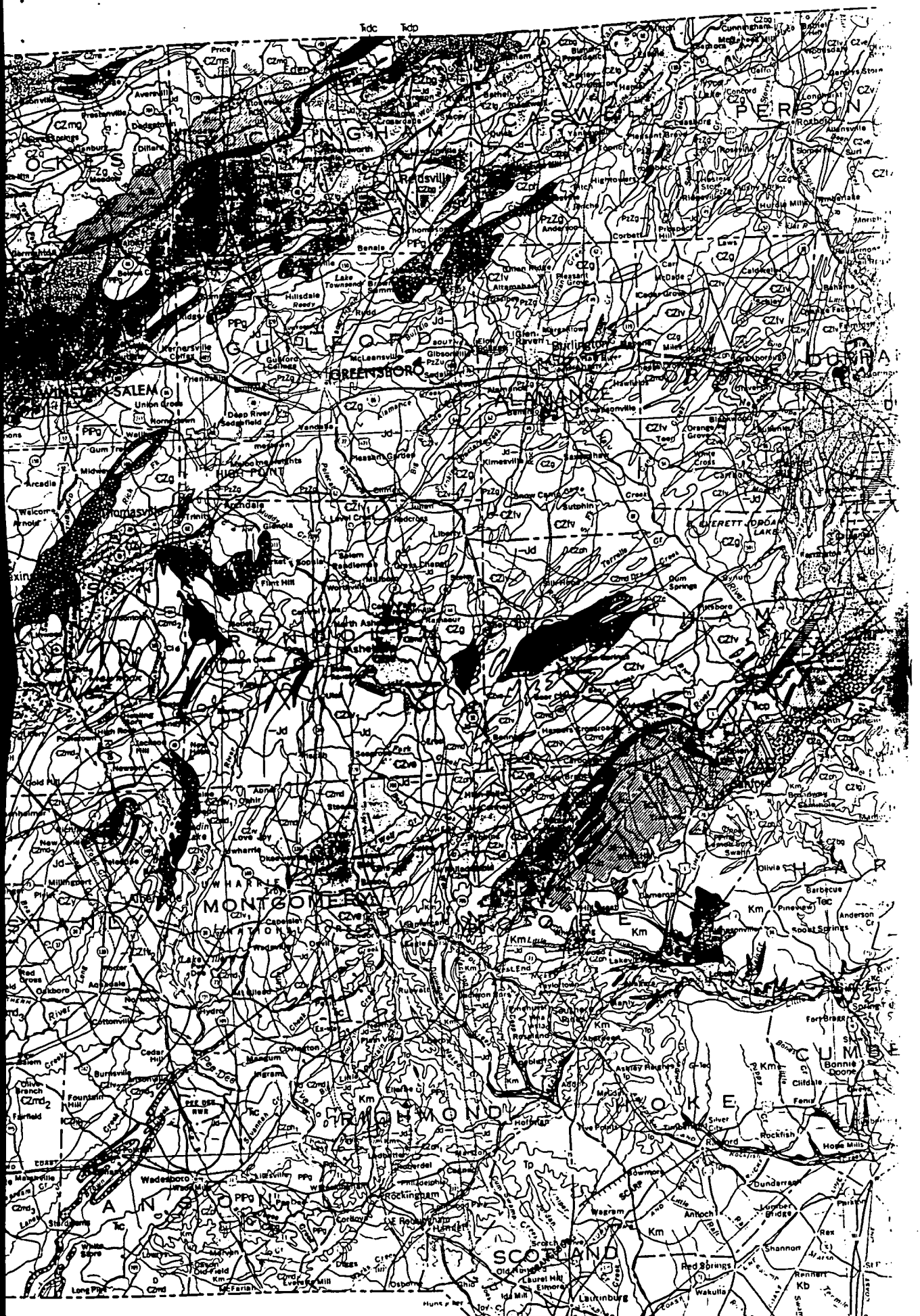
NEWARK SUPER

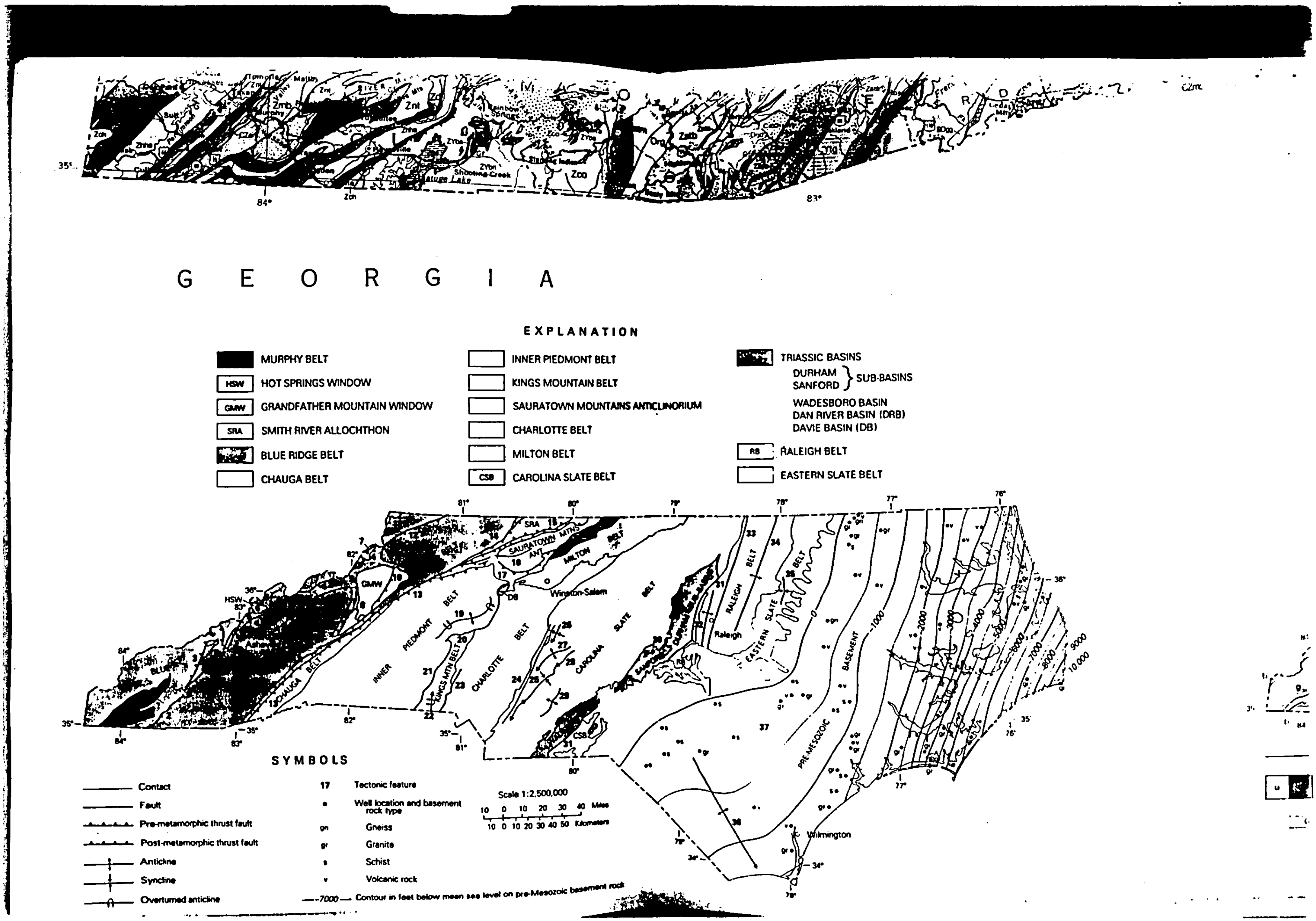
DAN RIVER G

Jd DAN RIVER sandstor and mud

Jds STONEV stone

Jdc COW B


Tdc
Tdp
CASWELL
PERSON
ROCKINGHAM
Reidsville
GUILFORD
GREENSBORO
WINSTON-SALEM
ALAMANCE
DURHAM
HIGH POINT
Thomasville
EVERETT
ORANGE
LAKE
RANDOLPH
CHATHAM
MONTGOMERY
STANLY
RICHMOND
CUMBERLAND
HOKE
ANSON
SCOTLAND
Wadesboro
Rockingham
Laurinburg


G E O R G I A
EXPLANATION
MURPHY BELT
HSW HOT SPRINGS WINDOW
GMW GRANDFATHER MOUNTAIN WINDOW
SRA SMITH RIVER ALLOCHTHON
BLUE RIDGE BELT
CHAUGA BELT
INNER PIEDMONT BELT
KINGS MOUNTAIN BELT
SAURATOWN MOUNTAINS ANTICLINORIUM
CHARLOTTE BELT
MILTON BELT
CSB CAROLINA SLATE BELT
TRIASSIC BASINS
DURHAM
SANFORD
SUB-BASINS
WADESBORO BASIN
DAN RIVER BASIN (DRB)
DAVIE BASIN (DB)
RB RALEIGH BELT
EASTERN SLATE BELT
SYMBOLS
Contact
Fault
Pre-metamorphic thrust fault
Post-metamorphic thrust fault
Anticline
Syncline
Overturned anticline
17 Tectonic feature
Well location and basement rock type
gn Gneiss
gr Granite
s Schist
v Volcanic rock
-7000- Contour in feet below mean sea level on pre-Mesozoic basement rock
Scale 1:2,500,000
Miles
Kilometers
Winston-Salem
Raleigh
Wilmington
INNER PIEDMONT BELT
CHARLOTTE BELT
CAROLINA SLATE BELT
CHAUGA BELT
KINGS MTN BELT
SAURATOWN MTNS ANT
MILTON BELT
RALEIGH BELT
EASTERN SLATE BELT
PRE-MESOZOIC BASEMENT

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NORTH CAROLINA
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
R. BRUCE ETHERIDGE, DIRECTOR

DIVISION OF MINERAL RESOURCES
JASPER L. STUCKEY, STATE GEOLOGIST

BULLETIN NUMBER 55

Geology and Ground Water IN THE Greensboro Area, North Carolina

BY

M. J. MUNDORFF

PREPARED IN COOPERATION WITH THE GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR

RALEIGH
1948

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ABSTRACT

The Greensboro area is in the north-central Piedmont of North Carolina and includes Alamance, Caswell, Forsyth, Guilford, Rockingham, and Stokes Counties.

The area includes 2,975 square miles and had a population of 438,404 in 1940.

The area lies entirely within the Piedmont province, which is characterized by flat to rolling upland surfaces, separated by stream valleys, with a few scattered monadnock hills.

Except for a belt of sandstones and shales along Dan River, the area is underlain by igneous and metamorphic rocks, consisting chiefly of gneiss, schist, slate, and granite.

Wells drilled in greenstone schist have a considerably higher average yield than wells in any other rock unit. The average yield of municipal and industrial wells in this rock is 55 gallons a minute. In granite, gneiss, and the Triassic sandstones and shales, the average yield of municipal and industrial wells is 33 to 35 gallons a minute.

Topographic location has an important bearing on the amount of water yielded by wells. The average yield of wells drilled in draws and valleys is more than 3½ times greater than the average yield of wells drilled on hills. It is probable that draws and valleys mark the location of sheared and fractured zones in which the rocks are saturated with water, whereas hills occupy areas of massive, unbroken rock which contain, and will yield, relatively little water.

Wells drilled where the weathered mantle is thick generally yield larger supplies than those drilled where it is thin.

The yield per foot of well generally decreases with depth and beyond 250 feet drops quite sharply, indicating that it is usually not advisable to drill beyond that depth if the well has not obtained water when it reaches that depth.

Included in the report are a number of tables showing the relation of yield to type of rock, to topographic location, and to depth of wells. The report includes a chapter on the ground-water resources of each of the six counties with tables of well data, chemical analyses, and well logs.

GEOLOGY AND GROUND WATER IN THE GREENSBORO AREA, NORTH CAROLINA

INTRODUCTION

LOCATION OF AREA AND SCOPE OF THE INVESTIGATION

This report, the third of a series on the ground-water resources of the State, gives the results of an investigation of the ground-water resources in a part of the north-central Piedmont of North Carolina. The area consists of Alamance, Caswell, Forsyth, Guilford, Rockingham, and Stokes Counties.

The investigations on which the reports are based are being made through a continuing cooperative agreement between the North Carolina Department of Conservation and Development and the Geological Survey, U. S. Department of the Interior. The program is under the direction of Dr. J. L. Stuckey, State Geologist of North Carolina, and Dr. A. N. Sayre, Geologist in charge, Division of Ground Water, U. S. Geological Survey.

The first report, published as Bulletin 47 of the North Carolina Department of Conservation and Development, is a progress report giving general information on ground-water resources of the entire State, with particular emphasis on the Coastal Plain.

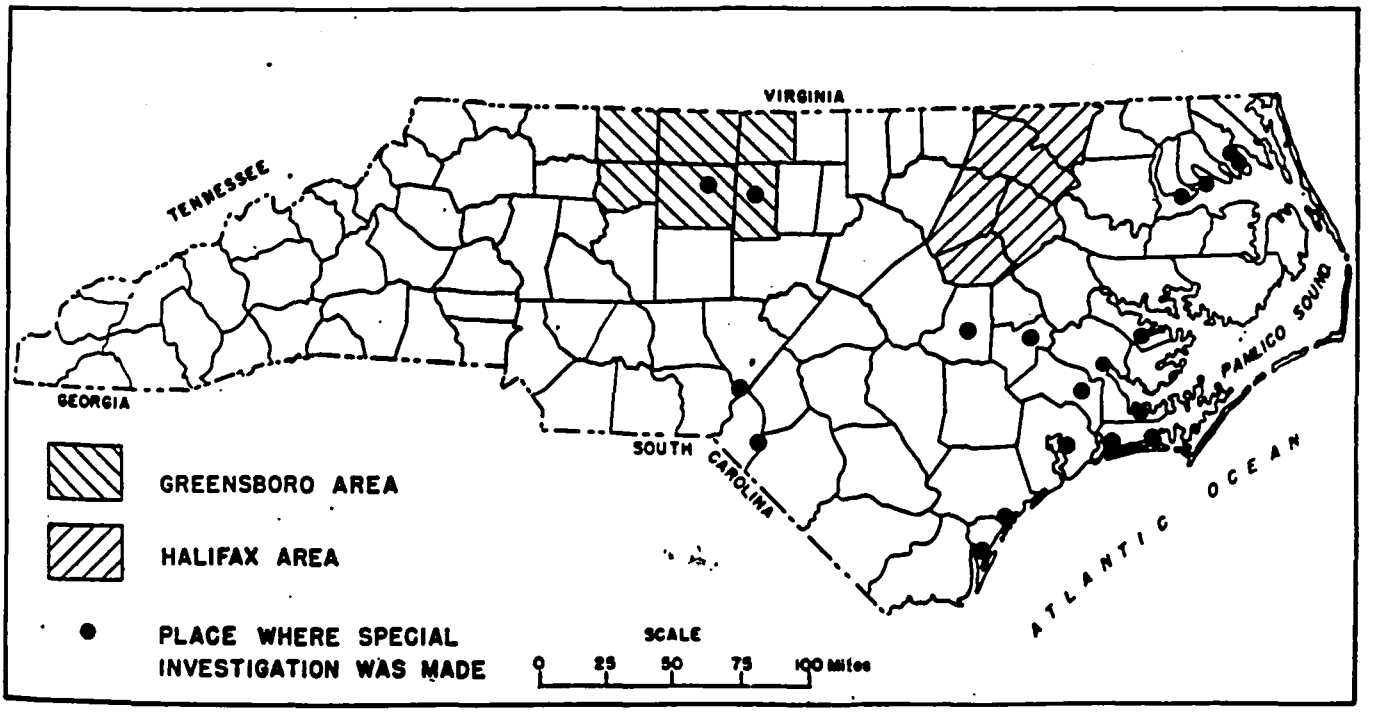

Fig. 1—Index map of North Carolina showing the location of the Greensboro area and other places where ground-water investigations have been made.

The second report, published as Bulletin 51, gives the results of an investigation of the ground-water resources of the Halifax area, including Edgecombe, Halifax, Nash, Northampton, and Wilson Counties.

Because of the many military establishments constructed in North Carolina during the war, most of which utilize ground water, a considerable amount of time has been devoted to special investigations and reports regarding ground-water supplies for military bases, war plants, and contiguous civilian housing areas. The index map (fig. 1) shows the areas in which investigations have been made.

The field work in the Greensboro area was done principally in the summers and autumns of 1942 and 1943 and consisted of obtaining data on about 1,300 wells, a number of springs, and the 23 municipal supplies, collecting samples of water, and noting the geologic and topographic setting of the wells. Information on the wells was obtained by interviewing well owners and operators and well drillers. A great deal of the information was given from memory and some of it, therefore, may be somewhat inaccurate.

During the course of the field work it was found that existing geologic maps were so generalized as to be wholly inadequate for use with the hydrologic data secured. Therefore, an additional 5 weeks were spent in the autumn of 1944 in mapping the geology on a reconnaissance scale. It should be emphasized that the geologic map (pl. 1) is based on these few weeks of field work plus notes made during the collection of hydrologic data in 1942 and 1943; and, in detail, the geology of the area is a great deal more complex than is shown by the map. Rocks of similar geologic and hydrologic characteristics have generally been mapped together. Also, some rocks of different kinds have been mapped together because they occur together in such a way that only mapping on a large scale, requiring a great deal of time, would permit their separation. The belt mapped as gneiss is a good example of this in that several types of gneiss and schist may alternate repeatedly in a short distance.

ACKNOWLEDGMENTS

Nearly all the chemical analyses were made by members of the Quality of Water Division, U. S. Geological Survey. The names of the analysts are given in the tables of analyses.

The writer wishes to acknowledge the courteous and generous assistance of the well owners, well drillers, school superintendents, superintendents of public water supplies, and many others. Without their aid the investigation could not have been successfully completed. Especial acknowledgment is due the well drillers, including the Carolina Drilling and Equipment Co., Danville Well Drilling Co., Heater Well Co., M. A. Holder, John Hopkins, W. B. Mayhew, J. A. Rich, F. L. Smith, J. Stafford, Sydnor Pump and Well Co., Virginia Machinery and Well Co., and Well Drillers Inc., who generously gave their time and effort in furnishing records of wells drilled by them.

GEOGRAPHY

INTRODUCTION

Area and population.—The Greensboro area is in the north-central part of the State, bordering the Virginia State line, and includes Alamance, Caswell, Forsyth, Guilford, Rockingham, and Stokes Counties, with a total area of 2,975 square miles. The location of the Greensboro area is shown in figure 1.

The area had a population of 438,404 in 1940, about 147 to the square mile, according to the U. S. Census Bureau report. There are 18 incorporated cities and towns with an aggregate population of 219,121, which is 50 percent of the total population of the area. Four cities, Burlington, Greensboro, High Point, and Reidsville, have a population of more than 10,000, and nine other cities and towns have a population of more than 1,000.

Agriculture and industry.—More than 79 percent of the area is included in farms, nearly half the total area of the farms, however, being woodland. The total value of the farm products in 1939, according to the 1940 census, was $20,599,677, tobacco accounting for slightly more than half the total. Other important products are livestock, dairy products, poultry and eggs, corn, wheat, hay, potatoes, and vegetables.

Manufacturing is the most important occupation in the area, with 67,607 wage earners being employed in 1939. The 1940 census report lists 526 manufacturing establishments in the Greensboro area. The total value added to that of the raw materials by the operations of these establishments in 1939, exclusive of the establishments in Forsyth and Rockingham Counties which are not reported, is more than $61,000,000. If these two counties were included, the total value added by manufacture probably would be well above $100,000,000. The textile industry, chiefly cotton, is the most important, employing about 65 percent of all factory workers. Tobacco manufacture, principally the manufacture of cigarettes, is next in importance, followed by furniture, food, chemicals, and lumber.

esistance to erosion; and because the beds
ion were developed on the more resistant
ʼcks has considerably modified the drainage
ple of structural control is that of the Dan
the North Carolina-Virginia line, a distance
outhward into the northwestern corner of
belt of Triassic sediments between Walnut
lows northeastward to Danville, Virginia,
ie contact between the Triassic shales and
ʼisses and schists is generally several hun-
the river flows. Dan River meanders con-
ʼainst the metamorphic rocks to the south-
in the Triassic shales by the greater resist-

ʼic structure, though not in such a spectac-

l in flat areas of considerable extent. Drain-
f these areas, in contrast to the complex

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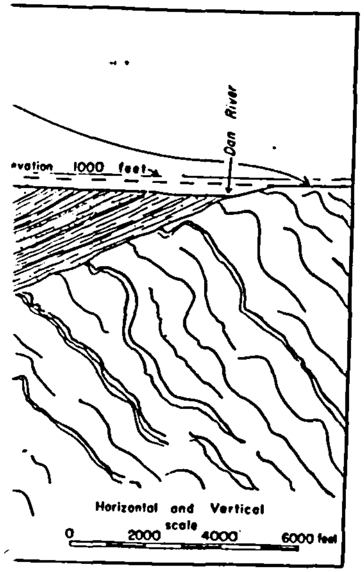
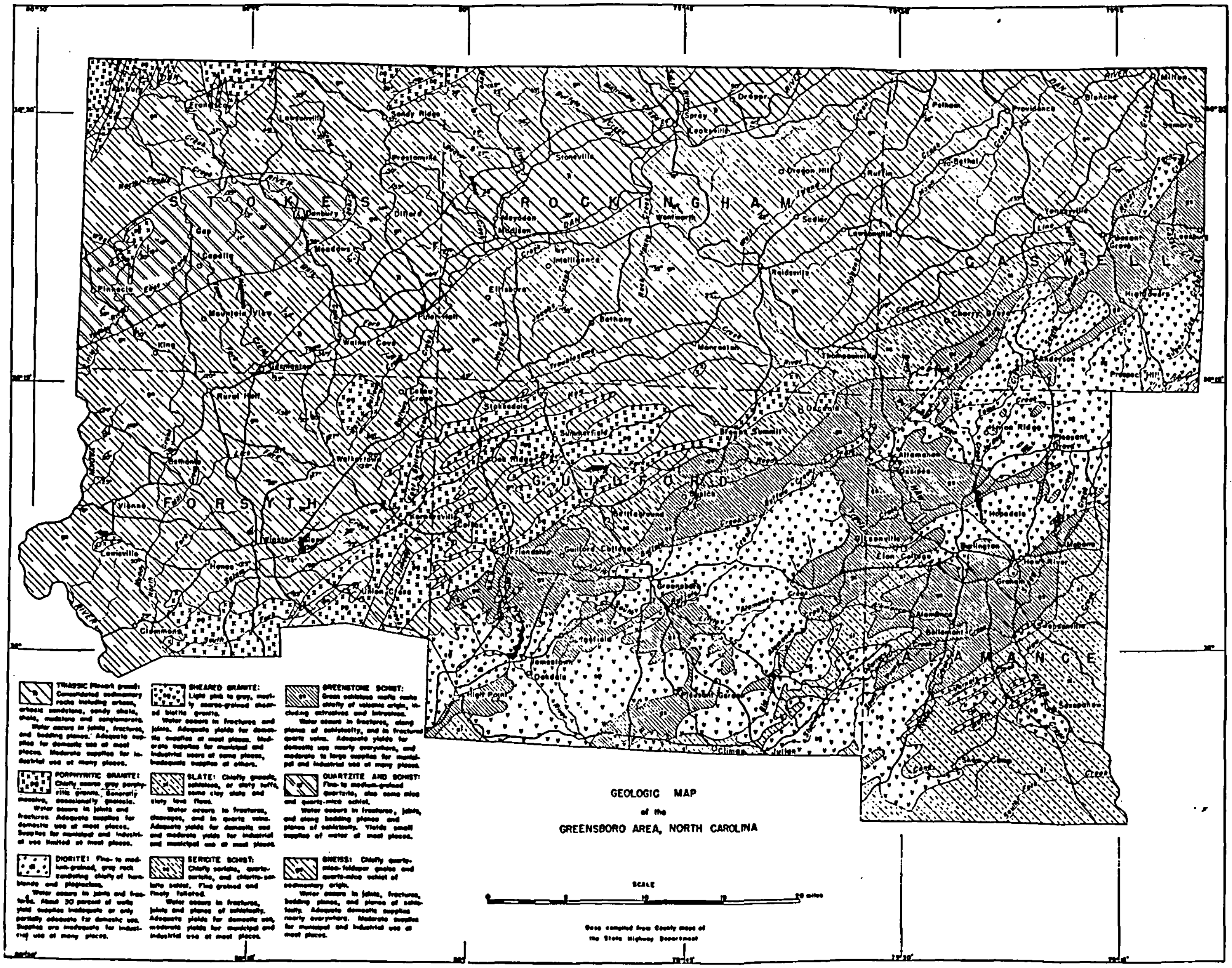
reas, remnants of the peneplane are pre-
at. This uniformity is illustrated in plate



ʼg the physiography and structure.



GEOLOGIC MAP
of the
GREENSBORO AREA, NORTH CAROLINA

Above-normal rainfall during 1935 and 1936 resulted in high ground-water levels in the spring in 1935, 1936, and 1937. However, the excess of rain did not prevent the water level from declining to near-normal levels in the autumn of each year. Below-normal rainfall in the winter and spring of 1938 prevented the normal winter and spring rise; and although about the normal amount of rain fell during the remainder of the year, the water level in the Lindale well reached record low stages. Because of the above-normal rainfall during the last part of 1938 at Haw River, the Governor Holt well did not decline to record lows. Rainfall and water levels in both wells were not far from normal in 1939 and 1940. Below-normal rainfall in nearly every month of 1941 and in January 1942 resulted in record low levels in both wells during the first part of February 1942. Approximately normal rainfall during February and March did not suffice to raise the water level of either well back to normal, evidently because of a very large deficiency in soil moisture. With approximately normal rainfall during the remainder of the year, both wells were at below-normal levels. However, the water level at the end of the year was not far below normal and evidently the soil-moisture deficiency was not large because the water level made its usual spring recovery in 1943 with normal or below-normal rainfall. Above-normal rainfall in 1944 built up the water table to a very favorable position at the end of 1944, although no record high was reached.

UTILIZATION OF GROUND WATER

Ground water in the Greensboro area is obtained from wells and springs. The different types of wells include dug, bored, and drilled wells.

Dug wells.—More domestic water supplies in the Greensboro area are obtained from dug wells than from any other type. Dug wells in the area range from a few feet to nearly 100 feet in depth. The hole is generally dug between 30 and 60 inches in diameter. When the well is curbed with terra cotta or concrete pipe, the inside diameter usually is 24 to 30 inches. The inside diameter of masonry- or rock-curbed wells and uncurbed wells generally is somewhat greater. Dug wells have certain advantages over other types of wells but also have certain disadvantages. Probably the most important consideration that leads to the choice of a dug well is that of cost. Generally this is the least expensive method of obtaining a water supply, with the possible exception of bored wells. Furthermore, many wells on farms and on the fringes of towns are dug by the owner in his spare time or in slack seasons, so that there is no cash outlay from digging. However, cost is not always in favor of the dug well, particularly where bedrock is encountered before a satisfactory supply is obtained. The cost of dug wells under such conditions has been reported at several places to have exceeded the cost of the average drilled well in the neighborhood. A second advantage of the dug well is the large storage capacity as compared particularly with the small-diameter drilled wells. A well 24 inches in diameter will contain nearly 24 gallons of water per foot of depth, as compared to 1½ gallons and 1/6 gallon per foot of depth for wells 6 inches and 2 inches in diameter, respectively. Thus, even though the yield of a well may be very low, a fairly large quantity of water can be withdrawn in a short time.

Dug wells have two important disadvantages. Usually the depth of water in a dug well is not great, either because of the difficulty involved in digging below the water table or because bedrock is encountered. In periods of drought, therefore, many dug wells go dry. A second disadvantage is that the water in these wells is much more susceptible to pollution or contamination by the entrance of impure surface water. A survey made in Pennsylvania in 1930 and 1931, during which 17,665 water supplies were examined for purity, showed that the supplies from 90 percent of the drilled wells were safe whereas less than 50 percent of the supplies from dug wells were safe[1].

The danger of contamination of dug wells can be decreased by observing certain precautions. All dug wells should be covered tightly to prevent direct entrance of contaminating material, either solid or liquid. The well should be cased or curbed with tile or concrete pipe or similar material and the joints should be cemented to a depth of at least a few feet below the water table, but in any event to a depth of at least 10 feet below the surface. The space between the walls and the curbing should be filled, above the water-bearing bed, with clay. The dug well should be located several hundred feet from any source of contamination and up the ground-water slope from any nearby source of contamination.

[1] Lohman, Stanley W., Ground water in northeastern Pennsylvania; Pennsylvania Topog. and Geol. Survey Bull. W4, p. 40, 1937.

ANALYSES OF GROUND WATER FROM FORSYTH COUNTY, NORTH CAROLINA

(Analysts: E. W. Lohr and M. S. Berry, U. S. Geological Survey. Numbers at heads of columns correspond to numbers in table of well data)

(parts per million)

	2	3	93	124	164
Silicia (SiO_2)	31	28	22	31	29
Iron (Fe)	.02	.02	.03	.03	.03
Calcium (Ca)	5.7	22	64	23	6.7
Magnesium (Mg)	3.1	8.0	24	7.4	3.0
Sodium and Potassium (Na+K)	14	7.2	67	7.0	1.3
Carbonate (CO_3)	0	0	0	0	0
Bicarbonate (HCO_3)	63	112	46	92	30
Sulfate (SO_4)	3.2	9.1	10	17	3.7
Chloride (Cl)	1.2	1.5	225	5	1.2
Fluoride (F)	----------	----------	.0	.5	----------
Nitrate (NO_3)	.0	.0	47	2.0	2.2
Dissolved solids	89	130	603	143	71
Total hardness as $CaCO_3$	27	88	258	88	29
Date of collection	May 21, 1943	May 20, 1943	Oct. 16, 1942	Oct. 13, 1942	May 19, 1943
Depth (feet)	130	350	714	308	110
Chief aquifer	Gneiss	Gneiss	Gneiss	Granite	Granite

GUILFORD COUNTY

(Area, 651 square miles; population, 153,916)

Geography, physiography, and drainage.—Guilford County, in the south-central part of the Greensboro area, is the largest of the six counties and has the largest population. It has four incorporated cities and towns and about 14 unincorporated towns and villages. Greensboro, located in the center of the county, is the largest city and county seat. High Point, the only other city, is in the extreme southwestern corner of the county. Greensboro is an important center of textile manufacturing and High Point also has a number of textile factories, although it is better known as a center of furniture manufacturing. There are a few factories in the smaller towns and villages, but the remainder of the county is dominantly agricultural. Guilford County has a good system of paved roads and railroads, most of which radiate from Greensboro.

Guilford County is in the Piedmont physiographic province. Its surface is formed by the uplifted and partially dissected peneplane of that province. The land surface near the larger streams is gently rolling, with a relief of 100 to 150 feet. The interstream areas are broad and generally quite flat. No large trunk streams flow through or near Guilford County and therefore there are no deep valleys. Because the base-level is higher, dissection has generally been less extensive than in other counties of the Greensboro area. Guilford County is underlain by rocks of several different types. Because some of these differ considerably in resistance to erosion, both the topography and the drainage pattern are greatly influenced by the geology. However, topographic maps have not been made of any part of the county, and the geology is complex and at many places obscure, so that the exact relation of the topography and drainage to the geology cannot always be ascertained. The outstanding feature is the northeastward trend of the ridges and streams. Apparently some of the streams flow along or near the contact between different kinds of rocks, whereas others flow in weaker rocks, the more resistant rocks forming interstream divides. The major exception to the northeastward trend of the streams is Deep River, which flows southeastward chiefly across diorite and granite, which are uniformly resistant.

Practically all of Guilford County is drained by the two main branches of the Cape Fear River system, Haw River and Deep River. About 75 percent of the county is drained by Haw River and its tributaries, the most important of which are Reedy Fork, Buffalo Creek, and Alamance Creek. Practically all of the remaining 25 percent is drained by Deep River, only a few square miles of the southwest corner of the county draining southward into Yadkin River.

Geology.—The geology of Guilford County apparently is more complex than that of any other county of the Greensboro area. Seven of the nine geologic units crop out in Guilford County and the areal distribution of most of them is quite irregular.

The gneiss unit crops out in several irregular belts extending northeastward across the northwestern corner of the county. These belts are separated by areas of porphyritic granite, which was intruded into the gneiss. The principal rocks of the gneiss unit are banded quartz-mica-feldspar gneiss and quartz-mica schist. They are chiefly of sedimentary origin, and although the rocks have been greatly changed by metamorphism at many places the bedding planes can still be distinguished. The granite has intimately intruded the gneiss so that the boundaries between the two units necessarily are greatly generalized.

The greenstone schist crops out in large, irregularly shaped areas in the southeastern two-thirds of the county. These areas are separated by areas of sheared granite. The greenstone schist consists of a green fine- to medium-grained basic schistose rocks, chiefly of volcanic origin. At most places the rock is highly schistose but at a few places it is coarser and fairly massive.

The sericite schist crops out in a belt extending northeastward across the county from a point near Guilford College. It is closely associated with the greenstone schist and may be a metamorphosed tuff or possibly a metamorphosed clay. The rock is greatly weathered, and usually the only recognizable minerals are quartz, sericite and iron oxide, the latter apparently an oxidation product of chlorite and hornblende.

The slate unit is limited to a narrow, highly irregular belt extending across the southeastern corner of the county and to a small patch in the south edge of High Point. The rocks are mostly tuffaceous slates but include some clay slates.

The sheared granite is exposed over about 50 percent of the southeastern half of the county, where it forms a fairly continuous area interrupted by large patches of greenstone and slate. The granite is generally a moderately coarse pink schistose and gneissic rock consisting chiefly of quartz, biotite, and feldspar. The granite has been considerably metamorphosed and intensely sheared. The outstanding feature of the granite is the schistose and slaty dikes, which are green in color and greatly resemble the greenstone schists.

Diorite crops out at a number of places but was mapped separately at only two places. The outcrops otherwise are too small or not well enough exposed to map separately. Places where diorite crops out but is not shown on the map include the vicinity of Sedgefield, Pleasant Garden, along State highway 62 between Climax and High Point, and an area about 6 miles north of High Point. The diorite is a medium- to coarse grained, dark-gray to greenish-gray rock consisting chiefly of plagioclase and hornblende. It generally is massive but at a few places is somewhat schistose.

The porphyritic granite outcrops in irregular, elongated patches across the northwestern corner of the county, where it is closely associated with the gneiss. In places the gneiss has been completely assimilated by the granite but in other places the gneiss has only been impregnated by emenations from the granitic magma. Because the granite has so intimately intruded the gneiss and because every gradation between true granite and true gneiss can be found, the map is necessarily greatly generalized.

The porphyritic granite is generally coarse-grained and medium gray, with large phenocrysts of feldspar. The ground mass consists of quartz, biotite, and feldspar. At most places the granite is entirely massive, but at some places the granite has some of the schistosity of the gneiss.

Ground water.—Nearly all domestic water supplies, many industrial supplies, and one of the three municipal water supplies are obtained from wells.

Dug wells are extensively used for domestic supplies in rural districts. Generally they are from about 15 to 50 feet deep and 2½ to 4 feet in diameter. Wells can generally be dug deep enough in gneiss and schist that they will not go dry even during a drought. However, at some places in granite, diorite, greenstone schist, and slate, the rock is so close to the surface that dug wells frequently go dry.

Bored wells are used considerably in suburban areas and are cheaply and easily constructed. They are bored by power-driven earth augers and cannot go below the completely weathered zone. For this reason, they are not always successful in rocks such as granite and diorite, where the water table at times declines below the weathered zone. Most bored wells are cased, and where they are properly constructed and of sufficient depth that they will not go dry, they are a satisfactory source of supply. Dug and bored wells

obtain their water from the weathered rock material at and just below the water table. For this reason, extra precautions must be observed to prevent contamination.

There are a large number of drilled wells in Guilford County. Records of more than 350 drilled wells are given in the tables of well data. Many of these were core-drilled with chilled shot and are 2 or 3 inches in diameter. There are many other core-drilled wells in Guilford County which do not appear in the table. Core-drilled wells have the advantages of all drilled wells and are cheaper than the larger percussion-drilled wells. However, although they are satisfactory for domestic wells, their small size makes them unsatisfactory for most industrial plants. About 7 or 8 gallons a minute is the maximum rate at which water can be removed from a 2-inch well by a deep-well pump. The average yield of 157 wells 2 inches in diameter in Guilford County is 6 gallons a minute and the average yield of 20 wells 3 inches in diameter is 10½ gallons a minute. These quantities are near the maximum amount that can be pumped from wells of that diameter and suggest that many of the wells would yield more than can be withdrawn from the well.

Most industrial, and public-supply wells are drilled with a percussion drill and are from 4 to 8 inches in diameter. The 6-inch well is by far the commonest. The larger-diameter wells encounter more fractures and cracks than small-diameter wells. Also, because a larger pump can be used, more water can be pumped from a large-diameter well than from a small-diameter well.

Drilled wells, both core-drilled and churn-drilled, have certain advantages over dug or bored wells. Because they are generally tightly cased and the water is obtained from crevices in the rock, they are much less liable to contamination. The depth of water in the well is generally large in comparison with the fluctuation of the water level, so that the yield decreases only slightly during a drought.

A summary of data on drilled wells 3 inches or more in diameter is given below:

TABLE 16—SUMMARY OF DATA ON WELLS IN GUILFORD COUNTY
(Drilled wells 3 inches or more in diameter)

ACCORDING TO ROCK TYPE

Type of Rock	Number of Wells	Average Depth (feet)	Yield (gallons a minute)			Percent of wells yielding less than 1 gallon a minute
			Range	Average	Per foot of Well	
Gneiss	20	123	1—50	15.6	0.126	5.0
Greenstone schist	67	163	1—200	36.5	.223	3.0
Sericite schist	8	116	5—20	11.1	.105	0
Slate	4	273	5—15	10.5	.039	0
Sheared granite	54	175	0—70	14.4	.093	13.0
Porphyritic granite	26	137	½—30	10.9	.079	3.8
All wells	179	158	0—200	22.0	.139	6.1

ACCORDING TO TOPOGRAPHIC LOCATION

Topographic Location	Number of Wells	Average Depth (feet)	Yield (gallons a minute)			Percent of wells yielding less than 1 gallon a minute
			Range	Average	Per foot of Well	
Hill	41	203	0—100	15.5	0.076	24.4
Flat	44	170	0—200	22.2	.131	2.3
Slope	55	130	2—120	21.8	.168	0
Draw	16	125	2½—75	22.8	.182	0
Valley	22	158	10—100	34.4	.218	0

Reference 12

SOIL SURVEY OF

Guilford County, North Carolina

United States Department of Agriculture
Soil Conservation Service

In cooperation with
Board of Commissioners, Guilford County, North Carolina, and
North Carolina Agricultural Experiment Station

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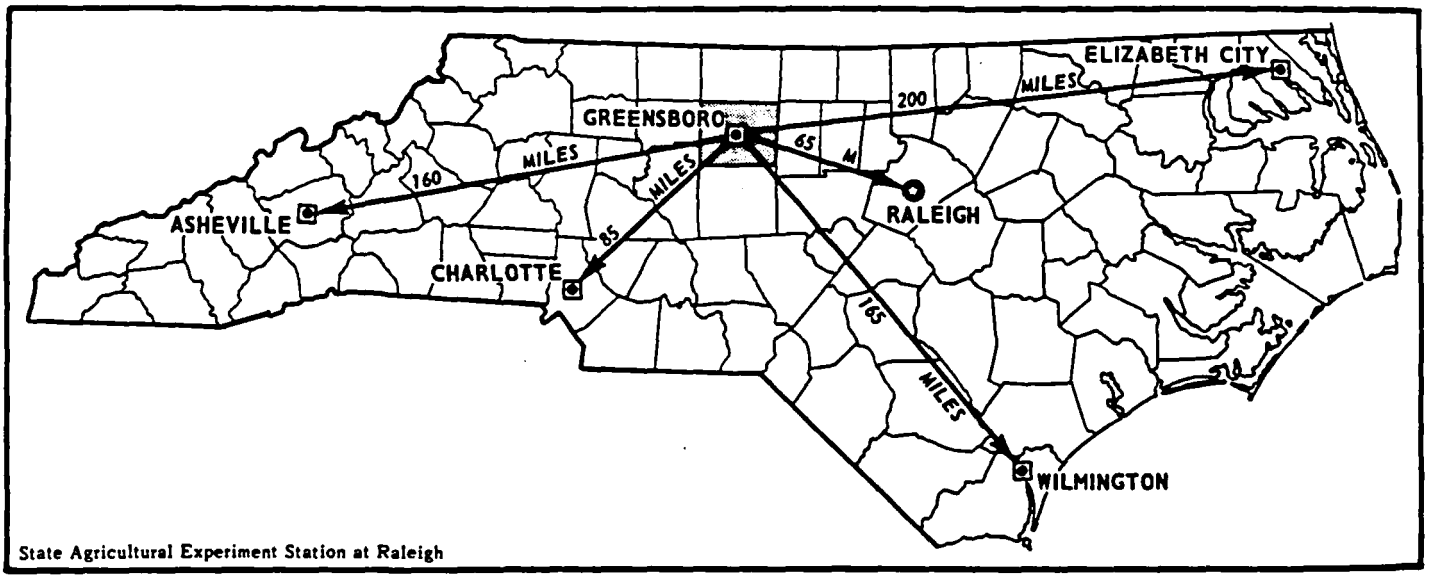
Issued December 1977



Location of Guilford County in North Carolina.

SOIL SURVEY OF GUILFORD COUNTY, NORTH CAROLINA

By Ronald B. Stephens

Soils surveyed by E. H. Karnowski, R. B. Stephens, Marcus R. Bostian, R. L. Howard, Roger J. Leab, and Michael L. Sherrill, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with Board of Commissioners, Guilford County, North Carolina, and North Carolina Agricultural Experiment Station

Introduction

GUILFORD COUNTY is an agricultural, industrial, and urbanized county in north-central North Carolina (See map on facing page). It is bounded on the east by Alamance County, on the north by Rockingham County, on the west by Forsyth County, and on the south by Randolph County. The area of Guilford County is 415,940 acres. In 1970 the population was 288,590. The City of Greensboro is the county seat and is at the geographic center of the county.

Guilford County is in the Piedmont physiographic province. The county is generally rolling with moderately steep slopes along the drainageways.

Guilford County is rapidly growing into an industrial and urban county. Well diversified industry, government at all levels, educational institutions, wholesale and retail outlets, and transportation all contribute substantially to the economy of the county.

The northern part of the county is still primarily agricultural. Tobacco provides about 80 percent of the gross farm income from the major crops. Corn, hay, wheat, soybeans, oats, sweet potatoes, Irish potatoes, lespedeza seed, and cotton account for most of the remaining farm income. Beef and dairy livestock and poultry are also raised.

General Nature of the County

This section gives general facts about Guilford County. It briefly discusses climate, history, cultural facilities, industry and transportation, water supply, and land use.

Climate

Guilford County is hot and generally humid in summer because of its moist maritime air. Winter is moderately cold but short because the mountains to the west protect the county against many cold waves. Precipitation is quite evenly distributed throughout the year and is adequate for all crops.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Greensboro for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter the average temperature is 40 degrees F, and the average daily low is 29 degrees. The lowest temperature on record, -1 degree, occurred at Greensboro on January 16, 1972. In summer the average temperature is 76 degrees, and the average daily high is 86 degrees. The highest temperature, 102 degrees, was recorded on June 27, 1954.

Growing degree days, shown in table 1, are equivalent to "heat units." Beginning in spring, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 22 inches, or 52 percent, usually fails during the period April through September, which includes the growing season for most crops. Two years in 10, the April-September rainfall is less than 19 inches. The heaviest 1-day rainfall during the period of record was 6.24 inches at Greensboro on October 15, 1954. Thunderstorms number about 47 each year, 29 of which occur in summer.

Average seasonal snowfall is 11 inches. The greatest snow depth at any one time during the period of record was 15 inches. On the average, 4 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night in all seasons, and the average at dawn is about 85 percent. The percentage of possible sunshine is 64 percent in summer and 54 percent in winter. Prevailing winds are southwesterly. Average windspeed is highest, 9 miles per hour, in March.

In winter every few years heavy snow covers the ground for a few days to a week. Every few years in late summer or autumn, a tropical storm moving inland from

differences among the soils of Guilford County. Major differences among parent materials, such as differences in texture, can be observed in the field. Less distinct differences, such as differences in mineralogical composition, can be determined only by careful laboratory analysis.

The two broad classes of parent materials in Guilford County are residual materials and alluvium. Residual material is related to the underlying rock, from which it has weathered. Transported materials are related directly to the soils or rocks from which they were removed.

Guilford County is underlain by granite, diorite, slate, schist, and gneiss (*3*). Granite makes up about 48 percent of the underlying rock. Gneiss is found in the northwestern corner of the county and makes up about 15 percent. Schist underlies about 31 percent of the county. Minor amounts of diorite and slate make up the remaining underlying bedrock.

In Guilford County the parent materials of the residual soils derived primarily from acid and basic igneous and metamorphic rocks. The light-colored, acid rocks include granite, gneiss, and schist. Cecil and Appling soils formed in material derived from acid igneous and metamorphic rocks, as reflected in the low pH of these soils. In addition, the characteristics of the parent material have influenced the texture of these soils and of other more friable, coarser textured soils of this group. The dark-colored, basic rocks include diorite and gabbro. These rocks are the parent material of Iredell, Mecklenburg, and other soils of the county that are more plastic and finer in texture. The basic influence of the parent materials is reflected in the reaction of these soils: they are less acid than others in the county. A number of soils of Guilford County formed in mixed acid and basic rocks; for example, Coronaca, Helena, Sedgefield, and Wilkes soils. Greenstone schist makes up a large part of the mixed rocks. At various locations the mixture consists of weathered granitic rocks and dikes of basic, dark-colored rocks that intrude into the granite. These dikes vary considerably in width, and their sudden outcropping results in abrupt changes in kinds of soil. Many of the soils in such areas are mapped in the Helena-Sedgefield complex.

Transported parent materials are primarily alluvium and local alluvium, both of which may be young or old. Young alluvium has been deposited recently and consists of material that has been changed very little by the soil-forming processes. Old alluvium consists of material that has been deposited long enough for the soil-forming processes to change it in varying degrees. Local alluvium consists of soil material that has been transported short distances by water and has been deposited along small drainageways, in depressions, and at the foot of slopes. The principal soils that formed in alluvium along streams on flood plains are in the Congaree, Chewacla, and Wehadkee series.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

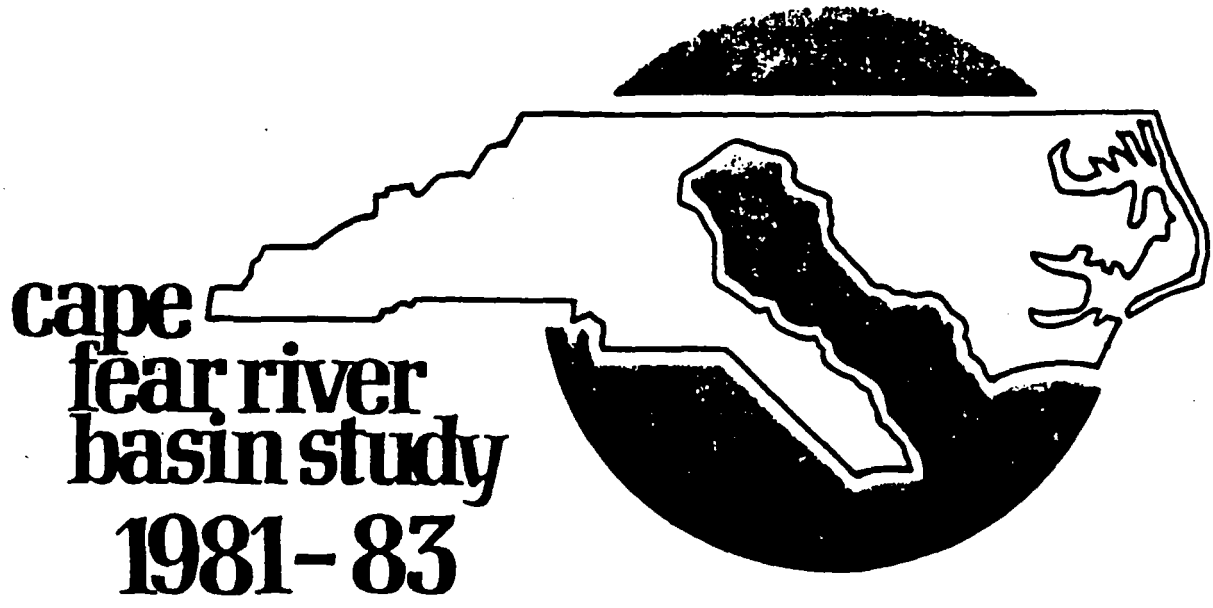
Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

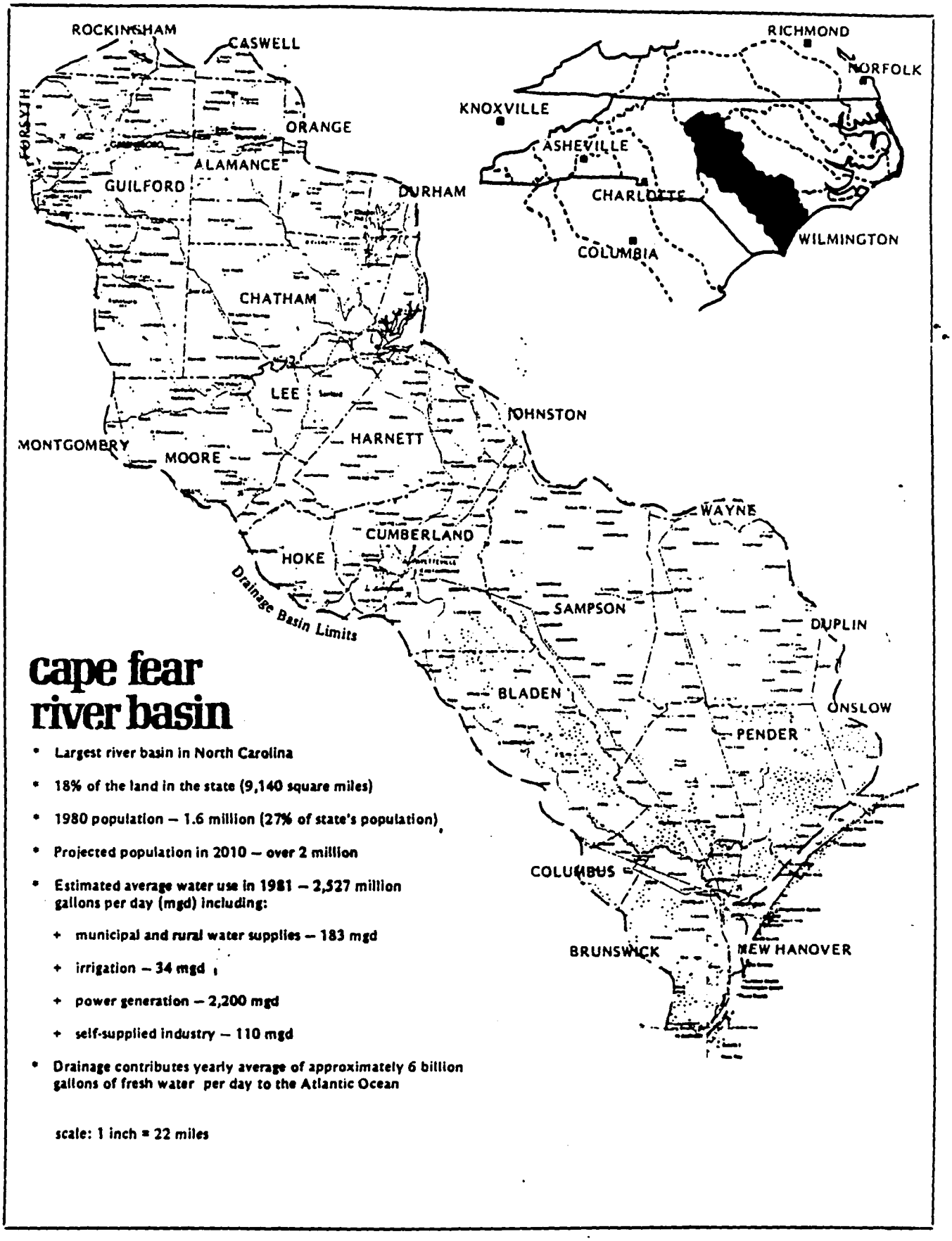
Reference 13

Bob Dooley

GROUND-WATER SUPPLY POTENTIAL AND PROCEDURES FOR WELL-SITE SELECTION

UPPER CAPE FEAR RIVER BASIN





cape fear river basin

- Largest river basin in North Carolina
- 18% of the land in the state (9,140 square miles)
- 1980 population – 1.6 million (27% of state's population)
- Projected population in 2010 – over 2 million
- Estimated average water use in 1981 – 2,527 million gallons per day (mgd) including:
  - municipal and rural water supplies – 183 mgd
  - irrigation – 34 mgd
  - power generation – 2,200 mgd
  - self-supplied industry – 110 mgd
- Drainage contributes yearly average of approximately 6 billion gallons of fresh water per day to the Atlantic Ocean

scale: 1 inch = 22 miles

GROUND-WATER SUPPLY POTENTIAL

AND

PROCEDURES FOR WELL-SITE SELECTION

UPPER CAPE FEAR RIVER BASIN

CAPE FEAR RIVER BASIN STUDY

Sponsored by

North Carolina Department of Natural
Resources and Community Development
and
U. S. Water Resources Council

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P. O. Box 27687
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GROUND-WATER SUPPLY POTENTIAL AND PROCEDURES FOR WELL-SITE SELECTION IN THE UPPER CAPE FEAR RIVER BASIN, NORTH CAROLINA

By

Charles C. Daniel III and N. Bonar Sharpless

ABSTRACT

Population growth and industrial development in the 1,750 square mile upper Cape Fear River basin of the central North Carolina Piedmont has been increasing, and current surface-water supplies are approaching limits of capacity. Thus, other water sources need to be considered as alternatives in planning for future water supplies. Ground water is one alternative source of supply. Ground water supplies nearly half the population in the Piedmont and Blue Ridge areas of North Carolina. Ground water is used at a rate of about 200 million gallons per day, yet it is a vastly underutilized resource and little used for large municipal and industrial sources of water.

This report describes the most favorable areas for high-yield wells (yields equal to or greater than 50 gal/min), estimates the total ground water availability both in storage and from recharge, and describes a site-selection procedure for wells that is based on bedrock lithology, geomorphic analysis to locate fractures, and reconnaissance mapping to locate areas of thick regolith and a high water table.

Ground water is stored in the regolith and in the underlying fractured bedrock. The regolith averages about 50 feet thick and contains approximately 1.5 billion gallons per square mile of potentially available water. Seasonally this value ranges from 1.3 to 1.7 billion gallons per square mile. Storage capacity in the fractured bedrock is low and decreases to nearly zero below a depth of about 400 feet. Precipitation data from National Weather Service stations

at Graham, Greensboro, and High Point averaged 45.9 inches per year for the period 1971 through 1980. About 19 percent of this amount infiltrates to the water table to recharge the ground-water system.

The mafic volcanics unit is the most productive bedrock aquifer, having nearly three times as many high-yield wells as the sheared granite, porphyritic granite, felsic volcanics, mica gneiss, and diorite. High-yield wells are absent in the mica schist and argillite units. The sheared granite, based on outcrop area and well yield, is the second best unit for wells.

High-yield wells are most often found in draws or narrow valleys where the well site is underlain by thick regolith and highly fractured bedrock, and has a high water table. Drainage patterns provide clues to the presence or absence of fractured bedrock.

Drilling of test wells demonstrated the usefulness of the site-selection criteria for locating, in selected geologic units, wells with above average yields that penetrated zones of highly fractured rock at sites with thick regolith and a high water table. A well completed in the sheared granite near Gibsonville yielded 18 gallons per minute, above average for the sheared granite unit. A production well drilled in the mafic volcanics near the Greensboro-High Point Regional Airport yielded 50 gallons per minute, nearly twice the average for the unit. That well was tested by continuous pumping for 62 hours at an average rate of 38.5 gallons per minute. Eighteen additional wells, 4 in bedrock and 14 in the regolith, were monitored during the test. The water table assumed the shape of an elliptical cone with the long axis approximately parallel to the strike of foliation in the bedrock. Nearly all the pumped water was derived from storage in the regolith.

INTRODUCTION

Additional water supplies will be needed in the upper Cape Fear River basin as population and industrial development continue to increase. Development of additional surface-water sources will be confronted by a number of problems, including: (1) reservoirs compete with farming, housing, and industrial development, for available land; (2) many of the best reservoir sites, those in deep, narrow valleys, are in use; (3) less suitable sites having wider, shallower valleys, will require more land area. Shallow reservoirs also tend to have more water-quality problems associated with biologic activity than deeper reservoirs; and, (4) increasing land and construction costs will make new reservoirs very expensive to build. Thus, other water sources need to be considered as alternatives in planning for future water supplies.

Ground water has many attractive features as a source of supply. Ground water in the Piedmont province has a relatively low cost of development (Cederstrom, 1973). Generally, ground water in Piedmont areas, such as the upper Cape Fear River basin, is of good chemical quality and requires little treatment. Because of the large quantity of water in storage, the ground-water system usually can sustain moderate yields during annual drought periods. Use of ground water generally permits other land use activities if they do not impede the infiltration of recharge or diminish water quality.

Ground water is an important but underutilized water-supply source in the Piedmont province and hydrogeologically similar Blue Ridge province of North Carolina. Data from a recent survey (Mann, 1978) show that 13 percent of the 132 public water supplies serving 500 or more customers in the Piedmont rely on ground water. In 1975, out of a total population of 3,950,000 in the Piedmont and Blue Ridge of North Carolina, two million people relied on ground water as a source of supply (Heath, 1978). Ground-water use was approximately 200 million gallons per day.

Results of studies in other areas of the Piedmont similar to the upper Cape Fear River basin suggest that the ground-water system may possibly support large yields. For example, many wells in the Georgia Piedmont produce more than 100 gal/min (gallons per minute) and some yield nearly 500 gal/min (David Swanson, Georgia Geological Survey, written comm., 1979). Similarly, Cederstrom (1972) found that yields of 100 to 300 gal/min are not uncommon for bedrock wells in the Piedmont and Blue Ridge provinces from Maine to Virginia.

Purpose and Scope

The primary purpose of this study was to evaluate ground water as a source of large supplies for the upper Cape Fear River basin. The occurrence and quantities of ground water available, both in storage and from recharge by precipitation, are described in this report along with improved techniques for developing the resource and locating sites to drill wells which will have a good probability of offering high sustained yields. This report discusses findings made from January 1982 to May 1983.

The most favorable conditions for ground-water development were identified in an analysis of existing records of high-yield wells (yields greater than 50 gal/min) and correlations between well yield and rock type, topographic position, distance from streams, and regolith thickness.

Ground-water storage was estimated from water-level records, estimates of regolith thickness, and hydrologic properties of core samples from the north Georgia Piedmont. An estimate of the maximum ground-water availability was determined in water-budget analyses for several streams in the upper Cape Fear River basin using continuous streamflow records and rainfall data collected between 1971 and 1980. Ground-water recharge was estimated by hydrograph separation.

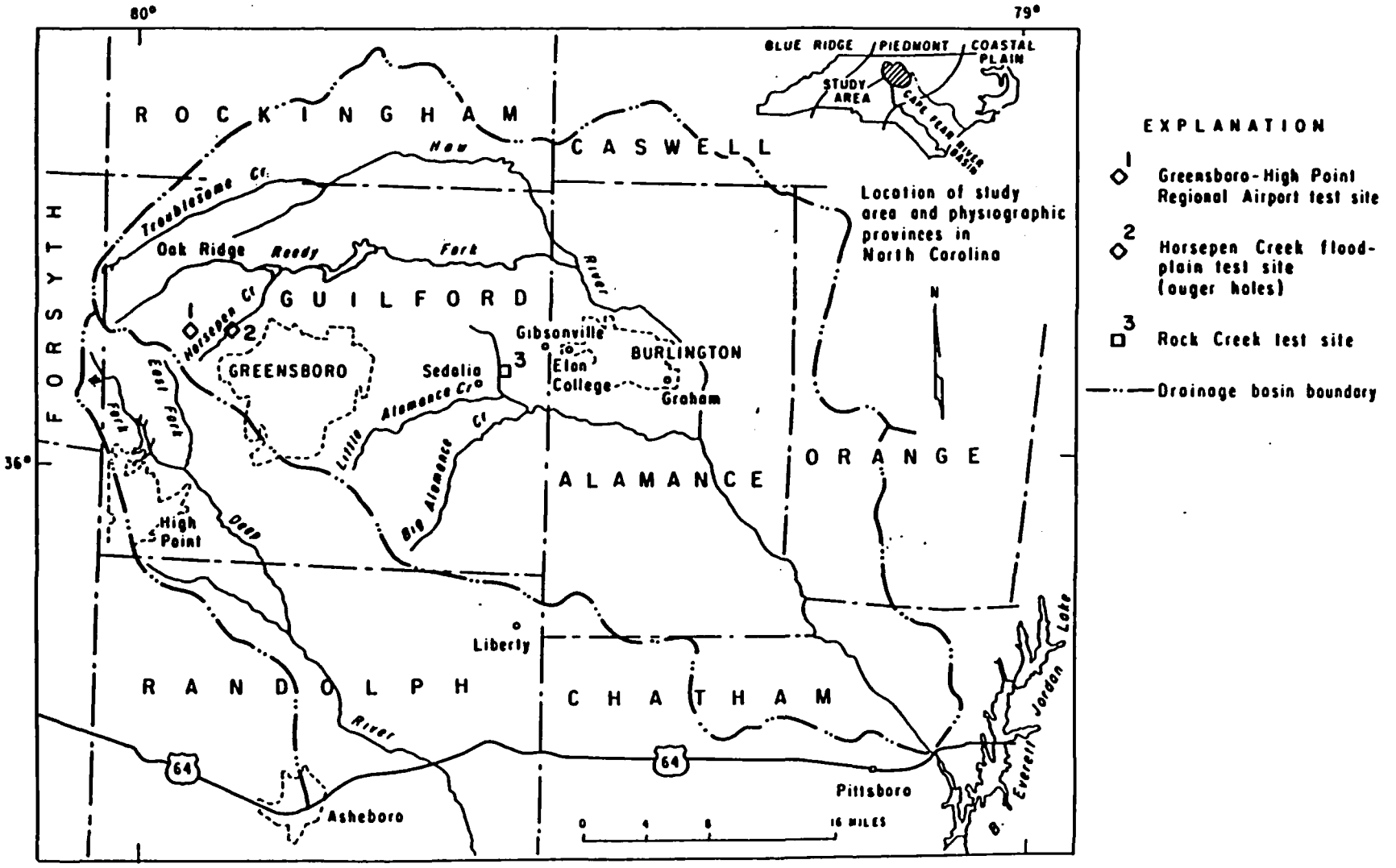

Figure 1.--Regional setting of the upper Cape Fear River basin study area in the Piedmont physiographic province of North Carolina.

Climate

The climate of the study area is temperate with distinct seasonal changes in weather. The coldest month is January with an average temperature of about 41 degrees Fahrenheit and the warmest month is July with an average temperature of about 78 degrees Fahrenheit. The average annual rainfall is approximately 45 inches. The growing season, that period without killing frosts, lasts from mid April to the end of October. The moderate weather and abundant rainfall support the lush growth of natural vegetation and crops of many kinds. Undeveloped areas are often heavily forested with stands of evergreen and deciduous trees. Fields and pastures support crops and grasses much of the year.

GEOHYDROLOGY

The principal components of the ground-water system in the study area are illustrated schematically in figure 3. The regolith consists of an unconsolidated or semiconsolidated mixture of clay and fragmental material ranging in size from silt and sand to boulders. The porosity of the regolith is on the order of 35 to 55 percent near land surface but decreases with depth as the degree of weathering decreases. Because of its high porosity, the regolith acts as a reservoir which slowly feeds water downward into the bedrock. The consolidated bedrock contains very little intergranular pore space. Rather, the water within the bedrock is contained primarily in planar secondary openings developed as a result of fracturing. Secondary porosity ranges from 1 to 10 percent in fractured crystalline rock (Freeze and Cherry, 1979, table 2.4). Porosities of 10 percent are atypical, whereas values of 1 to 3 percent are much more representative of the North Carolina Piedmont.

As a general rule, very few open fractures occur in bedrock of the Piedmont at depths greater than 400 feet (LeGrand, 1967). At greater depths, the pressure of the overlying material, or lithostatic pressure, holds these fractures closed and the porosity can be less than 1 percent. Fractures are most numerous and have the largest openings near the top of the bedrock. These fractures are the openings along which water can move.

The implications for the drilling of wells is obvious. The chances of penetrating open fractures and obtaining water (or additional water) at depths below 400 feet is low. In fact, 85 percent of the total possible yield from the average well is already obtained at a depth of 200 feet; the average yield increases only 5 percent by drilling to 300 feet (LeGrand, 1967). From the standpoint of ground-water production, two 200-foot deep wells are more effective, on

soil and saprolite as a reservoir and the desirability of having as large a reservoir as possible from which to draw water, the smaller drainages underlain by thick regolith seem to be better sites than the larger, broader stream bottoms which may only contain a thin veneer of alluvium on top of bedrock.

Using average casing depth of wells as an indication of regolith thickness (table 1), one might assume that the upland flats have the largest, thickest regolith reservoir and therefore represent the best location for a well site. However, under the influence of gravity ground water flows away from the hilltops and toward lower lying discharge areas along streams and lakes. Consequently wells in the lower part of a drainage area are able to intercept water flowing toward them and, in effect, derive water from a larger area because of the natural gradient toward the well. Wells on hilltops, on the other hand, must induce flow toward the well by pumping.

The Ideal Well Site

An ideal site would be located in the geologic unit having the greatest probability of high yields, have thick regolith, a high water table, be underlain by highly-fractured bedrock, and have a large contributing drainage area. High-yield geologic units of the area are known (fig. 8); regolith thickness can be estimated from existing well data (table 1); and fracture locations can be inferred from types of stream drainage patterns discussed earlier.

Sites having the greatest possible saturated thickness of regolith must also be identified. The porosity and specific yield of the regolith decrease with depth (fig. 5). Consequently, sites with a large saturated thickness of regolith, and a high water table, will have the greater amount of available water in storage. In addition, the higher the water table, the greater the available drawdown to wells (in comparison to a well of similar depth in an area with a low water table). In the upper Cape Fear River basin the regolith is generally thickest in the interstream areas and thinnest in the flood plains of perennial streams. On the other hand, the depth to

SUMMARY

Ground water is used by nearly half the population of the Piedmont and Blue Ridge provinces of North Carolina as their source of water supply, yet it is a vastly underutilized resource and little used for large municipal and industrial sources of water. In a 1978 survey, only 13 percent of the public water supplies serving 500 or more customers in this region were using ground water as a supply source.

In contrast to the small amount of ground water actually used (approximately 200 million gallons per day) the amount of potentially available water stored in the ground is very large. In the Piedmont and Blue Ridge provinces, ground water is stored in the regolith and in the underlying fractured bedrock. Nearly all of the storage capacity is in the regolith. The storage capacity within fractures in the bedrock is low and below a depth of about 400 feet the storage capacity decreases nearly to zero. In the upper Cape Fear River basin, the average thickness of the regolith is about 50 feet and the average depth to the water table 15 feet. Given that the remaining 35 feet is saturated with water and has a 20 percent drainable porosity, each square mile contains an estimated 1.5 billion gallons of water some of which drains to springs, streams, lakes, and wells. Due to seasonal changes in the water table, the amount of water in storage can vary from about 1.3 to 1.7 billion gallons per square mile.

On an annual basis, the change in ground-water storage is usually small and recharge will be about equal to ground-water discharge or base runoff. Within the upper Cape Fear River basin average annual precipitation is 45.9 inches per year or about 1,500 $(gal/min)/mi^2$. Of this amount, about 19 percent infiltrates to the water table and part is available to wells.

The most favorable area for ground-water development within the upper Cape Fear River basin is the area underlain by the mafic volcanics unit. The second best is the area underlain by the sheared granite unit. The likelihood of obtaining a high-yield well is

greatest in these areas. Selection of the best sites within any rock unit is based on considerations of topography and drainage patterns. The best well sites will be in topographically low areas having a high water table and large saturated thickness of regolith, all of which is underlain by highly fractured bedrock. The best sites are within the smaller valleys and draws of fracture-controlled intermittent streams. Drainage patterns provide clues as to the presence of fractured rock; drainage linears that cut across lithologic boundaries are a good indication of fracture control. Reconnaissance geologic mapping is used to confirm interpretations of drainage patterns, help determine the presence and thickness of regolith, and facilitate final site selection.

Two test sites were selected for evaluating the site selection procedure. One site was in the Rock Creek basin southwest of Gibsonville, an area underlain by sheared granite. The other site was in the Horsepen Creek basin, about 1 mile southeast of the Greensboro-High Point Regional Airport. The second site is in an area underlain by the mafic volcanics unit.

Between December 14, 1982 and April 26, 1983, two wells were drilled at the Rock Creek site and 20 wells were drilled at the airport site. Two potential production wells were drilled at each site; however, only one production well was successfully completed at each site. The Rock Creek well yielded about 18 gal/min, above average for the sheared granite. The airport well was pumped at rates as high as 65 gal/min, much more than the average yield of 28 gal/min for the mafic volcanics unit, as reported by Mundorff (1948).

The remaining wells at the airport were used for monitoring water levels during a pumping test of the production well, conducted May 9 to 13, 1983. The average pumping rate for 62 hours of continuous pumping was 38.5 gal/min and a total volume of 143,200 gallons was pumped from the well. Nearly all of this water was derived from storage in the regolith. Water levels in the production well declined to 153.5 feet below the top of the casing by the end of the test.

The final pumping level was 61.5 feet above the pump intake. Water levels in all 18 observation wells declined during the test; declines ranged from less than 1 foot to more than 13 feet. The water table assumed the shape of an elliptical cone by the end of the test. The long axis of the cone was approximately parallel to the strike of foliation in the bedrock, or N. 50° E.

After the pump was turned off the water level recovered to 28.6 feet below the top of the casing at the end of one hour and to 19.7 feet, within 1.9 feet of the starting level, after 14 hours.

The successful completion of wells at test sites chosen using site-selection criteria based on geologic units, fracture identification by geomorphic analysis, and regolith thickness, demonstrated the usefulness of the criteria for identifying well sites.

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AN APPRAISAL OF THE GROUNDWATER RESOURCES OF THE UPPER CAPE FEAR RIVER BASIN NORTH CAROLINA

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MAY 1974

AN APPRAISAL OF THE GROUND-WATER RESOURCES OF THE UPPER CAPE FEAR RIVER BASIN, NORTH CAROLINA

by

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INTRODUCTION

This report has been jointly prepared by the U.S. Geological Survey and the Division of Ground Water of the North Carolina Department of Natural and Economic Resources as a contribution to the interagency study of the water resources of the upper Cape Fear River basin. The report describes the occurrence, availability, chemical quality, and cost of development of the ground-water resources in the basin.

The authors wish to acknowledge the cooperation of Heater Well Company, Inc., McCall Brothers, Inc., and Bainbridge and Dance, Inc., in supplying estimates of well-drilling costs in the basin.

PURPOSE AND SCOPE

An adequate and dependable supply of good-quality water is a prime requisite to economic development of an area. The decision to use ground water or surface water as a source of supply should not be made until both sources are compared in terms of quantity, dependability, quality, and costs.

The purpose of this report is to supply information pertaining to the feasibility of using ground water as a source of supply in the upper Cape Fear River basin. Within the scope of this report, an appraisal of the ground-water resources can be made by discussing, in general terms, the following basic questions:

Table 1.-- Population supplied with water from surface-water and ground-water sources in the counties lying entirely or partly in the upper Cape Fear River basin.

County	Population in 1970	Population served with		Percent using ground water
		Ground water	Surface water	
Alamance	96,362	46,562	49,800	48
Chatham	29,554	21,854	7,700	74
Caswell	19,055	17,555	1,500	92
Durham	132,681	32,681	100,000	25
Guilford	288,590	66,293	222,297	23
Harnett	49,667	34,017	15,650	68
Lee	30,467	17,967	12,500	59
Montgomery	19,267	13,767	5,500	71
Moore	39,048	27,468	11,580	70
Orange	57,707	24,207	33,500	42
Randolph	76,358	53,858	22,500	71
Rockingham	72,402	31,702	40,700	44
Wake	228,453	91,653	136,800	40
Totals	1,139,611	479,584	660,027	42

GROUND-WATER RESOURCES

Occurrence of Ground Water

The source of all water in the upper part of the Cape Fear River basin is precipitation, about 45 inches each year. Most of the precipitation runs overland to streams and is classed as "surface runoff." Another large part is returned to the atmosphere through evaporation and by transpiration of plants. Ten to 15 percent of the total amount percolates to the water table and becomes ground water. Beneath the water table, ground water is stored in and is transmitted through the openings in the rocks to points of discharge, such as wells and streams.

The rocks underlying the basin generally occur in two distinct zones. The uppermost zone is formed by weathering of the underlying bedrock. The residual material formed by weathering is referred to as saprolite. It usually consists of clay with lesser amounts of sand and large rock fragments. The thickness of saprolite in the upper Cape Fear River basin ranges from a few feet or less near rock outcrops to somewhat more than 100 feet. The average thickness on most hills and ridges is 30 feet.

Saprolite that has been eroded from the hills and transported to the stream valleys to form the flood plains is called alluvium, which may range in composition from clay to boulders. Its thickness is generally less than 20 feet.

The saprolite in the basin is underlain by unweathered bedrock. It consists of several different types of rock, most of which have similar hydrologic properties. The different rock types will be discussed in another section of this report.

The saprolite and fractured parts of the bedrock form the ground-water reservoir of the basin. The quantity of water that can be stored or transmitted by the saprolite-bedrock reservoir is dependent on the size, shape, and abundance of their contained openings. In the saprolite, ground water occurs in the pore spaces between particles. In bedrock, water occurs in the sheetlike openings developed along fractures in the rock.

The bedrock has been subjected to great stresses during its long geologic history and comprises a complex reservoir system. The degree of fracturing of the rocks resulting from these stresses varies greatly from place to place, ranging from very small, widely spaced fractures to zones of intensely broken rocks that are tens or hundreds of feet wide. Generally, bedrock fractures are only fractions of an inch in size and spaced a few inches to several feet apart. As a rule, the fractures decrease in number and size with depth. Data show that zones of significant fracturing extend to depths of more than 800 feet. The range of depth and degree of fracturing is not adequately known and considerable exploratory drilling will be necessary to ascertain the structure of the reservoir system.

One of the basic concepts of ground-water hydrology is that aquifers function both as a reservoir to store water and as a pipeline to transmit water. The quantity of water that can be stored depends on the porosity of the aquifer material. The ability to transmit water depends on the permeability and thickness of the aquifer material. The porosity usually is between 20 and 50 percent in saprolite whereas the porosity of bedrock is generally a fraction of 1 percent. The permeability of both materials generally is between 1 and 100 gpd (gallons per day) per square foot. Obviously, the water in storage in a unit volume of saprolite is many times greater than in an equal volume of bedrock. However, the thickness of the water-bearing zone in bedrock is generally several times greater than the thickness of the saturated part of the saprolite. In most cases it is useful to consider that the saprolite functions as the reservoir and that the bedrock functions as the pipeline.

Geologic Units

The occurrence of ground water in the upper Cape Fear River basin is influenced to a large extent by the local geology. The type and structure of the rocks have a strong influence on such factors as topography and the thickness of the saprolite.

LeGrand (1967) has shown that the yield of wells in the Piedmont region, which includes the upper Cape Fear River basin, is related to the topography at the well site and to the thickness of the saprolite. The highest-yielding wells are almost invariably located in topographically low areas, such as draws and stream valleys. The lowest-yielding wells are generally located near the tops of hills and ridges.

The differences in yield in different topographic situations apparently reflect the composite effect of several factors. Chief among these is the number and size of fractures in the bedrock. Valleys are believed to be located where fractures are most abundant, whereas the hills and ridges suggest the presence of relatively massive (unfractured) rock. Another factor is the tendency of the ground water to move toward valleys from the adjoining ridges, so that more water is available to pumping wells in valleys. A third factor, and one of the most important, is the infiltration of water from streams into the fractured rock when ground-water levels are lowered by pumping.

The thickness of saprolite is important because, as noted earlier, the saprolite functions as a reservoir. When fractured-rock wells are pumped, water slowly seeps downward from the saprolite into the fractures in the rock. Thus, the thicker the saprolite the larger the volume of water available for withdrawal. From what was said in the preceding paragraph about stream infiltration in valley areas, it is apparent that the thickness of saprolite is of greatest significance to the yield of wells in upland areas. In uplands underlain by 25 to 50 feet of saprolite, the sustained yield of wells may be double that of wells in uplands underlain by only 5 to 10 feet of saprolite.

Quantity of Available Ground Water

During extended dry periods the flow of streams in the basin is sustained by ground water discharging from the adjacent aquifers. The volume of ground water discharged to streams is an indication of the amount of water available for development from the ground-water reservoir.

Comprehensive quantitative studies of the amount of ground water available for development in the upper part of the Cape Fear River basin have not been made. However, based on studies in similar areas, it is estimated that the streamflow equaled or exceeded 70 percent of the time is a reliable indicator of the amount of ground water available.

Figure 3 shows areas of approximately-equal ground-water discharge, based on the flow of streams equaled or exceeded 70 percent of the time. The area encompassed by each coincides with the areas underlain by the three principal hydrologic units and represents the average rate of ground-water discharge to streams, in millions of gallons per day per square mile of

ground-water development, and after spending thousands of dollars in drilling wells they still do not have an adequate supply of water. However, the ground-water resources of the basin are adequate to meet demands many times larger than those presently being met. To minimize future problems, development of ground-water supplies for industries and municipalities should be carefully designed and managed by qualified professional personnel.

Pollution

Even though ground water is better protected from pollution than surface water, there are many places where pollutants are known to have found their way into the aquifers. With increased development of an area, there comes an increasing potential for pollution of the ground-water resource. Sanitary land fills are becoming more numerous and in each case provide almost direct connection between the refuse and the water table. Sewage, fertilizers, and industrial wastes are common agents of stream pollution, and, if unchecked, they may preclude the development of potentially large ground-water supplies from some of the stream valleys in the basin.

CONCLUSIONS

Large amounts of water are stored in the rocks underlying the upper part of the Cape Fear River basin. Dependable ground-water supplies can be developed from these rocks in all parts of the basin if the hydrologic conditions are properly evaluated and the wells and well fields are designed accordingly.

The chemical quality of the ground water in the basin is generally suitable for most uses. However, excessive concentrations of iron, hardness, and chloride occur in some local areas. Where necessary, the objectionable constituents can be effectively and economically reduced or removed by treatment of the water.

It is not within the scope of this report to provide exact data for development of water supplies at specific sites. However, with the available data, it is possible to predict, within acceptable limits, the general hydrologic conditions over a sizable area. Even in similar geologic and topographic situations, the hydrologic conditions can differ greatly within a short distance. For this reason, it is rarely possible to predict accurately the conditions at a specific site prior to actual on-site testing.

The different geologic, hydrologic, and economic conditions that had to be considered in appraising the ground-water resources of the basin make it necessary that certain generalized assumptions be made in estimating the costs of development. On these assumptions were based the estimated costs of construction and operation of hypothetical wells. These estimates are valid only for a comparison with estimates of costs of developing a supply from surface-water sources or from the different geologic units in the basin. Because of these assumptions, the estimates given are neither appropriate nor intended for use in detailed planning of a specific system. Planning and design of specific systems require geologic and hydrologic data from the actual project site and also the services of consulting ground-water hydrologists and qualified well-drilling contractors.

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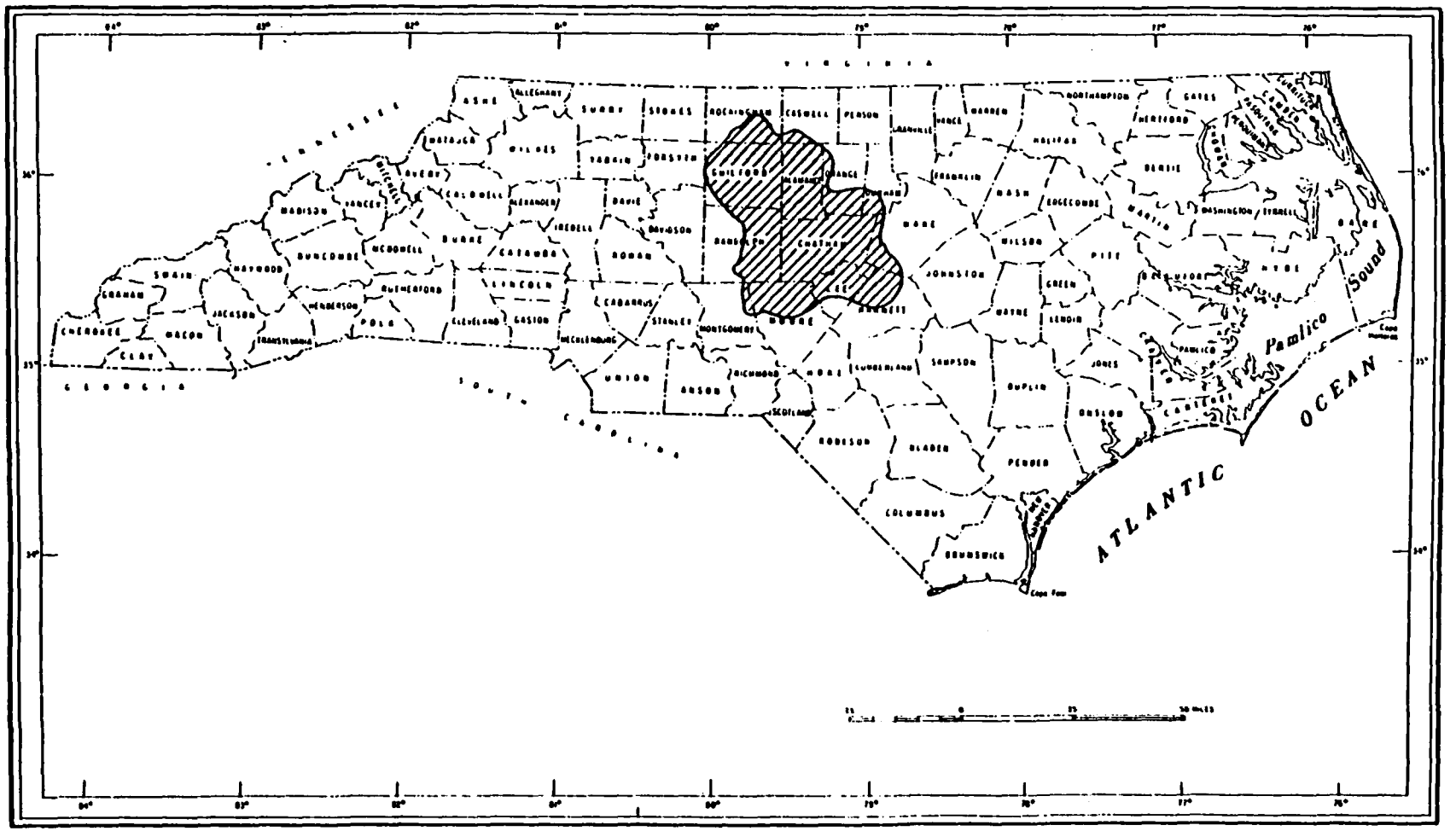

Figure 1. Map of North Carolina showing the location of the upper part of the Cape Fear River basin.

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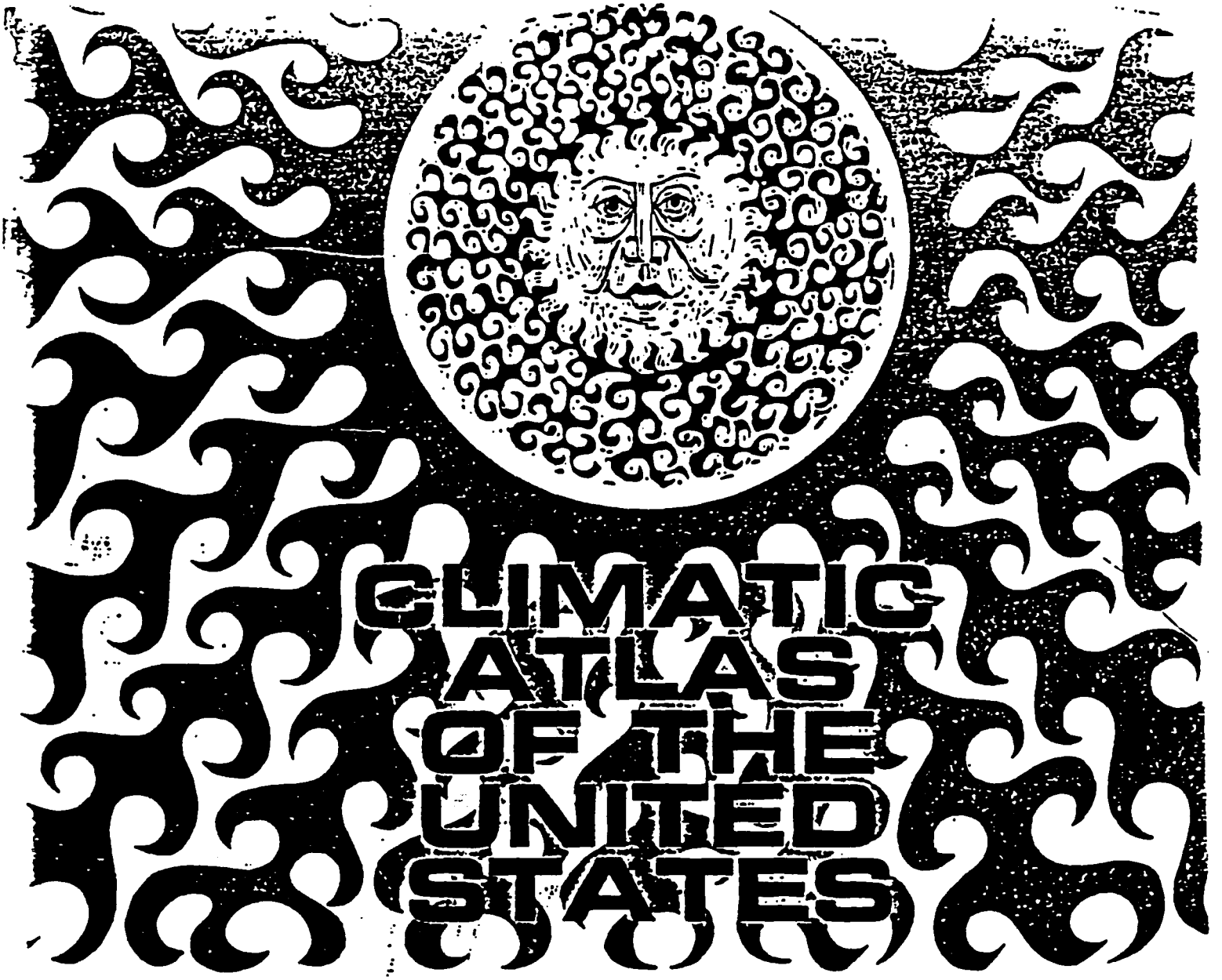

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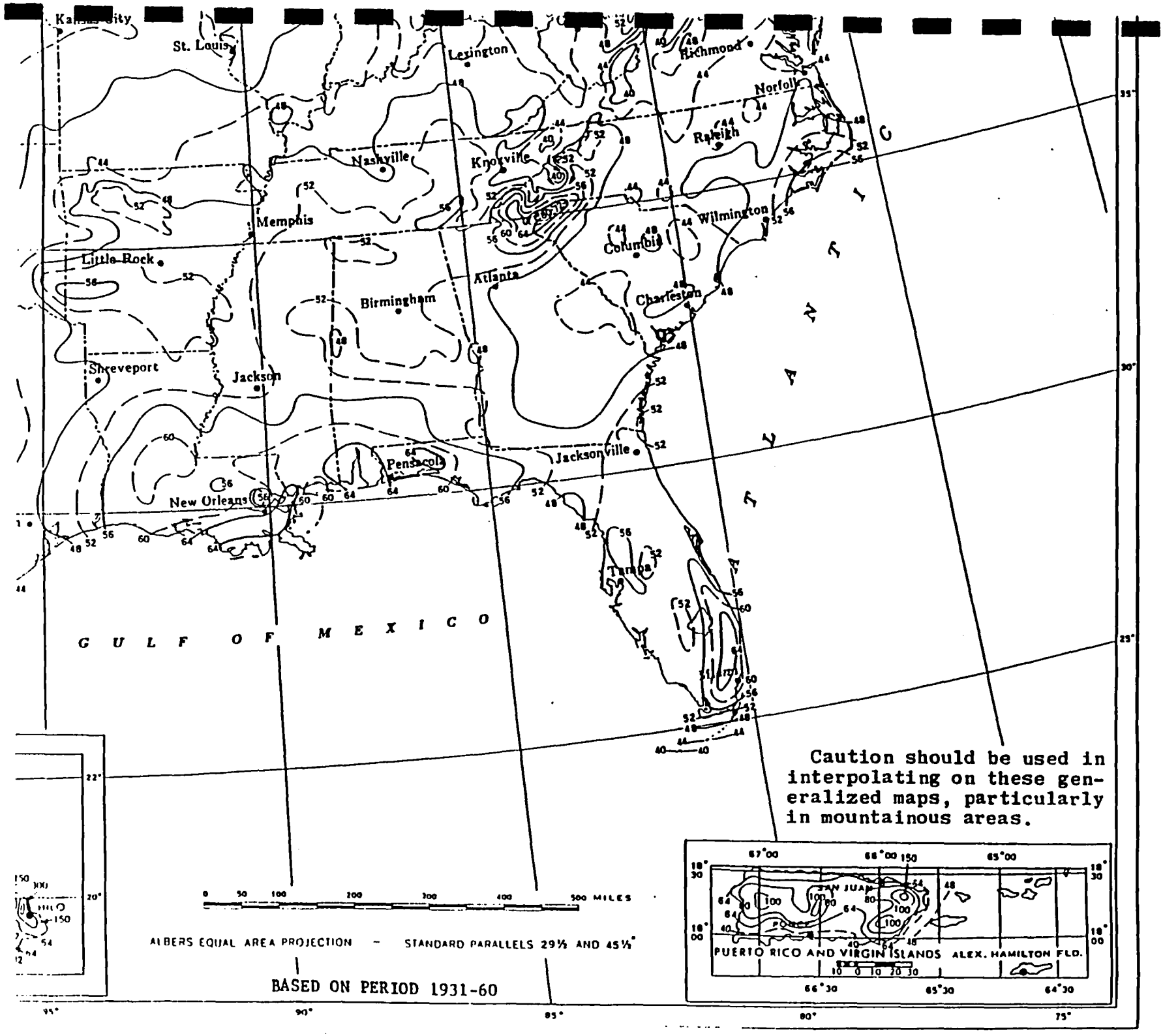
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A T L A N T I C
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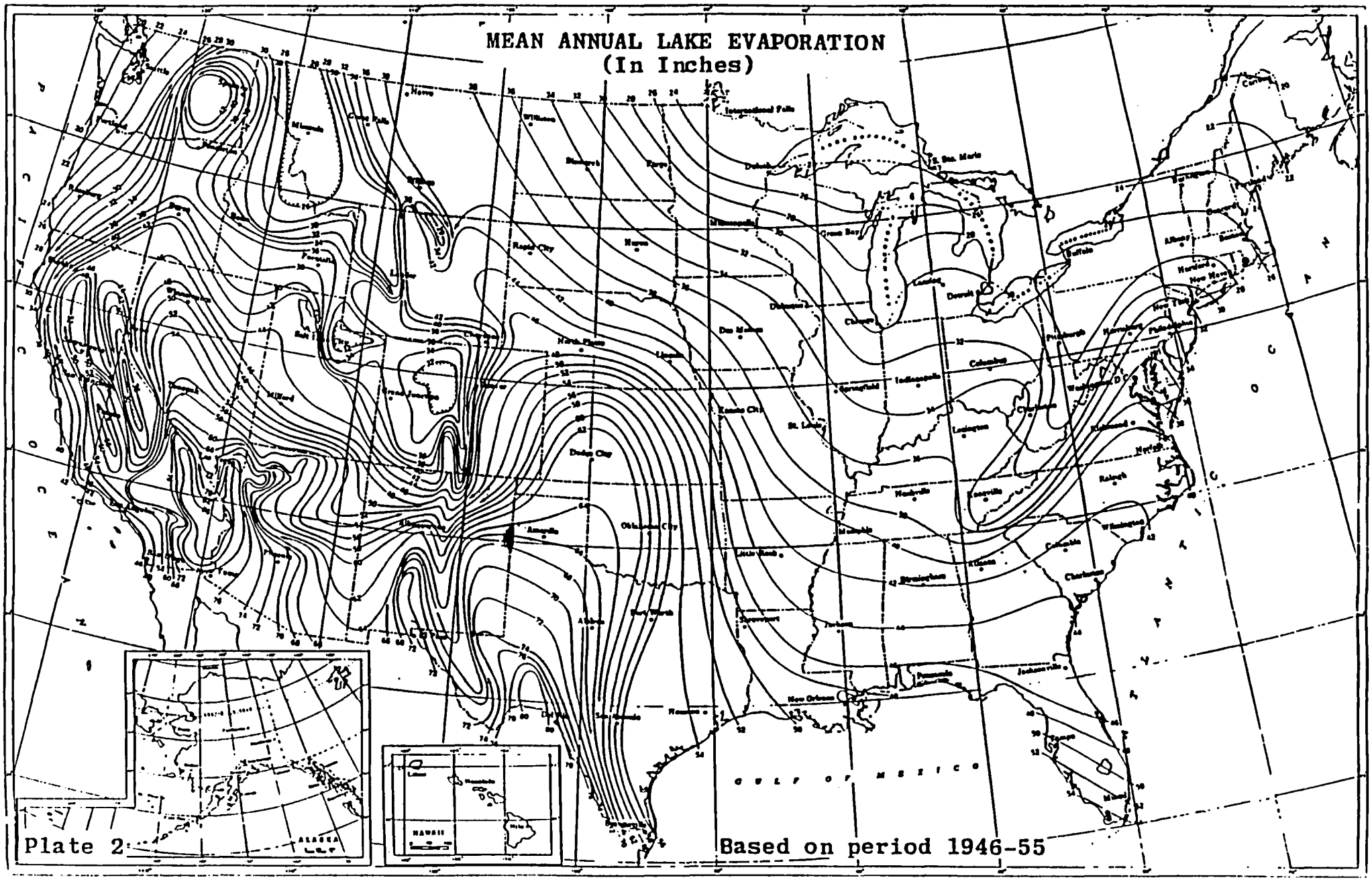

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for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
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STATISTICAL ANALYSIS RELATING WELL YIEL TO CONSTRUCTION PRACTICES AND SITING OF WELLS IN THE PIEDMONT AND BLUE RIDG PROVINCES OF NORTH CAROLINA

U.S. GEOLOGICAL SURVEY

WATER RESOURCES INVESTIGATIONS REPORT 86-4132

Prepared in cooperation with the

North Carolina Department of Natural Resources

and Community Development

U.S. GEOLOGICAL SURVEY

WATER RESOURCES INVESTIGATIONS REPORT 86-4132

Errata sheet

References were omitted from captions to figures 3 and 6 on pages 7 and 19 respectively. The correct captions are as follows:

Figure 3.--Physical setting of the ground-water system in North Carolina (From Heath, 1980).

Figure 6.--Geologic belts, terranes, and some major structural features within the Piedmont and Blue Ridge provinces of North Carolina (From Brown, P.M., and Parker, J.M., III, 1985).

The equation on page 33 is incorrect as shown. The equation should read:

$$\text{yield} = a - b(\text{depth}) + c(\text{depth} \times \text{diameter}) - d(\text{depth}^2 \times \text{diameter})$$

where a, b, c, and d are regression coefficients.

STATISTICAL ANALYSIS RELATING WELL YIELD TO CONSTRUCTION PRACTICES AND SITING OF WELLS IN THE PIEDMONT AND BLUE RIDGE PROVINCES OF NORTH CAROLINA

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NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
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1987

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COVER PHOTOGRAPH: Drilling of a test well in Guilford County near the Greensboro-High Point Regional Airport, December 16, 1982. Yield at time of photograph approximately 50 gallons per minute. (Photograph by Charles C. Daniel, U.S. Geological Survey.)

STATISTICAL ANALYSIS RELATING WELL YIELD TO CONSTRUCTION PRACTICES AND SITING OF WELLS IN THE PIEDMONT AND BLUE RIDGE PROVINCES OF NORTH CAROLINA

By Charles C. Daniel III

ABSTRACT

A statistical analysis was made of data from more than 6,200 water wells drilled in the fractured crystalline rocks of the Blue Ridge, Piedmont, and western edge of the Coastal Plain where crystalline rocks underlie sediments at shallow depths. The study area encompassed 65 counties in western North Carolina, an area of 30,544 mi^2, comprising nearly two-thirds of the State. Additional water supplies will be needed in western North Carolina as population and industrial development continue to increase. Ground water is an attractive alternative to surface water sources for moderate to large supplies. The statistical analysis was made to identify the geologic, topographic, and construction factors associated with high-yield wells.

It is generally held that the crystalline rocks of the Blue Ridge and Piedmont provinces yield only small amounts of water to wells, that water is obtained from vertical fractures that pinch out at a depth of about 300 feet because of lithostatic pressure, and that the function of a large diameter well is primarily for storage. These concepts are reasonable when based upon the average well drilled in these rocks: a domestic well, 125 feet deep, 6 inches or less in diameter, and located on a hill or ridge. However, statistical analysis shows that wells in draws or valleys have average yields three times those of wells on hills and ridges. Wells in the most productive hydrogeologic units have average yields twice those of wells in the least productive units. Wells in draws and valleys in the most productive units average five times more yield than wells on hills and ridges in the least productive units.

Well diameter can have a significant influence on yield; for a given depth, yield is directly proportional to well diameter. Maximum well yields are obtained from much greater depths than previously believed. For

example, the average yield of 6-inch diameter wells located in draws and valleys can be expected to reach a maximum of about 45 gallons per minute at depths of 500 to 525 feet; for similarly located 12-inch diameter wells, the average yield can be expected to reach a maximum of about 150 gallons per minute at depths of 700 to 800 feet.

INTRODUCTION

Additional water supplies will be needed in the Piedmont and Blue Ridge provinces of North Carolina (fig. 1) as population and industrial development continue to increase. Municipal and industrial water supplies are derived almost exclusively from surface water sources. However, the potential for further development of surface water is limited, and ground water is an attractive alternative for moderate to large water supplies.

Ground water has many attractive features as a source of supply. Ground water in the crystalline rocks of the Piedmont and Blue Ridge provinces has a relatively low cost of development (Cederstrom, 1972). Generally, ground water in these areas is of good chemical quality and requires little treatment. Because of the large quantity of water in storage, the ground-water system usually can sustain moderate yields during seasonal dry periods. The use of ground water generally permits other land-use activities if they do not impede the infiltration of recharge or diminish water quality.

The crystalline rocks underlying the Blue Ridge and Piedmont have the reputation for furnishing only small quantities of ground water. This impression is the outgrowth of drilling large numbers of domestic wells, which do not represent efforts to obtain quantities of water beyond the minimum requirement of 2 to 10 gal/min. About 70 percent of all wells drilled in the Blue Ridge and Piedmont are for domestic supply and most were located and drilled without regard to geology, topography, and optimal construction. There are, however, a significant number of wells that yield a few tens to a few hundreds of gallons per minute. Additional high-yield wells likely could be developed at carefully selected sites throughout the area.

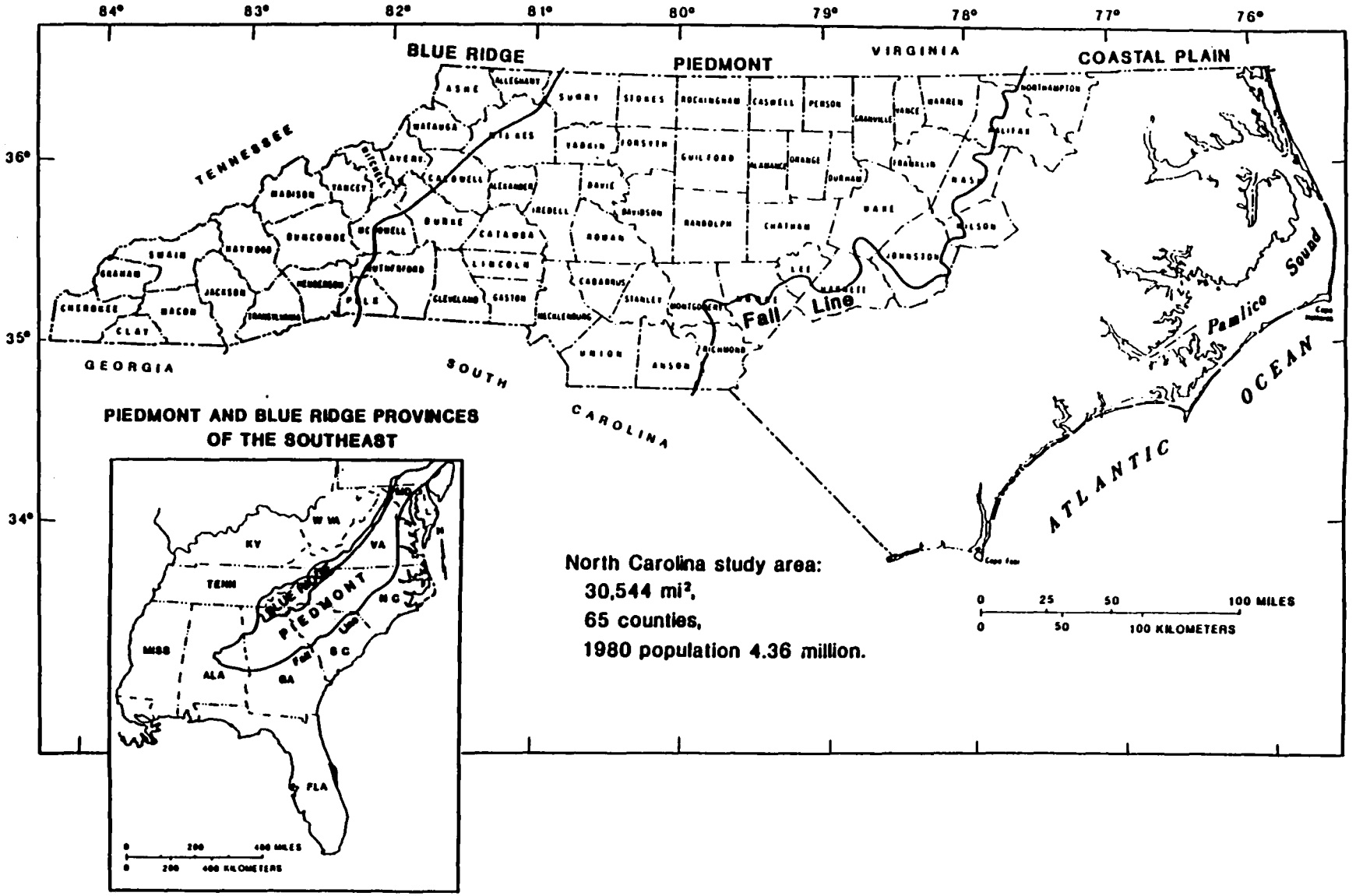

Figure 1.--Area of investigation showing counties and physiographic provinces.

Results of studies in several areas of the Piedmont, both within and outside North Carolina, show that the ground-water system can support large well yields. For example, Daniel and Sharpless (1983) reported finding more than 300 wells in an eight-county area of central North Carolina that produce 50 gal/min or more. Cressler and others (1983) found a substantial number of wells in the Georgia Piedmont that yield more than 100 gal/min and some that yield nearly 500 gal/min. They also found 66 mainly industrial and municipal wells that had been in use for periods of 12 to more than 30 years without experiencing declining yields. Similarly, Cederstrom (1972) found that yields of 100 to 300 gal/min are not uncommon for bedrock wells in the Piedmont and Blue Ridge provinces from Maine to Virginia.

To evaluate the potential for large ground-water supplies in the Piedmont and Blue Ridge provinces of North Carolina, the U.S. Geological Survey, in cooperation with the North Carolina Department of Natural Resources and Community Development, conducted a five-year study of ground-water resources in the region. This report is part of that study.

Purpose and Scope

The purpose of this report is to describe a statistical analysis of data from a large number of water wells in the Piedmont and Blue Ridge provinces of North Carolina that was undertaken to identify factors associated with high-yield wells.

The statistical analysis was made by using hydrologic, geologic, topographic, and well-construction data obtained from records of more than 6,200 water wells. The wells are in an area including all of the Blue Ridge and Piedmont provinces in the State and an adjoining narrow strip at the western edge of the Coastal Plain province where a number of wells draw water from Piedmont crystalline rocks at shallow depth beneath the sedimentary cover. The study area encompassed all of 65 counties in North Carolina, an area of 30,544 mi^2, comprising nearly two-thirds of the State (fig. 1).

The Coastal Plain has little relief in contrast to the adjoining Piedmont. It is marked by sluggish streams flowing in broad valleys cut into predominately sand and clay units that thicken seaward from a feather edge at the Fall Line. Along the western edge of the Coastal Plain, the sediments are underlain at shallow depth by crystalline Piedmont rocks (fig. 3).

Geology

The geology of the Piedmont and Blue Ridge is extremely complex. All major classes of rocks--metamorphic, igneous, and sedimentary--are represented, although metamorphic rocks are the most abundant. The metamorphic and igneous rocks range in composition from felsic to ultramafic and range in age from Precambrian in the Blue Ridge to Triassic and Jurassic in the Piedmont. The metamorphism of the rocks varies in grade from low rank to high rank, that is, varying in degree of recrystallization and destruction of the original texture; many have been folded and refolded during multiple metamorphic and orogenic events. The rocks are broken and displaced by numerous faults and zones of shearing, some of which are many miles in length. Nearly everywhere are rock fractures without displacement called joints. The joints commonly cluster in groups orientated about one or more preferred directions. Within the crystalline rocks of the Piedmont are downfaulted basins (grabens) filled with sedimentary rocks of Triassic age.

There have been three or more periods of igneous intrusion (Fullagar, 1971) with the emplacement of plutonic bodies ranging in size from batholiths down to dikes, sills, and veins. Most instrusions have been metamorphosed, deformed, and fractured, but some are massive and have little or no foliation. All rocks have been subjected to uplift, weathering, and erosion, which resulted in the widening of fractures and the formation of new openings such as stress-relief fractures. These breaks in the otherwise solid rock are the conduits for ground-water flow. All of the events and processes that are part of the geologic history of the area have given the hydrogeologic system properties that control the present-day movement and circulation of ground water.

Bedding and planes of metamorphic foliation generally are folded and tilted and can have almost any attitude and orientation. Fractures, bedding, and foliation create inhomogeneities in the rocks, with the result that permeability is usually greatest parallel to bedding and foliation and zones of fracture concentration, and least at right angles to the plane of these features.

Bedrock may be exposed at land surface on steep slopes, rugged hilltops, or in stream valleys, but nearly everywhere else is overlain by unconsolidated material to depths of more than a hundred feet. Collectively this unconsolidated material, which is composed of saprolite, alluvium, and soil, is referred to as regolith. Saprolite is clay-rich, residual material derived from in-place weathering of the bedrock. When the bedrock weathers to form saprolite, the relict structures generally are retained and the directional properties of permeability are also retained. In many valleys the saprolite has been removed by erosion, and bedrock is exposed or thinly covered by alluvial deposits. Soil is nearly everywhere present as a thin mantle on top of both the saprolite and alluvium. The water-storing and transmitting characteristics of bedrock and regolith and the hydrologic relation between them determines the water-supply potential of the ground-water system in the Piedmont and Blue Ridge provinces.

Hydrogeologic Units

Within the Piedmont and Blue Ridge of North Carolina there are hundreds of rock units which have been defined and named by various conventions more in keeping with classical geologic nomenclature than hydrologic terminology. The geologic nomenclature does little to reflect the water-bearing potential of the different units. To overcome this shortcoming and to reduce the number of rock units to the minimum necessary to reflect the differences in water-bearing potential, a classification scheme based on origin, composition, and texture was devised (table 1). The rationale behind the hydrogeologic units shown in table 1 is the hypothesis that these factors would be linked not only to a rock's primary porosity but also to its susceptibility to the development of secondary porosity in the form of

unit(s). The yield data used for this comparison also were corrected to an average 154-foot depth and 6-inch diameter. A regression analysis of well yields in the various belts is shown in figure 14. The average difference in yield between belts is 0.9 gal/min. Average yield varies from a low of about 11.5 gal/min for the Smith River allocthon (SR) and Triassic basins (TR) to a high of about 23 gal/min for the Blue Ridge belt (BR). Analysis of variance tests found that the average yield of belts at the upper and lower ends of the data are significantly different. The inequalities significant at the 0.95 confidence level are also shown in figure 14.

The belts with the highest yields, the Blue Ridge (BR), Chauga (CA), and Inner Piedmont (IP), are dominated by high rank metasedimentary rocks, mafic gneisses, schists, and quartzites, and include smaller areas of metaigneous rocks, all of which have above average yields. The Charlotte belt (CH), which is characterized by igneous rocks intruded into country rocks of metavolcanic and metaigneous origin (Fullagar, 1971), and the Carolina slate belt (CS), which is dominated by metavolcanic rocks (Butler and Ragland, 1969), both are belts having low average yields.

The areas containing sedimentary rocks, the Triassic basins (TR) and the western edge of the Coastal Plain (CP), are far apart in average yield with the Triassic basins having the next-to-lowest yield and the Coastal Plain the third highest.

SUMMARY AND CONCLUSIONS

A statistical analysis was made of data from more than 6,200 wells drilled in the crystalline rocks of the Blue Ridge, Piedmont, and the western edge of the Coastal Plain where crystalline rocks underlie sediments at shallow depths. This analysis was made to identify factors associated with high-yield wells. The data were classified according to geologic belts, hydrogeologic units composed of similar rock types, topographic setting, total and saturated thickness of regolith, water level, casing depth, yield, total depth, well diameter, and water use.

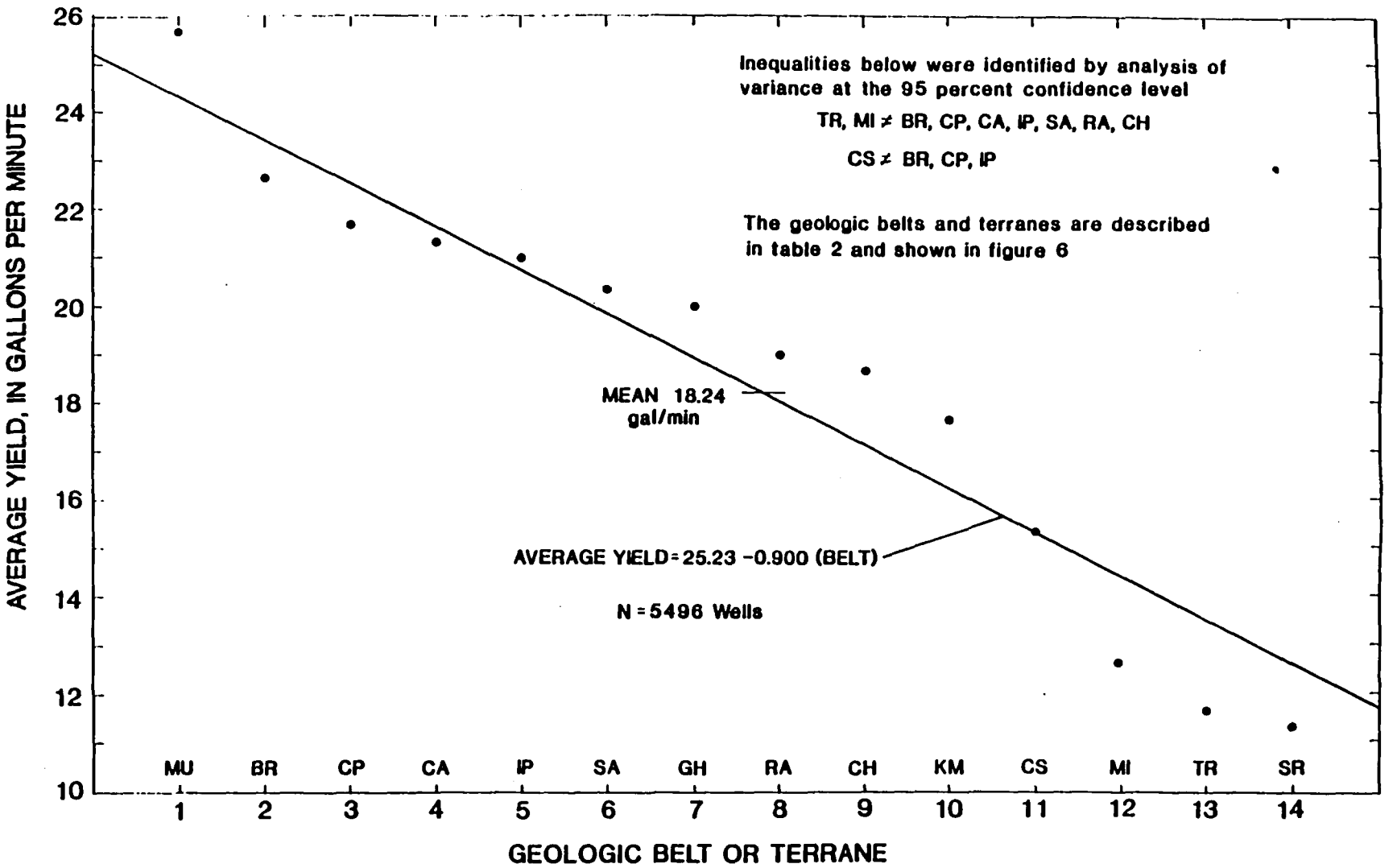

Figure 14.--Average yield of wells of average construction in the geologic belts and terranes of the Piedmont and Blue Ridge provinces of North Carolina.

Six topographic settings were combined into three groups based on well yields: hills and ridges, slopes and flats, and draws and valleys. Wells on hills and ridges had the lowest yields (averaging about 10 gal/min), wells in draws and valleys, the greatest (averaging about 30 gal/min). Regolith thickness was about the same regardless of topographic group, but saturated thickness was least (about 19 feet) under hills and ridges and greatest (about 34 feet) under draws and valleys. Average yields in the geologic belts and hydrogeologic units ranged from about 11 to 25 gal/min. There was considerable scatter in yields in all geologic belts and hydrogeologic units. Of 14 geologic belts, 10 were statistically different on the basis of well yield, as were 9 of 21 hydrogeologic units.

About 70 percent of the wells were drilled for domestic use and, on the average, yielded about 11 gal/min; 80 percent of these wells were located on hills and ridges. The 30 percent of the wells drilled for public supply and commercial-industrial supply yielded about 30 gal/min on the average; about 50 percent of these wells were located in draws and valleys. The domestic wells had an average depth of about 125 feet, the public-supply and commercial-industrial wells about 225 feet. Fewer than 2 percent of the domestic wells were 8 inches in diameter or larger, whereas nearly 25 percent of the public-supply and commercial-industrial wells were 8 inches or larger.

Selecting the most favorable hydrogeologic unit or geologic belt alone can improve the chance of increasing the yield of the average 6-inch diameter, 154-foot deep well from about 11 to 12 gal/min to about 23 to 24 gal/min, about a two-fold increase. Considering topography alone, the average well on hills and ridges can be expected to average less than 12 gal/min, whereas wells in draws and valleys can be expected to average about 29 gal/min, an increase of 2.4 times. When the factors of hydrogeologic unit or geologic belt are considered in combination with topographic setting, the range in yields is even greater. Wells in draws and valleys in the most productive units average five times more yield than wells on hills and ridges in the least productive units.

The statistical analysis supported some concepts and criteria for well-site selection, such as the siting of a well with regard to topography. More importantly, however, the analysis indicates that some previously held concepts may be in error. First and foremost is the generally held concept that the crystalline rocks yield only small amounts of water to wells. The analysis showed that this concept may be due to cultural bias. Most wells drilled in these rocks are small diameter, are located primarily on hills and ridges--the poorest possible sites for wells--and are drilled only to depths where sufficient water for a domestic supply is obtained. In the same theme, well diameter has not been considered to have much effect on yield--a large-diameter well was considered a storage tank. Statistical analysis shows, however, that for a given depth the yield of a well is directly proportional to the well diameter. The larger the diameter the greater the yield.

Well construction in crystalline rocks has long been based on the concept of a well intersecting near vertical open fractures and joints that because of lithostatic pressure, pinch out at depths of about 300 feet. As a result, the drilling of many wells has been arbitrarily stopped when the depth of 300 feet was reached. The average well, whether domestic or commercial-industrial, is not even that deep. The analysis indicates that very few wells have been drilled deep enough to test the full potential of the sites. For example, the average yield of 6-inch diameter wells located in draws or valleys reaches a maximum of about 45 gal/min at depths of 500 to 525 feet; the average yield of 12-inch diameter wells located in draws or valleys reaches a maximum of about 150 gal/min at depths of 700 to 800 feet.

Whatever the hydrogeologic unit or topographic location, the chances of obtaining high yields are enhanced by increasing the depth and diameter of the well to a much greater extent than previously thought.

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☆U.S. GOVERNMENT PRINTING OFFICE 1987—748-188/40040

Reference 18'

Uncontrolled Hazardous Waste Site Ranking System

A Users Manual

(HW-10)

Originally Published in
the July 16, 1982, *Federal Register*

United States
Environmental Protection
Agency

1984

FOREWORD

The method for ranking hazardous substance facilities that is described in this document was developed by The MITRE Corporation under contract to the U.S. Environmental Protection Agency. The method has benefited from extensive review and comment by EPA personnel, state officials, and interested parties in the private sector.

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1.0 INTRODUCTION

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (PL 96-510) requires the President to identify the 400 facilities in the nation warranting the highest priority for remedial action. In order to set the priorities, CERCLA requires that criteria be established based on relative risk or danger, taking into account the population at risk; the hazardous potential of the substances at a facility; the potential for contamination of drinking water supplies, for direct human contact, and for destruction of sensitive ecosystems; and other appropriate factors.

This document describes the Hazard Ranking System (HRS) to be used in evaluating the relative potential of uncontrolled hazardous substance facilities to cause human health or safety problems, or ecological or environmental damage. Detailed instructions for using the HRS are given in the following sections. Uniform application of the ranking system in each State will permit EPA to identify those releases of hazardous substances that pose the greatest hazard to humans or the environment. However, the HRS by itself cannot establish priorities for the allocation of funds for remedial action. The HRS is a means for applying uniform technical judgement regarding the potential hazards presented by a facility relative to other facilities. It does not address the feasibility, desirability, or degree of cleanup required. Neither does it deal

TABLE 1

COMPREHENSIVE LIST TO RATING FACTORS

HAZARD MODE	FACTOR CATEGORY	FACTORS		
		GROUND WATER ROUTE	SURFACE WATER ROUTE	AIR ROUTE
Migration	Route Characteristics	• Depth to Aquifer of Concern • Net Precipitation • Permeability of Unsaturated Zone • Physical State	• Facility Slope and Intervening Terrain • One-Year 24-Hour Rainfall • Distance to Nearest Surface Water • Physical State	
	Containment	• Containment	• Containment	
	Waste Characteristics	• Toxicity/Persistence • Hazardous Waste Quantity	• Toxicity/Persistence • Hazardous Waste Quantity	• Reactivity/Incompatibility • Toxicity • Hazardous Waste Quantity
	Targets	• Ground Water Use • Distance to Nearest Well/ Population Served	• Surface Water Use • Distance to Sensitive Environment • Population Served/Distance to Water Intake Downstream	• Land Use • Population Within 4-Mile Radius • Distance to Sensitive Environment
Fire and Explosion	Containment	• Containment		
	Waste Characteristics	• Direct Evidence • Ignitability • Reactivity • Incompatibility • Hazardous Waste Quantity		
	Targets	• Distance to Nearest Population • Distance to Nearest Building • Distance to Nearest Sensitive Environment • Land Use • Population Within 2-Mile Radius • Number of Buildings Within 2-Mile Radius		
Direct Contact	Observed Incident	• Observed Incident		
	Accessibility	• Accessibility of Hazardous Substances		
	Containment	• Containment		
	Toxicity	• Toxicity		
	Targets	• Population Within 1-Mile Radius • Distance to Critical Habitat		

The ranking of facilities nationally for remedial action will be based primarily on S_M. S_{FE} and S_{DC} may be used to identify facilities requiring emergency attention.

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

Reference 20

CONTROL NO. TDD No. F4-8803-42	DATE: May 3, 1988	TIME: 1315

DISTRIBUTION: Custom Finishers, Inc., High Point, North Carolina

BETWEEN: Wayne Slaydon, Water &Sewer Supervisor	OF: City of High Point Water & Sewer	PHONE: (919) 883-3465

AND: Michael Profit, NUS Corporation

MP 5-3-88

DISCUSSION:

High Point obtains its water from High Point city lake located northeast of town. The intake is located in Deep River, just below the dam which forms High Point Lake. System serves 30,000 connections within the city limits; the population of High Point is 62,000. The system is branching out to serve currently unserved areas of Guilford County between High Point and Greensboro.

NUS CORPORATION AND SUBSIDIARIES **TELECON NOTE**

Reference 21

CONTROL NO.	DATE: 4/24/89	TIME: 1630

DISTRIBUTION:

BETWEEN: John Frezell, Town Manager	OF: Town Hall of Jamestown	PHONE: (704) 454-1138

AND: Eric Corbin, NUS Corporation

Eric Corbin 5/18/89

DISCUSSION:

Mr. Frezell was contacted in an effort to determine the source of water for the Jamestown Water Department. He stated that they purchase water from the High Point Water Dept., from the Greensboro Water Dept., and they have a surface water intake located at the Oakdale treatment facility on the Deep River. He further stated that they served at 1,000 residences and at 150 businesses.

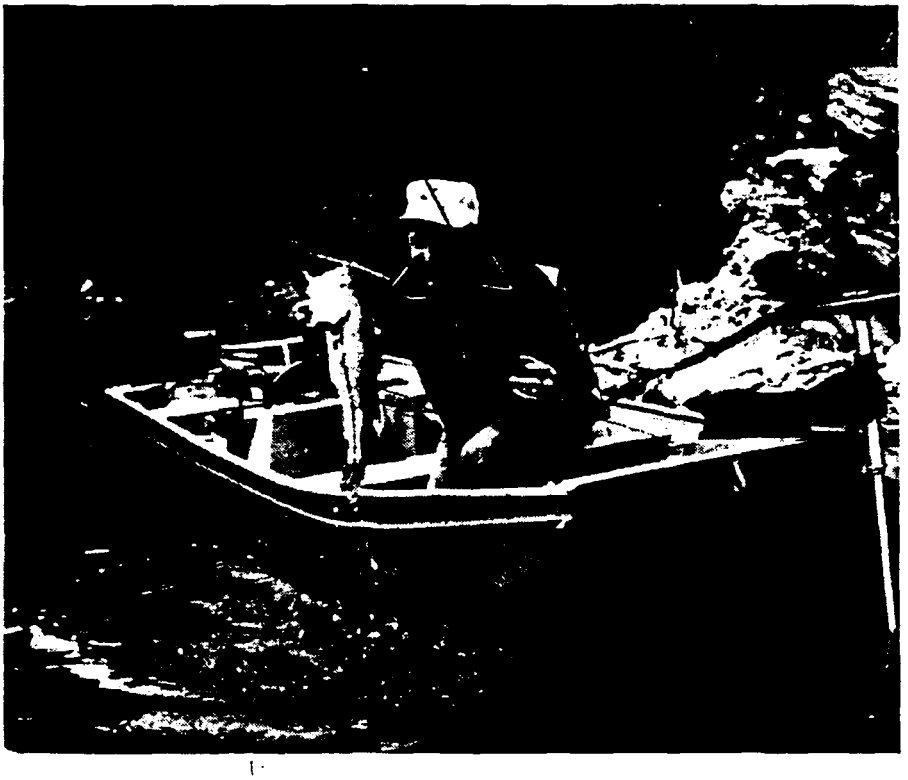
FISHING INFORMATION FOR NORTH CAROLINA

CITY LAKE FISHING in the Central Piedmont

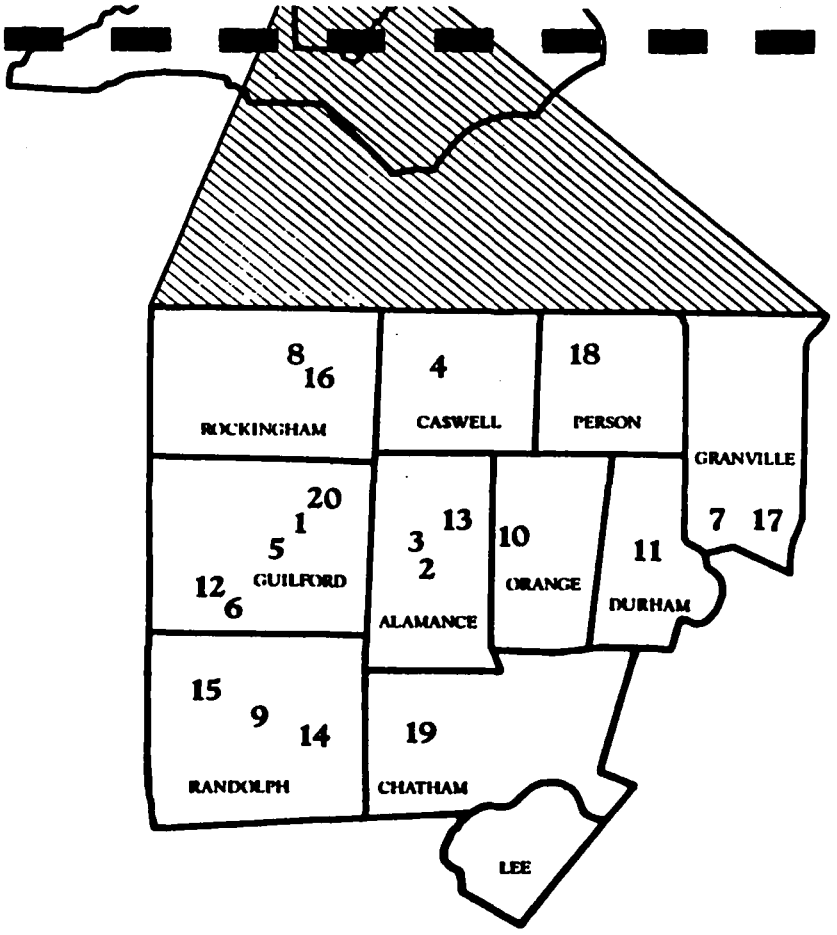
Reference 22

Revised Edition

Roger Jones, Fishery Biologist
Division of Boating and Inland Fisheries



September 1985
North Carolina Wildlife Resources Commission



1. Brandt
2. Old Burlington City
3. Cammack
4. Farmer
5. Higgins
6. High Point
7. Holt
8. Hunt
9. Lucas
10. Michael
11. Michie
12. Oak Hollow
13. Quaker Creek
14. Ramseur
15. Reese
16. Reidsville City
17. Rogers
18. Roxboro
19. Siler City
20. Townsend

Figure 1

FOR NORTH CAROLINA CENTRAL REGION

Roger Jones, Fishery Biologist

Division of Inland Fisheries
North Carolina Wildlife Resources Commission
Raleigh, North Carolina

Introduction

Municipal water supply reservoirs are an important water resource in the central Piedmont area of North Carolina. These reservoirs are located in the most densely populated areas of the state and thus receive extensive use which includes sport fishing. The primary purpose of this brochure is to provide the sportsmen of North Carolina with information about fishing in these central Piedmont city lakes. The lakes are found in an 11 county area (see map) that forms the Wildlife Resources Commission's District Five. The Commission has entered into written agreements with several municipalities to develop fish management for each of these lakes. Presently, there are eight lakes under such agreements in this area but fisheries management assistance has been provided upon request by city governments at an additional 12 lakes.

Commission activities being conducted on these water supply reservoirs include fish population surveys, creel surveys, fish stockings, and aquatic vegetation control. The Commission has also cooperated with municipalities to install fish attractors or reefs in many lakes to provide cover for numerous kinds of fish in hopes of improving angler success. Information gathered from these and similar activities over extended periods of time provide the basis for making fishery management decisions including selecting and evaluating size and creel limits and stocking forage and game fish species.

The lakes are listed in alphabetical order and are followed by short paragraphs describing their location, size and fishery. A guide to the facilities available at each lake can be found near the end of this brochure.

Lake Brandt

Lake Brandt, a raw water source for the City of Greensboro, is located north of the city on Reedy Fork Creek with access near the dam off SR 2303 (Guilford Co.). This lake covers 810 surface acres and has been managed by the North Carolina Wildlife Resources Commission (N.C.W.R.C.) under the small lakes program since May 1968. The major game fishes of Lake Brandt are bluegill, crappie and largemouth bass. This lake supports a very good trophy bass fishery and crappie fishing is considered good in the early spring months. Threadfin shad and channel catfish have been stocked over the past few years, the shad providing forage for crappie and largemouth bass while the catfish were stocked to supplement natural reproduction. The lake also supports large populations of white catfish and bullheads, which are under-harvested, and several large carp are caught each spring. Lake Brandt is closed to fishing on Tuesdays during the fishing season and for the entire duck hunting season. Night fishing was started in 1985 for one day a week during the summer months. This should provide additional fishing opportunity especially for catfish and crappie which are commonly active at night.

Old Burlington City Lake

Old City Lake, a primary water supply for the City of Burlington, is located on Stoney Creek near the small community of Hopedale with access off SR 1730 via NC 62 north (Alamance Co.). This lake covers 350 acres and is downstream from Lake Cammack. The old lake supports fair to good bass fishing with the best chances of catching a lunker bass occurring during November and December. Crappie fishing is good with nice stringers caught during the spring months. Bream fishing is excellent with plentiful catches of 8-10 inch sunfish. Striped bass x white bass hybrids are occasionally caught with reports of some fish in excess of 5 pounds. These fish were originally stocked in Lake Cammack and have migrated downstream. Outboard motors are restricted to 10HP on the Old City Lake.

Lake Cammack

Lake Cammack, formerly called Lake Burlington, is a narrow "Y" shaped lake covering 840 acres. The lake serves as a secondary raw water supply for the City of Burlington and has been managed under the small lakes program since December 1967. Cammack is located north of Burlington on Stoney Creek with access at the marina off SR 1002 (Alamance Co.). This lake supports many kinds of fish including the Morone hybrid. Hybrids were stocked in the early 1980s to provide an additional sport fish. According to local anglers, the hybrids are best caught during the fall months and many fish are in the 7-8 pound class. The largemouth bass population is fair with numerous small fish caught in the spring. However, Cammack is noted for its frequent catches of lunker bass (8 pounds and above) during the late fall and winter months. Many of these lunker bass are caught by jigging in the old stream channels. The lake also supports fair to good populations of chain pickerel (jack) and redear sunfish (shellcracker). Jack are caught in the winter months by trolling in the upper portions of the lake. Also, anglers report frequent catches of white bass from Cammack during the early spring months. A zoned fishing area is located upstream in both arms of the lake.

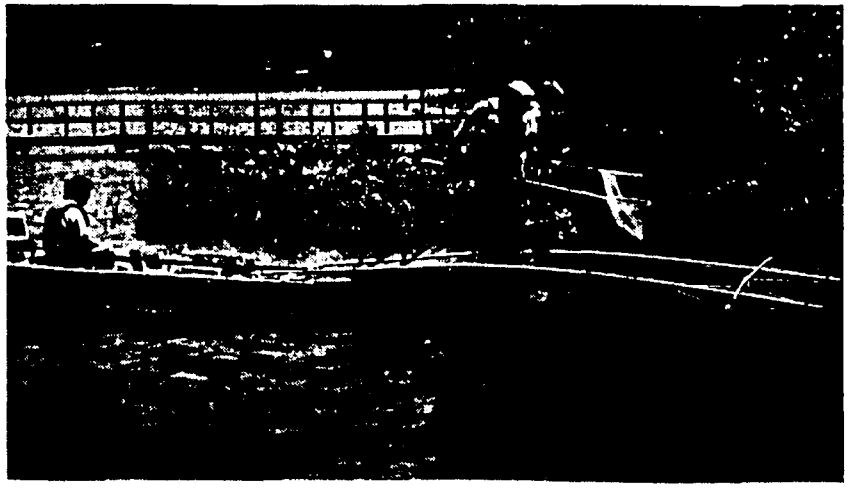
Lake Farmer

Lake Farmer serves as primary source of raw water for the City of Yanceyville and is located on Country Line Creek southwest of the town. Access to the lake is via a new road running west from SR 1156 (Old Hwy. 62) about 3 miles from Yanceyville (Caswell Co.). The lake covers 369 acres and was filled in 1983. The N.C.W.R.C. stocked Lake Farmer in 1984 with largemouth bass, bluegill and redear sunfish. The lake will open to public fishing in 1986 and should provide anglers with excellent fishing.

High Point Lake

High Point Lake, a primary source of raw water for the City of High Point, is an impoundment of the Deep River located in the city with access at the boat dock off US 29-70A (Guilford Co.). The lake covers approximately 356 acres and was placed in the small lakes program in 1968. Dominant game fishes present are bluegill, pumpkinseed, crappie, Morone hybrids and largemouth bass. Many nice stringers of crappie are caught during the spring months. Largemouth bass fishing is considered fair to good with a few lunker bass taken during the early spring months. Hybrid bass fishing is good and the lake held the state record a few years ago. Other species found in the lake are shellcracker, bullheads, robin, pickerel and carp. Several large carp and channel catfish are caught each year. Excellent pier fishing is available for panfishing in the cove adjacent to the marina. The lake has been stocked occasionally with threadfin shad to provide adequate forage for crappie.

Surveys



Electrofishing is one method that fisheries biologists use to sample fish populations in city lakes. Stunned fish are netted, measured and released unharmed.

Lake Higgins

Lake Higgins, a secondary raw water source for the City of Greensboro, is located north of the City on Bush Creek (tributary of Reedy Fork Creek) with access off SR 2135 via US 220 north (Guilford Co.) and covers 287 acres. It was placed in the small lakes program in May 1968. Largemouth bass fishing is fair with an occasional lunker taken throughout the year; however, most of the fish caught average around 12 inches in length. Threadfin shad are stocked frequently to provide forage for crappie and largemouth bass. Lake Higgins also has been stocked with channel catfish and Morone hybrids. Hybrids are caught frequently with some fish topping the scales at 10-12 pounds. Nice stringers of 3 to 4-pound channel catfish often are caught during late spring and summer months. The crappie fishing is considered fair to good by local anglers with the best fishing occurring in the spring of the year around brush piles and bridge crossings. Higgins is closed to fishing on Mondays during the fishing season. Pier fishing is available at the lake. Night fishing was started in 1985 for one day a week during the summer months. This should provide excellent fishing opportunity for hybrid bass and catfish species. Fishing licenses are sold at the lake.

Lake Holt

Lake Holt, formerly called Lake Butner, serves as a primary source of raw water for the City of Butner. The lake is located on Knapp of Reeds Creek northwest of the town with access off SR 1004 near the intersection of SR 1103 and SR 1112 (Granville Co.). Lake Holt covers 330 acres and is surrounded mostly by game lands property which provides a scenic background. Ten kinds of fish have been collected in fish samples conducted by the N.C.W.R.C. with bluegill, pumpkinseed, white perch, yellow perch and largemouth bass being numerous. Largemouth bass fishing is considered fair by local anglers with average size around 12-14 inches. Stringers of white perch averaging 8-10 inches are frequently caught in 6-8 feet of water over rocky shoals during the spring months. Channel catfish have been stocked into Lake Holt and are a favorite with many local anglers.

Reference 24

NUS CORPORATION AND Subsidiaries — **TELECON NOTE**

CONTROL NO. F4-8803-58	DATE: May 9, 1988	TIME: 3:00 p.m.

DISTRIBUTION:

Glass, E. H. Co. Landfill
Cone Mills Corp. - White Oak Plant

BETWEEN: Don Grubbs	OF: Guilford Co. Water Dept. Greensboro, N. C.	PHONE: (919) 373-2055

AND: Joan Dupont, NUS Corporation

Joan Dupont 5/9/88

DISCUSSION:

The Guilford County Water Department obtains its water supply from Lake Townsend, Lake Higgins, and Lake Brandt. The county has two raw water lines; water from Lakes Brandt and Higgins is treated at Mitchell and water from Lake Townsend is treated at Townsend. Water from the different lines is probably combined somewhere in the distribution system; Mr. Grubbs said he would have to check pipeline maps to verify this. The water system has approximately 66,000 accounts (i.e., connections).

Inside the city limits of Greensboro, approximately 99.9% of the people are served by the county water system. Water is also provided by the county in its service areas outside the city limits; however, residents outside the city limits are not required to be hooked up to the water and sewer lines. Mr. Grubbs did not know how to find out which residents were not hooked up, other than going through individual account records.

From the dam at Lake Townsend, Guilford County's water service lines go south. Mr. Grubbs was not sure whether areas north of Guilford's service areas (i.e., south of Lakes Townsend and Jeannette) are on wells and septic tanks. Residences along service area boundary lines are served by county water. There are no other water service areas immediately north of Guilford County's water service areas; the next closest water service area to the north is located in Reidsville, in Rockingham County.

Lake Jeannette was formerly called Richland Lake, among other names. It is owned by the Cone Mills Corporation and has been developed by the company as a residential area. The residents are on Guilford County water.

Groundwater wells in the Greensboro area are approximately 150 feet deep or deeper; Mr. Grubbs has a well that is approximately 360 feet deep and supplies good water. He did not know the depth of the water table.

Reference 25

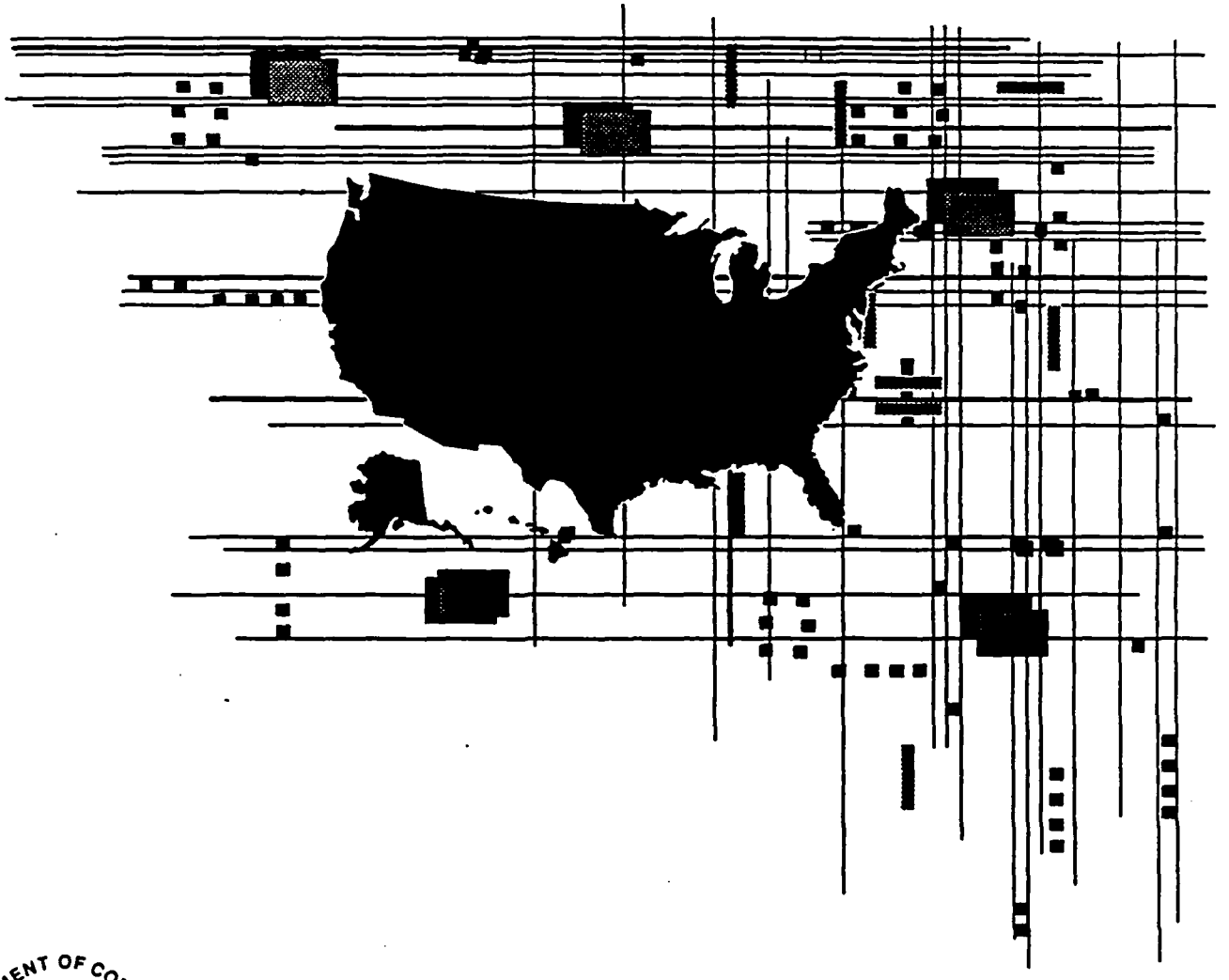
CURRENT POPULATION REPORTS

Special Studies

Series P-23, No. 156

U.S. Census Bureau
Regional Office
(Nancy Olsen)
(704) 371-6652

Estimates of Households, for Counties: July 1,1985



U.S. Department of Commerce
BUREAU OF THE CENSUS

Acknowledgments

This report was prepared by **Campbell Gibson**, Demographic Advisor, Population Division. **Edith L. Reeves**, **Marie Pees**, and **Steven Smith** were responsible for computer programming. **Gerda K. Mudd** provided statistical assistance, and **Mary J. Kisner** provided typing assistance. **Prithwis Das Gupta** reviewed the contents of the report.

The staff of Publications Services Division, **Walter C. Odom**, Chief, provided publication planning, design, composition, and printing planning and procurement. **Paula Coupe** edited and coordinated the publication.

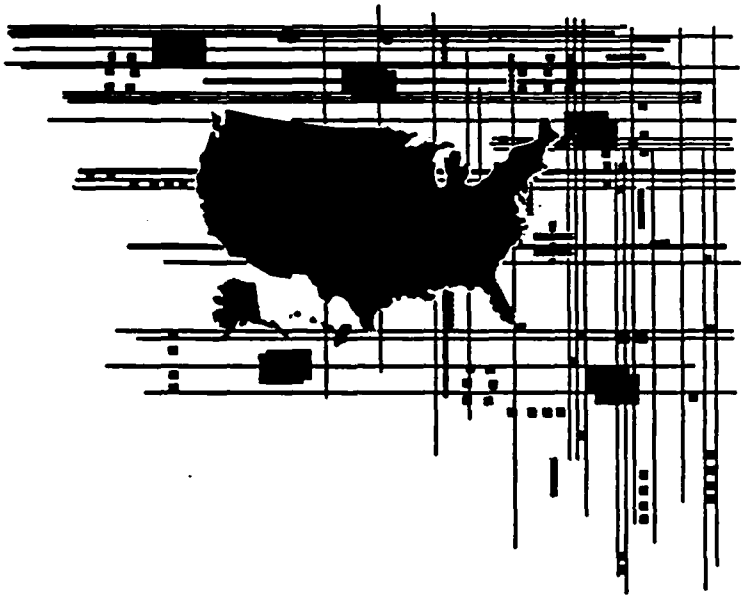
The Department of Housing and Urban Development provided financial support for the research on county household estimates. **Connie Casey** was responsible for overseeing this research on behalf of that Department.

CURRENT POPULATION REPORTS

Special Studies

Series P-23, No. 156

Estimates of Households, for Counties: July 1,1985



Issued March 1988

U.S. Department of Commerce
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Robert Ortner, Under Secretary
for Economic Affairs

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John G. Keane, Director

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POPULATION DIVISION
Paula J. Schneider, Chief

SUGGESTED CITATION

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Estimates of Households, for Counties: July 1, 1985

INTRODUCTION

This report presents estimates of households for 3,138 counties and county equivalents in the United States as of July 1, 1985. County equivalents include census areas and boroughs in Alaska, parishes in Louisiana, the District of Columbia, and independent cities in Maryland, Missouri, Nevada, and Virginia.

Estimates are included for two counties established since the 1980 census: Cibola County, NM, created from part of Valencia County in 1981; and La Paz County, AZ, created from part of Yuma County in 1983. The 1980 data shown for these four counties are estimates reflecting current boundaries. Data for Maui County, HI, include Kalawao County, which had only 71 households in 1980. Because of the creation of two new counties and the merging of one county for statistical purposes, the number of counties (including county equivalents) included in this report is one more than the 3,137 counties in 1980 census reports. Kobuk Census Area in Alaska (with a boundary change) was renamed Northwest Arctic Borough in 1986.

In addition, this report includes July 1, 1985, estimates of population and average population per household. The estimates of population are consistent with revised county population estimates for July 1, 1985, issued for individual States.[1] These estimates supersede provisional July 1, 1985, county population estimates published in 1986.[2] The estimates of July 1, 1985, households in this report are consistent with previously published State household estimates,[3] except in Arizona where five counties (including over 80 percent of the State's population) had special censuses in 1985. The use of special censuses in developing county household estimates is discussed in the section on methodology.

The 1980 census data shown on households, average population per household, and population are as published in 1980 census reports and do not reflect corrections to census counts because corrections were not made to counts of households (occupied housing units). The July 1, 1985, estimates of households in this report are consistent with population estimates that reflect corrections to 1980 census population counts. See the section, Accuracy of County Household Estimates, and table A-1 concerning corrections to 1980 census counts.

This report represents the first time that the Census Bureau has published postcensal estimates of households for counties. The research underlying these estimates was funded partially by the Department of Housing and Urban Development. The methodology has been tested using data from the 1970-80 decade; however, it will not be possible to test how well the methodology works for estimating households for counties in the 1980's until results of the 1990 census become available.

METHODOLOGY

General. The method used to prepare July 1, 1985, estimates of households for counties assumes that the trend (proportionate change) in the adult population per household in a county since the 1980 census is the same as the estimated trend in the State's adult population per household during the same period. In general, this method represents an extension of the method used to estimate households for States based on the national trend in the average adult population per household and is referred to hereafter as the adult-population-per-household method.[4]

One important difference is that whereas the adult population was defined as 18 years and over in estimating State households, the adult population is defined as 15 years and over or 20 years and over in estimating county households. This situation reflects the fact that the underlying county population estimates by age are available only for 5-year age groups. The choice between defining the adult population as 15 years and over or 20 years and over is discussed later in this section.

[1] U.S. Bureau of the Census, Current Population Reports, Series P-26, Nos. 85-AL-C through 85-WY-C (1987-1988).

[2] U.S. Bureau of the Census, Current Population Reports, Series P-26, No. 85-52-C, *Provisional Estimates of the Population of Counties: July 1, 1985* (August 1986).

[3] U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1010, *State Population and Household Estimates, with Age, Sex, and Components of Change: 1981-86* (September 1987).

[4] For a discussion and evaluation of the method used to estimate households for States, see Series P-25, No. 1010, pp. 12-14. Regarding methodological research on household estimation, see Prithwis Das Gupta, Campbell Gibson, Roger Herriot, Enrique Lamas, and Meyer Zitter, "New Approaches to Estimating Households and Their Characteristics for States and Counties," in U.S. Bureau of the Census, *Proceedings of the Second Annual Research Conference: March 23-26, 1986* (June 1986), pp. 83-110.

Adult population. The methodology underlying the Census Bureau's postcensal county age estimates was developed originally in the late 1970's with the financial support of the National Cancer Institute.[5] In general, the method uses a cohort-component technique to carry forward the census population of a county with data on births, deaths, inmigration, and outmigration. Estimates of inmigrants and outmigrants by age are based on the pattern of 5-year migration data from the latest decennial census with special adjustments for military and college populations. These estimates are adjusted, sometimes extensively, so that the estimated total population agrees with the Census Bureau's independent total population estimate for the county. Medicare data are used also in developing estimates of the population 65 years and over. The major factor affecting the accuracy of the county age estimates is probably the assumption that the age pattern of migration for the postcensal period is similar to the age pattern in the five years preceding the census. In addition, sample variation in the census migration data, especially for counties with very small populations, and errors in reporting county of residence 5 years ago, are sources of errors in the postcensal estimates of migration by age.[6] It should be noted that proportionate errors in estimates for broad age groups, such as used in making county household estimates, are less than the proportionate errors in estimates for 5-year age groups because errors in opposite directions for 5-year age groups counteract each other.

Estimates of the adult population for counties for July 1, 1985, are based on provisional county age estimates.[7] These estimates were adjusted to be consistent with revised July 1, 1985, estimates of total population for counties and of population by age for States using a two-way raking procedure.

For Virginia, the provisional county age estimates were not used because of problems resulting from errors in the underlying migration data from the 1980 census. There was a tendency for persons who moved from a county adjacent to an independent city (of which Virginia has 41) to report the independent city as their place of residence in 1975,[8] partly due to the fact that the territory served by city post offices sometimes extends into neighboring counties. For Virginia, the estimates of the adult population for counties for July 1, 1985, are based on county population projections by age prepared by Virginia's Department of Planning and Budget.[9] These projections, which used net migration patterns for the 1970-80 decade and which are consistent with county population estimates for July 1, 1984, were then adjusted using the two-way raking procedure noted earlier.

Group quarters and adult household populations. The adult-population-per household-method in concept requires estimates of the adult household population and of the adult population per household. Postcensal estimates of the adult population by county are not available separately for persons living in households or in group quarters; however, since the total group quarters population by county can be estimated, the adult household population is defined here operationally as the adult population minus the group quarters population (all ages) and is an approximation of the adult household population.

The total group quarters population for each county for July 1, 1985, is estimated by adding the group quarters population covered by administrative data to an estimate of the remaining group quarters population. The latter estimate is derived by assuming that the ratio of the remaining group quarters population to the population 15 years and over (which included 98 percent of the group quarters population in 1980) excluding persons in group quarters covered by administrative data was the same as in 1980. The available postcensal data on group quarters population by county are limited to administrative data which included 56 percent of the group quarters population enumerated in the 1980 census and which include major group quarters facilities like college dormitories and military barracks.

As noted earlier, the adult population is defined as 15 years and over or 20 years and over in using the adult-population-per-household method to estimate households for counties. Research for the 1970-80 period showed that overall the 15+ and 20+ definitions of the adult population produced similar average errors in estimates of households for 1980, but that the 20+ definition produced a lower average error in counties where the group quarters percentage of the county population was low and changed little between 1970 and 1980 and that the 15+ definition produced a lower average error otherwise. Based on this research, the 20+ definition was used for the counties in which the group quarters percentage was under 2 percent in both the

[5] U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 103, *Methodology for Experimental Estimates of the Population of Counties, by Age and Sex: July 1, 1975* (May 1980); and *Methodology for Experimental County Population Estimates by Age, Sex, and Race: 1980-84* (forthcoming in Current Population Reports).

[6] Series P-23, No. 103, *op. cit.*, pp. 13-16.

[7] The July 1, 1985, county age estimates used here are the latest currently available. The 1985 Medicare data used in developing these estimates are provisional, and thus the county age estimates used here to develop county household estimates are also provisional. Revised July 1, 1985, county age estimates will be prepared at a later date after final 1985 Medicare data become available.

[8] U.S. Bureau of the Census, 1980 Census of Population, Supplementary Report, PC80-S1-17, *Gross Migration for Counties: 1975 to 1980*, (March 1984).

[9] Donald P. Lillywhite, Larry E. Robinson, and Julie A. Henderson, *Virginia Population Projections 2000* and unpublished projections for 1985, Department of Planning and Budget, Richmond, Virginia (October 1986).

1980 census and the 1985 estimate and changed less than 1 percentage point between 1980 and 1985 (61 percent of all counties) and the 15+ definition was used for the remaining counties (39 percent).[10] For a more detailed discussion of research for the 1970-80 decade, see the section, Accuracy of County Household Estimates.

The results of the research reflect the low householder rate under age 20 nationally and the sizable group quarters population in the 15-19 age group nationally and in many counties. Only about 3 percent of persons 15 to 19 years old in 1980 were householders, compared with 52 percent of persons 20 years and over,[11] and thus trends in the population 15 to 19 years old have little effect on trends in households. However, the lack of postcensal estimates of group quarters population by age and the resulting need to define the adult household population operationally as the adult population minus the total group quarters population (i.e., treating the total group quarters population statistically as adults) introduces more distortion for the 20+ definition than for the 15+ definition. This is because only 73 percent of the group quarters population in 1980 was 20 years and over, whereas 98 percent was 15 years and over.[12]

Adult population per household and household estimates. As noted earlier, the adult-population-per-household method assumes that the proportionate change in the adult population per household in a county since the most recent census is the same as the estimated proportionate change in the State's adult population per household during the same period. For the 1980-85 period:

$$\frac{C_{ij(1985)}}{C_{ij(1980)}} = \frac{S_{i(1985)}}{S_{i(1980)}} \quad \text{and} \quad C_{ij(1985)} = \frac{C_{ij(1980)} \bullet S_{i(1985)}}{S_{i(1980)}}$$

where

$C_{ij(1985)}$ = the adult population per household for county j in State i in 1985;

$C_{ij(1980)}$ = the adult population per household for county j in State i in 1980;

$S_{i(1985)}$ = the adult population per household for State i in 1985;[13] and

$S_{i(1980)}$ = the adult population per household for State i in 1980.

The estimate of a county's adult population can then be used to estimate households:

$$H_{ij(1985)} = \frac{P_{ij(1985)}}{C_{ij(1985)}}$$

where $H_{ij(1985)}$ = households for county i in State j in 1985; and

$P_{ij(1985)}$ = adult population for county i in State j in 1985.

For counties in California, county household estimates were adjusted slightly to reflect estimated changes in the distribution of the population 20 years and over in individual counties and county groups in three racial/ethnic groups: (1) Asian and Pacific Islander and American Indian (including Eskimo and Aleut); (2) Hispanic origin; (3) remainder of the population (White non-Hispanic and Black non-Hispanic).[14] These adjustments were made for county household estimates in California for a combination of three reasons: (1) the sizable increase in the adult population per household *relative* to the national trend, partly because of the increased proportion of Hispanics and Asians in the State's population combined with the high average population per household among these two groups;[15] (2) the wide range among individual counties and county groups in the 1980-85 period in the estimates of change in the distribution of the population among the three racial/ethnic groups noted earlier; and (3) the large number of individual counties (generally, counties with over 100,000 population) for which racial/ethnic estimates are available for California.[16]

As discussed earlier, the estimates of county population by age are particularly subject to error, partly because of the assumption that the age pattern of migration for the postcensal period is similar to the pattern in the 5 years preceding the census. In cases where the proportionate distribution of the population

[10] In 1980, 2.5 percent of the U.S. population lived in group quarters; 1980 Census of Population, Volume 1, Characteristics of the Population, Chapter B, *General Population Characteristics*, Part 1, United States Summary, PC80-1-B1 (May 1983), table 61.

[11] 1980 Census of Population, Vol. 1, Characteristics of the Population, Chapter D. Detailed Population Characteristics, Part 1, United States Summary, PC80-1-D1-A (March 1984), tables 253 and 265.

[12] *Ibid.*, table 266.

[13] This estimate is based on the estimated adult population divided by the number of households estimated previously for the State (Series P-25, No. 1010, *op. cit.*, pp. 12-14).

[14] *Population Estimates by Race and Hispanic Origin for States, Metropolitan Areas, and Selected Counties: July 1, 1985* (forthcoming in Current Population Reports).

[15] Series P-25, No. 1010, *op. cit.*, p. 14.

[16] The size of the adjustments to county household estimates in California, where the Asian and Pacific Islander, American Indian, and Hispanic-origin populations 20 years and over increased an estimated 4.9 percentage points (22.0 percent to 26.9 percent) in the 1980-85 period, can be illustrated with the most extreme cases. In Los Angeles County, with an estimated 7.4 percentage-point increase (29.8 percent to 37.2 percent), the 1985 household estimate was adjusted downward by 1.0 percent. In Shasta County, with an estimated 0.7 percentage-point increase (4.7 percent to 5.4 percent). the 1985 household estimate was adjusted upward by 1.9 percent. See also county household estimates published by the State of California (Population Research Unit, Department of Finance, 1025 P Street, Sacramento, CA 95814).

between adults and non-adults is incorrect, the derived estimate of the average population per household could be incorrect even if the estimate of the average adult population per household was correct. To protect against the possibility of extreme error from this situation, a tolerance was implemented on the estimated 1980-85 change in the average population per household in a county *relative* to the change in its State. This tolerance was based on 1970-80 trends in the average adult population per household, which showed that the change for counties differed from the change for their State by more than 10 percentage points (1 percentage point per year) for less than 1 percent of all counties. For the 109 counties in which the estimated county changes in average population per household differed from their estimated State changes by more than 5.25 percentage points (1 percentage point per year) in the April 1, 1980, to July 1, 1985, period, the estimates of the average population per household for 1985 were adjusted to this tolerance with corresponding adjustments in the estimates of households.

The final step in the estimation procedure was to adjust estimates of households and average population per household for counties for July 1, 1985, to be consistent with special censuses of population taken by the Bureau of the Census or, in the case of Alaska and California, by the State agency participating with the Bureau of the Census in the Federal-State Cooperative Program for Population Estimates. (The results of these special censuses are reflected in the population estimates for July 1, 1985.) These special censuses (with counties and dates in parentheses) were taken in Alaska (Kenai Peninsula Borough, 8-25-84; Ketchikan Gateway Borough, 10-28-83; Kodiak Island Borough, 7-16-82), Arizona (La Paz, 11-5-85; Maricopa, 10-1-85; Pima, 4-1-85; Pinal, excluding the towns of Kearny and Superior, 3-14-85; Yuma, 11-6-85), California (Alpine, 10-28-85), Colorado (Archuleta, 9-20-83), Mississippi (Grenada, 2-26-86), North Dakota (Mercer, 7-18-83), Wisconsin (Menominee, 4-28-86), and Wyoming (Uinta, 8-21-86). Except in Arizona, the adjustments to county household estimates were very small and did not produce any changes to State household estimates (rounded to thousands) published previously. In Arizona, where special censuses in five counties included over 80 percent of the State's population, the July 1, 1985, State household estimate in this report (1,176,000) is larger than the estimate published previously (1,159,000).[17]

ACCURACY OF COUNTY HOUSEHOLD ESTIMATES

General. The accuracy of the county household estimates depends on the accuracy of the adult-population-per-household method and of the underlying estimates of adult population. The accuracy of the method (i.e., the accuracy of the assumption that county trends in the adult population per household parallel State trends) can be tested using 1970 census data on age and households and 1980 census data on age for counties to estimate households for counties in 1980. The accuracy of the underlying postcensal estimates of adult population is more difficult to assess, as discussed later.

Adult-population-per-household method. The method used to estimate households for counties represents an extension of the method used to estimate households for States. A test of the method for States for the 1970-80 decade yielded the following errors in 1980 household estimates for States: a median error of 0.7 percent, a mean error of 0.8 percent, and a root mean square error (RMSE) of 1.0 percent.[18]

Results of various tests of the method to estimate 1980 county households are shown in table A. In the ideal case where group quarters data by age are available (which permits use of actual adult household population estimates by age), the 20+ adult definition tests better than the 15+ adult definition as measured by median error, mean error, and RMSE (columns 1 and 2). This result reflects the fact that persons 15-19 years old have little effect on the number of households, as discussed in the section on methodology.

In the case paralleling the actual situation with postcensal estimates for counties where estimates of group quarters population by age are not available, the choice between the two adult definitions is not clear. The 20+ adult definition has a lower median error and mean error and a higher RMSE than the 15+ adult definition (columns 3 and 4). The higher RMSE using the 20+ adult definition (owing to more cases of large percent errors) reflects the weakness in assuming that the group quarters population is all adults when the 20+ adult population is used, as discussed in the Methodology section.

The similarity in errors between the 15+ and 20+ definitions of adult population when it is assumed that the group quarters population is all adults obscures a systematic difference between these two alternatives suggested by the preceding discussion: the 15+ adult definition tends to perform better when the group quarters proportion of a county's population is high or has

[17]Series P-25, No. 1010, *op. cit.*, p. 87.

[18]For States, a State trends variant was used in combination with the national trends variant of the adult-population-per-household method, which significantly lowered the error in 1980 household estimates for States: median error of 0.5 percent, mean error of 0.5 percent, root mean square error of 0.6 percent. Extension of the State trends variant to the county level (i.e., using past county trends in the adult population per household *relative* to past State trends in addition to using recent State trends) yielded erratic results; however, the use of the State trends variant is reflected in the estimates of adult population per household for States used to estimate adult population per household for counties. See Series P-25, No. 1010, pp. 12-14 for a discussion of the State trends variant of the adult-population-per-household method.

Table A. Percent Errors in 1980 Household Estimates for Counties, Classified by Treatment of Group Quarters Population

(Based on the adult-population-per-household method)

Percent error[1]	Using group quarters population by age		Assuming group quarters population is all adults		
	15+ adult definition (1)	20+ adult definition (2)	15+ adult definition (3)	20+ adult definition (4)	Combined 15+ and 20+ adult definition[2] (5)
Total[3]	3,125	3,125	3,125	3,125	3,125
0.0 up to 5.0	3,064	3,100	3,054	3,045	3,073
0.0 up to 1.0	1,395	1,696	1,367	1,522	1,518
1.0 up to 2.0	917	922	922	913	938
2.0 up to 3.0	471	343	475	384	402
3.0 up to 4.0	200	101	204	168	159
4.0 up to 5.0	81	38	86	58	56
5.0 up to 10.0	55	21	65	60	47
10.0 up to 15.0	3	4	3	9	5
15.0 up to 20.0	2	-	2	6	-
20.0 or more	1	-	1	5	-
Median error (percent)	1.18	0.92	1.21	1.04	1.05
Mean error (percent)	1.49	1.16	1.52	1.48	1.34
Root mean square error (percent)[4]	2.02	1.57	2.07	2.68	1.82

- Represents zero.

[1]Without regard to sign.

[2]15+ definition for 1,429 counties and 20+ definition for 1,696 counties based on the level and change in the group quarters proportion of a county's population. See Methodology and Accuracy of County Household Estimates sections.

[3] Includes county equivalents. The total (3,125) is slightly less than the 1970 census figure (3,141) and the 1980 census figure (3,137) because several counties were combined for geographic comparability between 1970 and 1980.

[4]The root mean square error $= \sqrt{\sum_{i=1}^{3,125} e_i^2/3,125}$

where e_i is the absolute percent error in the estimate for county i.

changed substantially whereas the 20+ adult definition tends to perform better when the group quarters proportion of a county's population is low and has changed little. An analysis of the errors in county household estimates by the level and change in the group quarters proportion of county population shows that the 20+ adult definition performs better when the group quarters proportion was below 2 percent in both 1970 and 1980 with less than a 1-percentage-point change (1,696 counties) and that the 15+ definition performs better or the two adult definitions perform about equally well when the group quarters level or change is above these thresholds (1,429 counties). The 15+ definition was used when the two definitions performed about equally well because of the possibility that the procedure for making postcensal estimates of the group quarters population by county may sometimes miss sizable changes.[19]

As shown in table A, the combined 15+ and 20+ definition of the adult population produces a lower mean error (1.34 percent) and RMSE (1.82 percent) than the 15+ or 20+ adult definition when the necessary assumption is made that the group quarters population is all adults (columns 3, 4, and 5). The combined 15+ and 20+ adult definition was used to develop the July 1, 1985, county household estimates, as described in the section entitled Methodology.

Adult population estimates. The preceding discussion of the accuracy of county household estimates made using the adult-population-per-household method was based on the use of census data on the adult population and thus does not reflect errors in postcensal estimates of the adult population by county used to make postcensal county household estimates. It is more difficult to assess the accuracy of the underlying postcensal estimates of adult population because the degree to which postcensal population estimates will be consistent with population counts from the next census is not yet known. (The next census will be the standard against which to evaluate postcensal estimates of adult population as well as households.)

[19]It should be noted that proportionately, county household estimates are not very sensitive to errors in estimates of the group quarters population. For example, if in a county with estimates of 10,000 adults and 200 persons in group quarters, the group quarters estimate is doubled to 400, the estimated adult household population drops from 9,800 to 9,600, or by 2 percent, resulting in a 2 percent drop in the household estimate.

An earlier test of the adult-population-per-household method provides some evidence for the 1970-80 period.[20] As shown in table B, the median error, mean error, and RMSE in 1980 county household estimates are all substantially higher when based on post-1970 census estimates of the 1980 adult population (columns 3 and 4) than when based on 1980 census data on the adult population. While these results show that the accuracy of postcensal household estimates depends heavily on the accuracy of underlying estimates of the adult population, the implication for post-1980 county household estimates is not clear. The national error of closure (the difference between the census count of population and the population estimate for the census date based on the previous census count carried forward with data on births, deaths, immigration and emigration) in 1980 was quite high (2.0 percent),[21] and the average error in county population estimates for 1980 was 4.2 percent.[22] The latter figure is of the same order of magnitude as the average errors in 1980 county population estimates based on post-1970 census estimates of the adult population: 4.6 percent using the 15+ adult definition, or 4.7 percent using the 20+ adult definition (table B, columns 3 and 4).

If the national error of closure in 1990 turns out to be about the same as in 1980, it seems likely that the mean errors in 1990 county population estimates and in 1990 household estimates consistent with these population estimates would be of the same order of magnitude as in 1980 with mean errors for 1985 estimates being roughly one-half of these levels. If the national error of closure in 1990 turns out to be low, as in 1960 and 1970 when it was less than 0.2 percent,[23] it seems likely that the mean errors would be substantially less.[24]

1980 census corrections. The 1985 county household estimates are consistent with 1985 county population estimates that reflect corrections to population counts. More specifically, the provisional 1985 county age estimates used to obtain estimates of the adult population,

[20]Campbell Gibson in Das Gupta, et al., *op. cit.*, p. 85, "Demographic Approach to Estimating Total Households for States and Counties and Households by Type and Size for States."

[21]U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1006, *United States Population Estimates and Components of Change: 1970 to 1986*, (May 1987), p. 2.

[22]U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 984, *Evaluation of Population Estimation Procedures for Counties: 1980* (September 1986), p. 3.

[23]Series P-25, No. 1006, *op. cit.*, pp. 9, 15-16.

[24]See also Series P-23, No. 103, *op. cit.*.

Table B. Percent Errors in 1980 Household Estimates for Counties, Classified by Type of 1980 Age Data

(Based on the adult-population-per-household method)

Percent error[1]	Using 1980 census age data[2]		Using post-1970 census age estimates for 1980	
	15+ adult definition (1)	20+ adult definition (2)	15+ adult definition (3)	20+ adult definition (4)
Total[3]	3,125	3,125	3,125	3,125
0.0 up to 5.0	3,036	3,046	2,010	1,993
0.0 up to 1.0	1,167	1,358	449	466
1.0 up to 2.0	941	944	446	435
2.0 up to 3.0	547	474	419	427
3.0 up to 4.0	267	198	371	354
4.0 up to 5.0	114	72	325	311
5.0 up to 10.0	83	58	835	847
10.0 up to 15.0	4	11	214	210
15.0 up to 20.0	2	5	40	52
20.0 or more	-	5	26	23
Median error (percent)	1.42	1.22	3.67	3.66
Mean error (percent)	1.70	1.59	4.63	4.67
Root mean square error (percent)	2.24	2.75	6.22	6.45

- Represents zero.

[1]Without regard to sign.

[2]These errors were calculated before the State trends variant of the method was developed and used in combination with the national trends variant of the method to estimate households for States and thus are slightly higher than the corresponding errors shown in table A, columns 3 and 4.

[3]Includes county equivalents. The total (3,125) is slightly less than the 1970 census figure (3,141) and the 1980 census figure (3,137) because several counties were combined for geographic comparability between 1970 and 1980.

[4]The root mean square error $= \sqrt{\sum_{i=1}^{3,125} e_i^2/3,125}$

where e_i is the absolute percent error in the estimate for county i.

which were used to estimate households as described in the section on Methodology, were controlled to estimates of total population for counties that reflect corrections to 1980 census population counts.

The 1980 census data shown in this report do not reflect corrections to census counts because corrections were made to counts of total population and total housing units, but not to counts of total households (occupied housing units). In the 1980 census, 80.4 million, or 91 percent, of the 88.4 million housing units enumerated in the United States were occupied housing units (households).[25] The proportion of housing units that are vacant (year round or seasonal) varies considerably by geographic area, and corrections do not always involve both population and housing units because of group quarters population and vacant housing units; so there is no simple formula for adjusting household counts based on adjustments to counts of population or housing units. However, to provide an indication of counties in which sizable corrections to household counts would have been most likely, the published and corrected 1980 census counts of population and housing units are shown in table A-1 for those counties with a correction in population or households of at least 100 or 1.0 percent.

DEFINITIONS AND EXPLANATIONS

Household. A household consists of all the persons who occupy a housing unit. A house, an apartment or other group of rooms, or a single room, is regarded as a housing unit when it is occupied or intended for occupancy as separate living quarters; that is, when the occupants do not live and eat with any other persons in the structure and there is direct access from the outside or through a common hall.

A household includes the related family members and all the unrelated persons, if any, such as lodgers, foster children, wards, or employees who share the housing unit. A person living alone in a housing unit, or a group of unrelated persons sharing a housing unit as partners, is also counted as a household. If there are 10 or more unrelated persons living together or nine or more who are unrelated to the person in charge, the living quarters are defined as group quarters and not as a housing unit.

Group quarters. All persons not living in households are classified as living in group quarters. There are two categories of persons in group quarters. The first category is inmates of institutions and includes persons under care or custody in institutions. Examples of institutions include facilities for the physically or mentally handicapped, homes for the elderly, orphanages, and correctional institutions. The second category is "other" and includes all persons in group quarters who are not inmates of institutions. Examples of other group quarters include college dormitories, military barracks, and rooming houses.

Householder. The householder is the person (or one of the persons) in whose name the housing unit is owned or rented (maintained) or, if there is no such person, any adult member, excluding roomers, boarders, or paid employees. If the house is owned or rented jointly by a married couple, the householder may be either the husband or the wife. The person designated as the householder is the "reference person" to whom the relationship of all other household members, if any, is recorded. The number of householders is equal to the number of households.

ROUNDING OF ESTIMATES

The household and population estimates in this report have been rounded to the nearest thousand for States and to the nearest hundred for counties. Derived measures (percent change and average population per household) are based on unrounded numbers.

AVERAGE POPULATION PER HOUSEHOLD

Average population per household represents household population (total population minus group quarters population) divided by households. See the Methodology section concerning 1985 estimates of average population per household.

RELATED REPORTS

The household estimates shown in this report are consistent with State household estimates published in Current Population Reports, P-25, No. 1010, except for Arizona, as described in the section on methodology. The 1980 census counts of households for counties were published in 1980 Census of Population, Volume 1, Characteristics of the Population, Chapter B, General Population Characteristics, Parts 2-52, PC80-B2 through PC80-B52.

[25] U.S. Bureau of the Census, *Statistical Abstract of the United States: 1987* (1986), p. 710.

Table 1. Estimates of Households, for Counties: July 1, 1985

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Alabama	1,444,000	1,341,856	103,000	7.6	2.73	2.84	4,022,000	3,893,888	128,000	3.3
Autauga	11,900	10,197	1,700	16.4	2.92	3.15	34,800	32,259	2,500	7.8
Baldwin	32,400	26,775	5,600	20.9	2.75	2.91	89,900	78,556	11,300	14.4
Barbour	8,800	8,375	400	4.9	2.84	2.93	25,200	24,756	400	1.7
Bibb	5,400	5,167	200	4.3	2.96	3.02	16,100	15,723	400	2.5
Blount	13,700	12,682	1,000	7.8	2.75	2.86	37,800	36 ,459	1,300	3.7
Bullock	3,500	3,455	-	0.9	2.96	3.07	10,300	10,596	-300	-2.6
Butler	7,600	7,471	100	1.4	2.86	2.88	21,900	21,680	200	0.9
Calhoun	42,600	39,651	3,000	7.5	2.70	2.82	123,500	119,761	3,800	3.2
Chambers	14,200	13,520	700	5.2	2.77	2.88	39,600	39,191	500	1.2
Cherokee	6,800	6,505	300	5.2	2.78	2.87	19,100	18,760	300	1.7
Chilton	11,300	10,742	600	5.5	2.71	2.83	30,900	30,612	300	1.0
Choctaw	5,600	5,405	200	3.9	2.99	3.11	16,900	16,839	-	0.1
Clarke	9,300	8,916	400	4.7	2.93	3.07	27,700	27,702	-	-0.1
Clay	4,800	4,767	-	0.2	2.74	2.87	13,100	13,703	-600	-4.3
Cleburne	4,700	4,373	300	6.6	2.75	2.87	12,900	12,595	300	2.2
Coffee	14,700	13,430	1,300	9.6	2.71	2.86	40,100	38,533	1,600	4.2
Colbert	20,300	19,181	1,200	6.1	2.67	2.82	54,700	54,519	200	0.4
Conecuh	5,400	5,456	-	-0.3	2.79	2.90	15,300	15,884	-600	-3.8
Coosa	3,900	3,899	-	-1.1	2.78	2.90	10,800	11,377	-600	-5.4
Covington	14,100	13,747	400	2.8	2.58	2.65	36,800	36,850	-100	-0.1
Crenshaw	4,900	5,024	-100	-2.1	2.70	2.78	13,400	14,110	-700	-4.9
Cullman	23,800	21,758	2,100	9.6	2.71	2.81	65,300	61,642	3,600	5.9
Dale	16,300	15,168	1,200	7.7	2.77	2.91	48,800	47,821	1,000	2.1
Dallas	18,500	17,590	900	5.1	2.83	3.02	53,100	53,981	-900	-1.6
De Kalb	19,800	19,247	600	2.9	2.69	2.77	53,700	53,658	-	-
Elmore	15,400	14,024	1,400	9.8	2.86	2.97	47,100	43,390	3,700	8.5
Escambia	12,500	12,653	-100	-0.9	2.79	2.91	36,500	38,440	-1,900	-5.1
Etowah	37,900	36,864	1,000	2.8	2.67	2.77	102,200	103,057	-900	-0.9
Fayette	6,900	6,710	200	3.5	2.70	2.78	18,900	18,809	100	0.5
Franklin	10,400	10,209	200	2.0	2.68	2.75	28,100	28,350	-200	-0.8
Geneva	8,700	8,572	100	1.7	2.74	2.82	24,000	24,253	-300	-1.2
Greene	3,500	3,452	100	2.4	3.03	3.17	10,800	11,021	-200	-2.2
Hale	4,700	4,850	-100	-2.2	3.09	3.18	14,900	15,604	-700	-4.7
Henry	5,300	5,258	100	1.3	2.79	2.91	14,900	15,302	-400	-2.8
Houston	29,200	26,183	3,000	11.6	2.70	2.83	79,500	74,632	4,900	6.5
Jackson	18,200	17,689	500	3.0	2.76	2.89	50,600	51,407	-800	-1.6
Jefferson	254,200	244,215	10,000	4.1	2.62	2.71	675,900	671,324	4,600	0.7
Lamar	5,900	5,787	100	1.2	2.77	2.81	16,400	16,453	-100	-0.4
Lauderdale	30,500	28,220	2,300	8.1	2.67	2.80	83,100	80,546	2,500	3.1
Lawrence	10,400	9,814	600	6.5	2.97	3.06	31,200	30,170	1,000	3.4
Lee	30,000	26,973	3,000	11.1	2.52	2.65	80,400	76,283	4,100	5.3
Limestone	17,600	15,358	2,300	14.9	2.79	2.97	50,500	46,005	4,500	9.8
Lowndes	3,800	3,732	100	1.9	3.36	3.55	12,800	13,253	-500	-3.4
Macon	8,600	8,273	400	4.2	2.77	2.93	26,200	26,829	-600	-2.2
Madison	81,500	67,082	14,400	21.5	2.73	2.86	228,000	196,966	31,000	15.7
Marengo	8,300	8,117	200	2.1	2.91	3.07	24,200	25,047	-800	-3.3
Marion	11,400	10,792	700	6.0	2.69	2.76	31,200	30,041	1,200	3.9
Marshall	26,400	23,489	2,900	12.2	2.66	2.77	70,800	65,622	5,100	7.8
Mobile	133,100	123,298	9,800	7.9	2.77	2.91	374,700	364,980	9,700	2.7
Monroe	7,300	7,242	100	1.2	3.05	3.11	22,500	22,651	-200	-0.7
Montgomery	76,400	68,471	7,900	11.5	2.71	2.79	213,400	197,038	16,400	8.3
Morgan	35,500	31,369	4,200	13.3	2.68	2.84	96,600	90,231	6,400	7.1
Perry	4,400	4,595	-200	-3.8	3.18	3.14	14,800	15,012	-200	-1.4
Pickens	7,100	6,997	100	1.7	2.98	3.04	21,400	21,481	-100	-0.3

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Alabama—Continued										
Pike	9,900	9,525	300	3.4	2.61	2.75	27,400	28,050	-600	-2.2
Randolph	7,200	7,045	100	1.7	2.75	2.82	19,900	20,075	-200	-0.8
Russell	17,400	16,252	1,100	6.8	2.74	2.89	47,800	47,356	500	1.0
St. Clair	15,600	13,850	1,700	12.5	2.85	2.95	45,800	41,205	4,600	11.0
Shelby	27,300	21,817	5,500	25.3	2.79	2.96	77,900	66,298	11,600	17.5
Sumter	5,100	5,253	-200	-3.3	3.08	3.12	16,300	16,908	-600	-3.7
Talladega	26,100	24,061	2,000	8.4	2.84	3.00	76,000	73,826	2,200	3.0
Tallapoosa	14,100	13,275	800	5.9	2.70	2.86	38,700	38,676	-	-
Tuscaloosa	50,000	46,820	3,200	6.8	2.61	2.74	139,500	137,541	1,900	1.4
Walker	24,300	23,817	500	2.0	2.73	2.86	67,100	68,660	-1,600	-2.3
Washington	5,300	5,272	100	1.3	3.14	3.19	16,800	16,821	-100	-0.3
Wilcox	4,500	4,362	100	2.4	3.13	3.36	14,100	14,755	-700	-4.5
Winston	8,000	7,718	300	3.4	2.69	2.82	21,700	21,953	-200	-1.1
Alaska	175,000	131,463	44,000	33.3	2.87	2.93	522,000	401,851	121,000	30.0
Aleutian Islands Census Area	1,600	1,598	-	-3.0	3.07	3.27	7,200	7,768	-600	-7.5
Anchorage Borough	83,200	60,470	22,800	37.7	2.73	2.80	232,300	174,431	57,900	33.2
Bethel Census Area	2,900	2,684	200	8.7	4.02	4.05	11,900	10,999	900	7.9
Bristol Bay Borough	300	246	100	34.7	2.85	3.07	1,200	1,094	100	9.5
Dillingham Census Area	1,400	1,214	200	19.1	3.66	3.80	5,300	4,616	700	14.8
Fairbanks North Star Borough	22,400	18,224	4,200	23.0	2.78	2.78	66,100	53,983	12,100	22.5
Haines Borough	600	572	-	3.7	2.89	2.93	1,700	1,680	-	2.4
Juneau Borough	9,000	7,035	2,000	28.2	2.72	2.74	24,900	19,528	5,400	27.7
Kenai Peninsula Borough	14,300	8,546	5,800	67.3	2.86	2.92	41,300	25,282	16,000	63.2
Ketchikan Gateway Borough	4,500	3,985	500	13.2	2.66	2.76	12,200	11,316	900	8.1
Kobuk Census Area	1,300	1,140	100	12.4	4.16	4.20	5,400	4,831	600	11.6
Kodiak Island Borough	4,100	3,027	1,100	35.9	2.97	3.06	13,700	9,939	3,800	38.0
Matanuska-Susitna Borough	11,500	5,699	5,800	101.2	3.07	3.06	36,100	17,816	18,300	102.8
Nome Census Area	1,900	1,741	200	11.6	3.68	3.70	7,300	6,537	700	11.0
North Slope Borough	1,100	980	100	13.6	3.93	3.91	4,800	4,199	600	14.7
Prince of Wales-Outer Ketchikan Census Area	1,400	1,121	300	27.3	3.21	3.25	4,800	3,822	1,000	26.0
Sitka Borough	2,400	2,440	-100	-2.8	3.05	3.05	7,700	7,803	-100	-1.8
Skagway-Yakutat-Angoon Census Area	1,100	1,087	-	-1.4	3.09	3.11	3,400	3,478	-100	-2.0
Southeast Fairbanks Census Area	1,900	1,666	200	12.2	3.23	3.17	6,500	5,676	800	14.3
Valdez-Cordova Census Area	2,800	2,689	100	3.9	2.81	2.84	8,600	8,348	300	3.2
Wade Hampton Census Area	900	947	-	-1.9	5.03	4.87	4,700	4,665	100	1.3
Wrangell-Petersburg Census Area	2,100	2,072	-	2.0	2.88	2.89	6,300	6,167	100	1.6
Yukon-Koyukuk Census Area	2,400	2,280	200	7.1	3.29	3.18	9,000	7,873	1,100	14.0
Arizona	1,176,000	957,032	219,000	22.9	2.63	2.79	3,153,000	2,718,215	435,000	16.0
Apache	14,900	12,638	2,300	17.8	3.85	4.09	57,700	52,108	5,600	10.8
Cochise	32,700	28,977	3,800	13.0	2.76	2.86	93,500	85,686	7,800	9.1
Coconino	26,400	21,890	4,500	20.7	2.99	3.15	84,400	75,008	9,400	12.5
Gila	14,200	12,847	1,300	10.5	2.71	2.87	38,800	37,080	1,700	4.5

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Connecticut—Continued										
New Haven	287,400	271,542	15,900	5.9	2.61	2.72	773,200	761,337	11,900	1.6
New London	89,100	81,814	7,300	8.9	2.62	2.78	245,500	238,409	7,000	3.0
Tolland	39,900	36,269	3,600	9.9	2.72	2.86	119,900	114,823	5,100	4.4
Windham	34,900	32,209	2,700	8.5	2.66	2.78	96,000	92,312	3,700	4.0
Delaware	227,000	207,081	20,000	9.5	2.67	2.79	622,000	594,338	28,000	4.7
Kent	35,800	32,737	3,000	9.3	2.78	2.88	103,000	98,219	4,800	4.9
New Castle	151,000	138,944	12,100	8.7	2.66	2.79	412,400	398,115	14,300	3.6
Sussex	39,800	35,400	4,400	12.5	2.64	2.72	106,700	98,004	8,600	8.8
District of Columbia	250,000	253,143	-3,000	-1.2	2.35	2.40	623,000	638,333	-15,000	-2.4
Florida	4,501,000	3,744,254	756,000	20.2	2.47	2.55	11,365,000	9,746,324	1,618,000	16.6
Alachua	65,200	54,607	10,600	19.5	2.52	2.60	173,700	151,348	22,300	14.8
Baker	5,000	4,243	800	18.0	3.10	3.22	17,300	15,289	2,000	13.1
Bay	42,700	34,754	7,900	22.8	2.64	2.76	114,600	97,740	16,900	17.3
Bradford	6,800	6,297	500	8.7	2.94	2.87	23,900	20,023	3,900	19.3
Brevard	135,400	101,783	33,600	33.0	2.53	2.64	347,600	272,959	74,600	27.3
Broward	475,800	417,517	58,300	14.0	2.34	2.42	1,120,200	1,018,200	102,000	10.0
Calhoun	3,500	3,221	300	8.6	2.72	2.84	9,700	9,294	400	4.1
Charlotte	36,000	25,922	10,100	38.9	2.20	2.25	79,500	58,460	21,000	35.9
Citrus	33,200	22,985	10,300	44.6	2.31	2.36	77,500	54,703	22,800	41.8
Clay	29,200	21,646	7,600	34.9	2.96	3.06	87,600	67,052	20,500	30.6
Collier	48,500	33,966	14,500	42.8	2.37	2.49	117,100	85,971	31,100	36.2
Columbia	14,100	12,183	1,900	16.0	2.81	2.87	40,200	35,399	4,800	13.6
Dade	659,400	609,830	49,600	8.1	2.61	2.63	1,744,500	1,625,~~781~~509	118,700	7.3
De Soto	7,300	6,256	1,100	17.1	2.68	2.76	21,400	19,039	2,400	12.4
Dixie	3,100	2,663	400	15.8	2.71	2.76	9,300	7,751	1,500	19.6
Duval	234,700	208,351	26,300	12.6	2.60	2.69	630,100	571,003	59,100	10.3
Escambia	94,600	81,067	13,500	16.7	2.70	2.79	262,900	233,794	29,100	12.5
Flagler	7,200	4,359	2,900	65.7	2.33	2.49	16,900	10,913	6,000	54.9
Franklin	3,000	2,765	300	9.3	2.69	2.73	8,300	7,661	600	7.9
Gadsden	14,000	12,092	1,900	16.0	3.03	3.24	44,400	41,~~565~~674	2,800	6.7
Gilchrist	2,500	2,006	400	22.4	2.74	2.82	7,200	5,767	1,500	25.5
Glades	2,500	2,224	300	13.2	2.69	2.69	6,800	5,992	800	13.2
Gulf	4,300	3,683	600	15.5	2.76	2.89	11,800	10,658	1,100	10.3
Hamilton	3,100	2,904	200	7.5	2.97	2.99	9,300	8,761	600	6.6
Hardee	7,100	6,253	800	13.2	2.94	3.05	21,200	~~18,379~~ 20,357	1,800	9.2
Hendry	7,400	5,959	1,400	24.3	2.93	3.06	22,600	18,599	4,000	21.6
Hernando	31,000	17,735	13,300	74.9	2.39	2.48	74,800	44,469	30,300	68.2
Highlands	24,700	18,960	5,700	30.1	2.31	2.43	58,900	47,526	11,400	23.9
Hillsborough	287,700	237,943	49,800	20.9	2.57	2.66	754,700	646,960	107,700	16.7
Holmes	5,700	5,244	500	9.5	2.75	2.79	15,900	14,723	1,200	7.8
Indian River	32,000	23,331	8,700	37.3	2.35	2.49	77,700	59,896	17,800	29.8
Jackson	14,000	13,332	600	4.8	2.77	2.76	41,400	39,154	2,200	5.7
Jefferson	3,900	3,486	400	12.1	2.93	3.04	11,600	10,703	900	8.3
Lafayette	1,500	1,413	100	5.5	2.87	2.86	4,500	4,035	400	10.9
Lake	53,300	41,650	11,700	28.1	2.36	2.47	126,200	104,870	23,300	22.2
Lee	111,000	82,509	28,500	34.5	2.38	2.46	266,800	205,266	61,600	30.0
Leon	64,100	54,103	10,000	18.5	2.50	2.57	169,800	148,655	21,100	14.2
Levy	9,300	7,267	2,000	28.1	2.57	2.70	24,200	19,870	4,300	21.7
Liberty	1,500	1,485	-	3.0	2.88	2.82	4,500	4,260	200	5.3
Madison	5,100	4,977	100	2.7	3.01	2.98	15,500	14,894	600	3.8
Manatee	74,400	61,998	12,400	20.0	2.32	2.36	174,600	148,442	26,200	17.6
Marion	64,500	45,458	19,100	42.0	2.51	2.64	164,800	122,488	42,300	34.5
Martin	34,600	25,863	8,800	33.8	2.32	2.40	82,900	64,014	18,900	29.5
Monroe	31,300	26,340	5,000	18.9	2.20	2.34	71,100	63,188	7,900	12.4

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

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State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Florida—Continued										
Nassau	13,800	10,976	2,800	25.5	2.87	2.98	39,800	32,894	7,000	21.1
Okaloosa	47,600	37,538	10,100	26.8	2.75	2.84	135,100	109,920	25,200	22.9
Okeechobee	9,600	6,981	2,600	37.4	2.68	2.85	26,000	20,264	5,800	28.5
Orange	208,000	170,754	37,200	21.8	2.59	2.67	555,000	~~471,016~~ 470,900	84,000	17.8
Osceola	29,700	18,615	11,000	59.3	2.54	2.60	76,700	49,287	27,500	55.7
Palm Beach	305,900	234,339	71,600	30.5	2.33	2.42	724,300	576,~~663~~ 759	147,500	25.6
Pasco	102,600	81,346	21,300	26.2	2.27	2.34	237,200	193,643	43,600	22.5
Pinellas	361,600	319,527	42,100	13.2	2.19	2.25	803,800	728,531	75,300	10.3
Polk	136,700	114,394	22,300	19.5	2.58	2.70	368,400	321,652	46,800	14.5
Putnam	22,200	18,397	3,800	20.5	2.62	2.72	58,700	50,549	8,100	16.1
St. Johns	25,800	18,623	7,200	38.7	2.54	2.65	67,900	51,303	16,600	32.4
St. Lucie	44,900	32,506	12,400	38.0	2.55	2.65	115,700	87,182	28,600	32.8
Santa Rosa	22,900	18,595	4,300	23.0	2.82	2.94	65,300	55,988	9,400	16.7
Sarasota	109,300	88,739	20,600	23.2	2.20	2.25	243,500	202,251	41,200	20.4
Seminole	85,000	63,247	21,700	34.4	2.70	2.82	230,900	179,752	51,200	28.5
Sumter	11,000	8,582	2,400	28.4	2.52	2.68	29,000	24,272	4,800	19.6
Suwannee	8,900	7,739	1,100	14.6	2.83	2.84	25,400	22,287	3,200	14.2
Taylor	6,700	5,826	900	15.8	2.68	2.83	18,200	16,532	1,700	10.0
Union	2,400	2,119	300	13.3	2.95	2.95	10,700	10,166	500	5.1
Volusia	130,600	105,773	24,900	23.5	2.32	2.39	310,800	258,762	52,000	20.1
Wakulla	4,500	3,730	800	21.9	2.85	2.89	13,100	10,887	2,200	20.5
Walton	9,900	8,043	1,800	22.8	2.61	2.64	25,900	21,300	4,600	21.6
Washington	5,700	5,235	500	9.2	2.74	2.75	15,800	14,509	1,300	8.8
Georgia	2,138,000	1,871,652	266,000	14.2	2.72	2.84	5,975,000	5,463,105	512,000	9.4
Appling	5,500	5,117	400	7.0	2.94	3.00	16,300	15,565	800	4.8
Atkinson	2,100	2,009	100	6.2	3.01	3.05	6,400	6,141	300	4.7
Bacon	3,200	3,116	100	3.2	2.91	2.98	9,500	9,379	100	0.8
Baker	1,300	1,208	-	4.0	2.95	3.15	3,700	3,808	-100	-2.6
Baldwin	11,400	10,151	1,300	12.5	2.76	2.88	38,100	34,686	3,400	9.8
Banks	3,500	3,034	400	14.7	2.84	2.86	9,900	8,702	1,200	13.8
Barrow	8,700	7,314	1,400	18.5	2.89	2.90	25,200	21,354	3,900	18.1
Bartow	16,100	13,804	2,300	16.9	2.82	2.94	45,600	40,760	4,800	11.9
Ben Hill	6,400	5,670	800	13.3	2.63	2.76	17,300	16,000	1,300	8.2
Berrien	5,100	4,653	400	8.8	2.73	2.89	13,900	13,525	400	2.8
Bibb	57,100	52,580	4,500	8.6	2.66	2.78	156,200	150,256	6,000	4.0
Bleckley	3,800	3,552	200	6.9	2.66	2.84	10,600	10,767	-100	-1.3
Brantley	3,300	2,784	500	18.4	2.95	3.13	9,700	8,701	1,000	11.9
Brooks	5,200	4,990	200	3.4	2.86	3.01	15,000	15,255	-200	-1.4
Bryan	4,000	3,214	800	25.1	3.05	3.17	12,300	10,175	2,100	20.4
Bulloch	12,500	11,339	1,200	10.1	2.74	2.86	37,400	35,785	1,600	4.4
Burke	6,700	6,212	500	7.7	3.06	3.09	20,600	19,349	1,300	6.7
Butts	4,400	3,987	400	9.2	3.02	3.09	15,100	13,665	1,400	10.3
Calhoun	1,900	1,833	100	5.4	2.85	3.07	5,600	5,717	-100	-2.1
Camden	5,800	4,388	1,400	32.3	3.03	3.00	17,900	13,371	4,500	33.9
Candler	2,600	2,527	100	4.8	2.80	2.86	7,700	7,518	200	2.5
Carroll	22,200	19,002	3,200	16.9	2.72	2.86	63,300	56,346	6,900	12.3
Catoosa	14,100	12,648	1,400	11.3	2.76	2.92	38,900	36,991	2,000	5.3
Charlton	2,400	2,226	200	9.2	3.06	3.26	7,500	7,343	200	2.6
Chatham	79,100	71,323	7,700	10.9	2.66	2.78	215,700	202,226	13,400	6.6
Chattahoochee	3,300	3,012	300	9.7	3.36	3.71	20,700	21,732	-1,000	-4.7
Chattooga	8,000	7,733	300	3.4	2.65	2.81	21,300	21,856	-600	-2.5
Cherokee	22,800	16,848	5,900	35.1	2.97	3.04	68,100	51,699	16,400	31.8
Clarke	29,300	26,587	2,700	10.3	2.35	2.49	77,600	74,498	3,100	4.2
Clay	1,100	1,193	-100	-4.9	2.88	2.94	3,300	3,553	-200	-6.9

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Georgia—Continued										
Clayton	60,400	50,449	10,000	19.7	2.76	2.97	167,300	150,357	16,900	11.2
Clinch	2,300	2,120	100	6.5	2.96	3.10	6,800	6,660	100	2.0
Cobb	141,600	106,595	35,000	32.8	2.62	2.77	373,100	297,718	75,400	25.3
Coffee	10,200	8,905	1,300	14.3	2.80	2.96	28,900	26,894	2,000	7.5
Colquitt	12,900	12,152	700	6.0	2.79	2.88	36,200	35,376	800	2.4
Columbia	17,500	12,834	4,600	36.2	3.01	3.12	52,700	40,118	12,600	31.5
Cook	4,700	4,476	200	4.3	2.95	2.99	13,900	13,490	400	2.8
Coweta	15,700	13,307	2,400	17.7	2.85	2.93	45,000	39,268	5,700	14.5
Crawford	2,400	2,357	100	3.0	3.04	3.21	7,500	7,684	-200	-2.4
Crisp	7,000	6,559	400	6.2	2.87	2.93	20,300	19,489	800	4.0
Dade	3,900	3,998	-100	-2.8	2.87	2.98	11,600	12,318	-700	-5.6
Dawson	2,200	1,663	500	31.4	2.85	2.86	6,200	4,774	1,500	30.8
Decatur	9,000	8,315	700	8.7	2.91	3.03	26,700	25,495	1,200	4.6
De Kalb	196,200	172,922	23,200	13.4	2.60	2.75	519,100	483,024	36,000	7.5
Dodge	5,900	5,867	-	-0.2	2.78	2.86	17,000	16,955	100	0.3
Dooly	3,400	3,529	-100	-4.2	3.03	3.03	10,400	10,826	-500	-4.3
Dougherty	35,400	33,043	2,300	7.0	2.85	2.97	103,500	100,718	2,800	2.8
Douglas	21,200	16,911	4,300	25.2	3.06	3.20	65,300	54,573	10,700	19.7
Early	4,300	4,303	-	0.3	2.98	3.04	12,900	13,158	-200	-1.6
Echols	800	735	100	10.7	2.94	3.13	2,400	2,297	100	4.2
Effingham	6,900	5,787	1,200	20.1	3.04	3.15	21,300	18,327	2,900	16.0
Elbert	6,900	6,554	300	5.0	2.72	2.83	18,900	18,758	200	0.9
Emanuel	7,200	6,991	200	3.5	2.91	2.93	21,400	20,795	600	2.8
Evans	2,900	2,859	100	3.1	2.77	2.92	8,300	8,428	-200	-2.0
Fannin	6,000	5,522	500	9.3	2.55	2.65	15,500	14,748	700	5.0
Fayette	13,900	9,208	4,700	51.2	3.10	3.15	43,200	29,043	14,200	48.8
Floyd	29,500	28,477	1,100	3.7	2.59	2.73	78,500	79,800	-1,300	-1.6
Forsyth	12,500	9,395	3,100	32.9	2.81	2.97	35,100	27,958	7,200	25.6
Franklin	5,800	5,363	400	8.0	2.67	2.78	15,800	15,185	600	3.8
Fulton	243,600	225,308	18,300	8.1	2.45	2.54	617,100	589,904	27,200	4.6
Gilmer	4,500	3,937	500	13.1	2.65	2.77	12,000	11,110	900	8.2
Glascock	800	836	-	-	2.75	2.72	2,400	2,382	-	1.0
Glynn	21,900	19,826	2,000	10.3	2.67	2.73	59,100	54,981	4,100	7.5
Gordon	11,600	10,280	1,300	13.0	2.83	2.91	33,000	30,070	2,900	9.7
Grady	7,300	6,620	700	10.4	2.87	2.97	21,100	19,845	1,300	6.6
Greene	4,000	3,757	300	7.7	2.93	3.01	11,900	11,391	600	4.9
Gwinnett	88,700	55,227	33,500	60.7	2.83	3.00	252,800	166,903	85,900	51.4
Habersham	9,200	8,396	800	10.0	2.69	2.79	26,800	25,020	1,800	7.2
Hall	30,600	26,071	4,500	17.3	2.72	2.86	84,400	75,649	8,700	11.5
Hancock	2,900	2,791	100	4.8	3.20	3.34	9,500	9,466	100	0.6
Haralson	7,400	6,504	900	14.0	2.65	2.79	20,000	18,422	1,500	8.3
Harris	6,100	5,236	900	17.0	2.76	2.92	17,100	15,464	1,600	10.6
Hart	6,900	6,286	600	9.8	2.77	2.91	19,400	18,585	800	4.3
Heard	2,400	2,204	200	9.3	2.83	2.93	6,900	6,520	400	5.9
Henry	14,800	11,630	3,100	26.8	2.97	3.09	44,300	36,309	8,000	22.0
Houston	29,300	25,509	3,800	14.7	2.86	2.99	85,300	77,605	7,700	9.9
Irwin	2,900	3,013	-100	-2.4	2.95	2.94	8,800	8,988	-200	-2.1
Jackson	10,000	8,619	1,400	15.8	2.74	2.91	27,700	25,343	2,400	9.3
Jasper	2,800	2,553	300	9.8	2.68	2.93	7,600	7,553	-	0.5
Jeff Davis	4,000	3,771	200	5.7	2.96	3.03	11,900	11,473	400	3.5
Jefferson	6,400	5,946	400	7.6	2.89	3.05	18,600	18,403	400	2.1
Jenkins	2,900	2,906	-	-0.8	2.87	2.99	8,400	8,841	-400	-4.7
Johnson	3,000	2,955	100	2.3	2.89	2.88	8,900	8,660	200	2.9
Jones	6,200	5,270	900	16.9	2.99	3.11	18,700	16,579	2,100	12.5
Lamar	4,300	4,010	300	6.8	2.82	2.98	12,300	12,215	100	0.9

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Georgia—Continued										
Lanier	1,900	1,822	100	3.3	3.05	3.07	5,800	5,654	200	2.7
Laurens	13,400	12,447	1,000	7.9	2.78	2.90	38,300	36,990	1,300	3.5
Lee	4,500	3,642	800	23.1	3.00	3.14	14,100	11,684	2,400	20.6
Liberty	11,300	9,629	1,700	17.2	3.16	3.12	42,100	37,583	4,500	12.1
Lincoln	2,400	2,185	200	11.0	2.90	3.07	7,000	6,716	300	4.8
Long	2,000	1,536	500	29.6	2.86	2.94	5,700	4,524	1,200	26.1
Lowndes	25,600	22,609	3,000	13.2	2.73	2.89	72,900	67,972	4,900	7.3
Lumpkin	3,900	3,388	500	14.0	2.80	2.86	12,000	10,762	1,200	11.3
McDuffie	7,100	6,270	800	13.5	2.76	2.93	19,900	18,546	1,400	7.3
McIntosh	2,700	2,630	-	1.2	3.02	3.06	8,000	8,046	-	-0.2
Macon	4,500	4,371	200	3.6	3.07	3.13	14,200	14,003	200	1.6
Madison	6,800	6,125	700	11.1	2.83	2.90	19,300	17,747	1,600	8.7
Marion	1,800	1,687	100	4.5	3.09	3.11	5,500	5,297	200	4.0
Meriwether	6,800	6,877	-100	-1.0	3.01	3.04	20,800	21,229	-400	-2.1
Miller	2,400	2,405	-	-1.4	2.86	2.91	6,800	7,038	-200	-3.1
Mitchell	6,800	6,486	300	4.4	3.16	3.23	21,500	21,114	400	2.0
Monroe	5,200	4,667	500	11.0	2.92	3.00	15,600	14,610	1,000	6.6
Montgomery	2,300	2,214	100	3.4	2.73	2.89	7,100	7,011	100	1.0
Morgan	4,100	3,663	400	10.6	3.03	3.13	12,400	11,572	800	7.2
Murray	7,400	6,539	800	12.6	2.96	3.01	21,800	19,685	2,100	10.9
Muscogee	65,700	59,112	6,600	11.1	2.63	2.76	179,100	170,108	9,000	5.3
Newton	12,900	10,976	2,000	17.9	2.99	3.09	39,300	34,~~489~~ 566	4,800	13.9
Oconee	5,200	4,237	1,000	23.7	2.82	2.93	14,800	12,427	2,300	18.8
Oglethorpe	3,300	2,947	300	10.4	2.91	3.03	9,500	8,929	500	5.9
Paulding	10,700	8,745	1,900	22.3	2.86	2.97	30,700	26,110	4,600	17.6
Peach	6,500	6,180	300	5.5	2.86	2.97	19,600	19,151	500	2.5
Pickens	4,800	4,161	700	16.3	2.72	2.78	13,300	11,652	1,600	14.0
Pierce	4,400	3,928	400	11.2	2.90	3.01	12,700	11,897	800	7.1
Pike	3,000	2,842	200	6.4	2.94	3.09	9,000	8,937	100	1.2
Polk	12,400	11,413	1,000	8.8	2.67	2.80	33,600	32,386	1,200	3.8
Pulaski	3,100	3,067	100	1.8	2.79	2.88	8,800	8,950	-100	-1.5
Putnam	4,100	3,398	700	21.1	2.77	2.96	11,700	10,295	1,400	13.6
Quitman	700	772	- -	-4.8	3.06	3.05	2,200	2,357	-100	-4.7
Rabun	4,200	3,891	300	8.4	2.58	2.68	10,900	10,466	500	4.5
Randolph	3,100	3,126	-	0.6	2.83	2.96	9,200	9,599	-400	-4.1
Richmond	66,500	59,501	7,000	11.7	2.69	2.81	191,800	181,629	10,200	5.6
Rockdale	14,800	11,592	3,200	27.3	2.97	3.15	44,200	36,~~747~~ 570	7,400	20.2
Schley	1,100	1,125	-	-3.0	3.08	3.05	3,400	3,433	-100	-2.2
Screven	5,100	4,769	300	6.8	2.82	2.90	14,600	14,043	500	3.8
Seminole	3,100	3,051	100	1.9	2.81	2.92	8,900	9,057	-200	-2.0
Spalding	18,000	16,177	1,800	11.4	2.84	2.93	51,800	47,899	3,900	8.2
Stephens	8,300	7,787	500	6.3	2.63	2.72	22,400	21,763	600	2.8
Stewart	2,000	1,891	100	3.6	2.90	3.10	5,700	5,896	-200	-3.2
Sumter	10,400	9,465	900	9.7	2.74	2.94	30,200	29,360	800	2.8
Talbot	2,200	2,086	100	3.1	3.07	3.13	6,600	6,536	100	1.1
Taliaferro	800	758	-	2.7	2.62	2.68	2,000	2,032	-	0.4
Tattnall	5,900	5,590	400	6.3	2.79	2.84	18,000	18,134	-100	-0.7
Taylor	2,900	2,653	300	9.8	2.74	2.98	8,000	7,902	100	1.1
Telfair	4,100	3,907	200	5.6	2.66	2.87	11,200	11,445	-200	-2.0
Terrell	3,900	3,839	100	1.8	2.95	3.09	11,700	12,017	-300	-2.7
Thomas	13,500	12,789	700	5.6	2.76	2.92	38,100	38,098	-	0.1
Tift	12,000	10,737	1,300	11.9	2.74	2.93	34,100	32,862	1,200	3.7
Toombs	8,400	7,672	700	9.6	2.79	2.90	23,900	22,592	1,300	5.6
Towns	2,300	2,024	300	15.6	2.48	2.57	6,100	5,638	500	8.6
Treutlen	2,200	2,073	100	5.9	2.72	2.91	6,000	6,087	-100	-0.9
Troup	19,300	17,455	1,900	10.8	2.74	2.81	53,900	50,003	3,900	7.7

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Georgia—Continued										
Turner	3,100	3,078	-	-0.1	3.05	3.06	9,500	9,510	-100	-0.5
Twiggs	3,200	2,812	400	15.6	3.10	3.28	10,200	9,354	800	9.0
Union	3,900	3,369	500	15.0	2.69	2.76	10,500	9,390	1,200	12.3
Upson	9,700	9,170	500	5.6	2.68	2.80	26,300	25,998	300	1.2
Walker	20,600	19,634	900	4.7	2.72	2.86	56,200	56,470	-300	-0.5
Walton	11,000	10,006	1,000	10.0	2.96	3.09	32,800	31,211	1,600	5.2
Ware	13,300	12,788	500	4.1	2.73	2.85	37,200	37,180	-	-0.1
Warren	2,000	2,110	-100	-5.8	3.09	3.07	6,200	6,583	-300	-5.2
Washington	6,400	6,076	300	5.6	2.99	3.07	19,400	18,842	500	2.9
Wayne	7,600	6,879	800	11.2	2.80	2.95	21,900	20,750	1,200	5.7
Webster	700	756	-	-6.1	3.03	3.10	2,200	2,341	-200	-8.0
Wheeler	1,700	1,733	-	-1.3	2.97	2.94	5,100	5,155	-	-0.3
White	4,200	3,499	700	20.9	2.60	2.77	11,400	10,120	1,300	12.4
Whitfield	24,700	22,466	2,200	9.8	2.76	2.91	68,500	65,789	2,800	4.2
Wilcox	2,600	2,596	-	1.0	2.78	2.87	7,500	7,682	-200	-2.1
Wilkes	4,100	3,880	200	5.0	2.73	2.80	11,200	10,951	200	2.2
Wilkinson	3,600	3,350	300	7.7	2.98	3.09	10,800	10,368	400	3.8
Worth	6,000	5,811	200	3.5	3.04	3.08	18,400	18,064	400	2.0
Hawaii	330,000	294,052	36,000	12.4	3.06	3.15	1,051,000	964,691	87,000	9.0
Hawaii	34,900	29,237	5,700	19.4	3.08	3.09	109,500	92,053	17,500	19.0
Honolulu	253,400	230,214	23,200	10.1	3.06	3.15	811,100	762,565	48,500	6.4
Kauai	14,300	12,020	2,300	18.9	3.14	3.22	45,400	39,082	6,300	16.1
Maui	27,700	22,581	5,200	22.8	3.04	3.10	85,500	70,991	14,500	20.4
Idaho	354,000	324,107	30,000	9.2	2.78	2.85	1,004,000	943,935	60,000	6.4
Ada	71,300	63,139	8,100	12.9	2.65	2.69	192,400	173,036	19,400	11.2
Adams	1,200	1,212	-	-2.0	2.83	2.75	3,400	3,347	-	0.6
Bannock	24,300	22,489	1,800	8.1	2.77	2.85	68,800	65,421	3,400	5.2
Bear Lake	2,100	2,211	-100	-5.5	3.20	3.12	6,700	6,931	-200	-2.9
Benewah	3,100	2,932	200	6.5	2.74	2.81	8,600	8,292	300	3.8
Bingham	11,300	10,772	600	5.2	3.35	3.35	38,300	36,489	1,800	5.1
Blaine	5,500	3,978	1,500	38.9	2.34	2.44	13,100	9,841	3,300	33.5
Boise	1,200	1,107	100	9.9	2.53	2.71	3,100	2,999	100	2.6
Bonner	9,700	8,814	800	9.6	2.68	2.73	26,000	24,163	1,800	7.4
Bonneville	23,600	21,307	2,300	10.9	2.95	3.08	70,200	65,980	4,300	6.5
Boundary	2,600	2,479	200	6.3	2.89	2.92	7,700	7,289	400	5.5
Butte	1,100	1,072	-	-0.9	2.94	3.04	3,200	3,342	-100	-4.2
Camas	300	291	-	-11.7	2.69	2.81	700	818	-100	-15.6
Canyon	31,500	28,458	3,000	10.7	2.76	2.86	89,300	83,756	5,600	6.7
Caribou	2,500	2,674	-100	-5.1	3.28	3.22	8,400	8,695	-300	-3.3
Cassia	6,800	6,119	700	10.9	3.03	3.16	20,700	19,427	1,200	6.3
Clark	300	262	-	2.6	2.75	2.99	800	798	-	-5.1
Clearwater	3,600	3,636	-	-0.8	2.69	2.81	10,000	10,390	-400	-4.2
Custer	1,900	1,237	700	56.9	2.68	2.73	5,200	3,385	1,800	54.3
Elmore	7,500	6,832	700	9.6	2.75	2.92	22,300	21,565	700	3.2
Franklin	2,800	2,662	100	4.0	3.42	3.33	9,500	8,895	600	6.7
Fremont	3,200	3,277	-100	-2.6	3.22	3.23	10,500	10,813	-300	-2.9
Gem	4,200	4,219	-	0.3	2.71	2.81	11,600	11,972	-400	-3.1
Gooding	4,300	4,143	200	4.4	2.70	2.77	12,100	11,874	200	2.0
Idaho	5,200	5,150	100	1.5	2.67	2.80	14,300	14,769	-500	-3.1
Jefferson	5,000	4,437	500	11.6	3.28	3.43	16,300	15,304	1,000	6.6
Jerome	5,200	5,084	100	2.1	2.93	2.90	15,300	14,840	500	3.3
Kootenai	24,600	21,404	3,200	15.0	2.68	2.76	66,800	59,770	7,000	11.8
Latah	11,900	10,256	1,600	15.6	2.40	2.52	31,100	28,749	2,300	8.0
Lemhi	2,800	2,681	100	4.4	2.64	2.76	7,500	7,460	-	-0.1

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Kansas—Continued										
Rawlins	1,400	1,573	-100	-8.7	2.62	2.56	3,800	4,105	-300	-6.3
Reno	24,900	24,448	400	1.8	2.54	2.58	65,100	64,983	100	0.2
Republic	3,000	3,116	-100	-3.7	2.35	2.37	7,200	7,569	-300	-4.6
Rice	4,500	4,525	-	-0.8	2.42	2.50	11,300	11,900	-600	-4.6
Riley	21,600	19,269	2,400	12.3	2.40	2.59	64,200	63,505	700	1.2
Rooks	2,600	2,698	-100	-2.8	2.59	2.56	6,900	7,006	-100	-1.8
Rush	1,800	1,827	-	-1.1	2.34	2.43	4,300	4,516	-200	-4.7
Russell	3,600	3,612	-	0.7	2.40	2.41	8,900	8,868	-	0.1
Saline	19,700	18,613	1,000	5.6	2.50	2.57	50,100	48,905	1,200	2.4
Scott	2,200	2,074	100	4.6	2.63	2.75	5,800	5,782	-	0.2
Sedgwick	148,800	137,744	11,100	8.0	2.56	2.62	387,200	366,531	20,700	5.7
Seward	6,900	6,125	700	11.9	2.68	2.75	18,700	17,071	1,600	9.5
Shawnee	63,000	58,832	4,200	7.1	2.46	2.55	159,700	154,916	4,800	3.1
Sheridan	1,200	1,259	-100	-4.6	2.81	2.79	3,400	3,544	-100	-4.0
Sherman	2,900	2,861	100	2.2	2.45	2.65	7,400	7,759	-400	-5.2
Smith	2,300	2,400	-100	-3.8	2.36	2.42	5,600	5,947	-400	-6.1
Stafford	2,300	2,307	-	1.0	2.39	2.39	5,700	5,694	-	0.8
Stanton	900	794	100	10.1	2.70	2.91	2,400	2,339	-	2.1
Stevens	1,700	1,694	-	1.0	2.78	2.76	4,800	4,736	100	1.8
Sumner	9,600	9,413	200	2.4	2.56	2.60	25,200	24,928	300	1.0
Thomas	3,200	3,072	100	4.8	2.62	2.64	8,800	8,451	300	3.9
Trego	1,600	1,596	-	0.5	2.58	2.57	4,200	4,165	-	1.0
Wabaunsee	2,500	2,487	100	2.3	2.61	2.70	6,800	6,867	-100	-0.8
Wallace	700	740	-	-4.3	2.77	2.73	2,000	2,045	-100	-2.7
Washington	3,000	3,270	-200	-7.2	2.52	2.56	7,800	8,543	-700	-8.7
Wichita	1,100	1,050	-	1.1	2.66	2.87	2,900	3,041	-200	-6.1
Wilson	4,700	4,773	-	-1.0	2.45	2.51	11,700	12,128	-400	-3.3
Woodson	1,800	1,832	-100	-2.9	2.40	2.42	4,400	4,600	-200	-3.6
Wyandotte	65,400	63,392	2,000	3.2	2.63	2.69	173,800	172,335	1,400	0.8
Kentucky	1,344,000	1,263,355	81,000	6.4	2.70	2.82	3,729,000	3,660,777	68,000	1.9
Adair	5,800	5,442	300	6.0	2.71	2.76	15,900	15,233	700	4.6
Allen	5,500	5,165	300	6.3	2.63	2.70	14,600	14,128	500	3.5
Anderson	5,000	4,414	600	14.3	2.66	2.83	13,500	12,567	900	7.4
Ballard	3,100	3,267	-100	-3.8	2.59	2.66	8,300	8,798	-500	-6.2
Barren	12,900	12,267	600	4.8	2.62	2.73	34,300	34,009	200	0.7
Bath	3,600	3,436	200	5.6	2.77	2.88	10,200	10,025	100	1.4
Bell	12,000	11,407	600	5.3	2.82	2.97	34,300	34,330	-	-0.1
Boone	17,200	14,848	2,300	15.8	2.96	3.07	51,300	45,842	5,400	11.8
Bourbon	6,800	6,814	-	0.4	2.79	2.83	19,300	19,405	-100	-0.7
Boyd	20,100	19,960	100	0.5	2.62	2.73	53,700	55,513	-1,900	-3.3
Boyle	9,300	8,816	500	5.9	2.57	2.68	25,400	25,066	300	1.2
Bracken	2,900	2,707	100	5.4	2.63	2.83	7,600	7,738	-200	-2.0
Breathitt	5,200	5,211	-	0.7	3.05	3.18	16,500	17,004	-500	-3.0
Breckinridge	6,200	5,881	300	5.8	2.70	2.85	16,900	16,861	100	0.3
Bullitt	14,700	12,944	1,700	13.4	3.11	3.34	45,700	43,346	2,400	5.5
Butler	4,000	3,839	200	4.0	2.76	2.82	11,300	11,064	200	1.7
Caldwell	5,100	5,041	100	1.8	2.55	2.63	13,400	13,473	-100	-0.8
Calloway	10,700	10,766	-	-0.4	2.39	2.48	28,900	30,031	-1,100	-3.7
Campbell	29,200	28,618	600	1.9	2.75	2.87	81,800	83,317	-1,500	-1.8
Carlisle	1,900	2,058	-100	-7.2	2.65	2.66	5,100	5,487	-400	-7.7
Carroll	3,600	3,377	200	6.0	2.66	2.71	9,700	9,270	400	4.3
Carter	8,800	8,214	600	6.7	2.92	3.02	25,800	25,060	700	2.9
Casey	5,400	5,159	200	4.5	2.79	2.87	15,100	14,818	200	1.6
Christian	20,800	19,646	1,200	6.0	2.67	2.95	64,100	66,878	-2,800	-4.1
Clark	10,500	9,893	600	6.4	2.74	2.84	29,000	28,322	700	2.6

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Kentucky—Continued										
Clay	7,400	6,821	600	9.0	3.14	3.31	23,600	22,752	900	3.9
Clinton	3,600	3,259	300	9.5	2.75	2.86	9,800	9,321	500	5.5
Crittenden	3,500	3,466	-	1.3	2.53	2.63	9,000	9,207	-200	-2.4
Cumberland	2,700	2,671	100	2.3	2.72	2.70	7,500	7,289	200	3.0
Daviess	32,600	30,208	2,300	7.8	2.65	2.79	87,800	85,949	1,800	2.1
Edmonson	4,000	3,357	600	19.2	2.79	2.92	11,300	9,962	1,400	13.7
Elliott	2,200	2,223	-	0.9	3.00	3.11	6,700	6,908	-200	-2.6
Estill	5,200	4,896	300	6.7	2.86	2.94	15,000	14,495	600	3.8
Fayette	83,600	75,440	8,200	10.8	2.40	2.56	212,100	204,165	7,900	3.9
Fleming	4,600	4,311	200	5.7	2.70	2.83	12,400	12,323	100	0.9
Floyd	17,200	15,973	1,200	7.8	2.94	3.04	50,800	48,764	2,100	4.2
Franklin	17,100	15,681	1,400	9.2	2.48	2.58	43,900	41,830	2,100	4.9
Fulton	3,100	3,384	-300	-8.2	2.57	2.61	8,100	8,971	-900	-9.7
Gallatin	1,600	1,649	-	-0.1	2.96	2.93	4,900	4,842	-	0.9
Garrard	4,200	3,940	300	6.6	2.74	2.73	11,600	10,853	700	6.9
Grant	4,700	4,422	300	7.0	2.93	2.97	14,100	13,308	800	5.9
Graves	12,800	12,775	100	0.4	2.53	2.63	32,900	34,049	-1,100	-3.3
Grayson	7,600	7,228	300	4.6	2.82	2.86	21,500	20,854	700	3.1
Green	4,100	3,982	100	1.8	2.64	2.73	10,900	11,043	-200	-1.6
Greenup	13,100	12,926	200	1.4	2.90	3.01	38,200	39,132	-900	-2.3
Hancock	2,800	2,552	200	8.3	2.89	3.00	8,100	7,742	300	4.1
Hardin	27,600	24,610	3,000	12.3	2.79	2.98	92,300	88,917	3,400	3.8
Harlan	14,300	13,849	500	3.3	2.94	3.01	42,400	41,889	500	1.1
Harrison	5,900	5,461	500	8.4	2.61	2.74	15,700	15,166	500	3.3
Hart	5,900	5,435	500	9.2	2.75	2.83	16,400	15,402	1,000	6.3
Henderson	15,800	14,688	1,100	7.3	2.66	2.75	42,500	40,849	1,600	4.0
Henry	4,900	4,564	400	7.8	2.69	2.77	13,300	12,740	600	4.7
Hickman	2,200	2,229	-	-1.3	2.56	2.67	5,700	6,065	-300	-5.3
Hopkins	17,500	16,552	900	5.7	2.62	2.74	46,700	46,174	500	1.1
Jackson	4,200	4,029	100	3.6	2.99	2.97	12,500	11,996	500	3.9
Jefferson	264,000	250,569	13,400	5.4	2.55	2.69	683,600	~~685,004~~ 684,638	-1,400	-0.2
Jessamine	9,900	8,413	1,500	17.8	2.77	2.95	28,600	26,146	2,400	9.4
Johnson	8,800	8,195	600	7.5	2.88	2.94	25,700	24,432	1,300	5.2
Kenton	50,500	48,062	2,400	5.1	2.68	2.82	137,000	137,058	-100	-
Knott	5,700	5,461	200	4.2	3.17	3.23	18,400	17,940	500	2.6
Knox	10,300	9,945	400	4.1	2.89	3.01	30,200	30,239	-	-0.1
Larue	4,500	4,268	200	4.5	2.77	2.78	12,400	11,922	500	4.3
Laurel	14,300	12,817	1,500	11.6	2.89	3.02	41,800	38,982	2,800	7.2
Lawrence	4,900	4,662	200	4.1	3.01	3.01	14,700	14,121	600	4.2
Lee	2,800	2,632	200	6.4	2.82	2.91	8,000	7,754	200	3.1
Leslie	4,900	4,569	400	7.8	3.10	3.25	15,300	14,882	400	3.0
Letcher	10,000	10,007	-	-0.1	3.01	3.06	30,200	30,687	-500	-1.5
Lewis	4,800	4,669	100	2.2	2.97	3.09	14,300	14,545	-300	-1.7
Lincoln	6,800	6,521	200	3.6	2.83	2.91	19,200	19,053	100	0.7
Livingston	3,600	3,418	200	6.2	2.48	2.67	9,100	9,219	-100	-1.3
Logan	9,400	8,548	900	10.1	2.72	2.80	25,800	24,138	1,700	7.0
Lyon	2,200	2,211	-	0.1	2.47	2.51	6,400	6,490	-100	-0.8
McCracken	24,100	23,459	600	2.6	2.49	2.58	60,800	61,310	-500	-0.8
McCreary	5,400	4,853	500	10.3	3.01	3.16	16,500	15,634	900	5.5
McLean	3,700	3,671	100	1.8	2.63	2.72	9,900	10,090	-100	-1.4
Madison	18,400	16,809	1,600	9.2	2.57	2.73	54,500	53,352	1,200	2.2
Magoffin	4,600	4,151	400	10.2	3.10	3.24	14,300	13,515	700	5.5
Marion	5,900	5,599	300	6.0	2.95	3.14	17,800	17,910	-100	-0.5
Marshall	9,900	9,427	500	5.1	2.57	2.68	25,900	25,637	200	0.9
Martin	4,300	4,182	100	3.4	3.30	3.33	14,300	13,925	400	2.6
Mason	6,300	6,361	-	-0.4	2.69	2.77	17,200	17,765	-600	-3.2

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Kentucky—Continued										
Meade	7,200	7,165	100	0.8	3.20	3.18	23,200	22,854	300	1.4
Menifee	1,800	1,670	100	6.6	2.92	3.02	5,300	5,117	100	2.9
Mercer	6,900	6,810	100	1.4	2.65	2.77	19,100	19,011	-	0.2
Metcalfe	3,500	3,267	200	6.3	2.81	2.88	9,800	9,484	400	3.7
Monroe	4,600	4,418	200	4.8	2.61	2.77	12,200	12,353	-100	-1.0
Montgomery	7,200	6,884	300	4.1	2.84	2.89	20,500	20,046	500	2.5
Morgan	4,100	3,996	100	1.8	2.93	2.99	12,000	12,103	-100	-0.4
Muhlenberg	11,700	11,120	600	5.5	2.66	2.83	32,000	32,238	-300	-0.8
Nelson	9,700	8,650	1,100	12.1	2.97	3.13	29,300	27,584	1,800	6.4
Nicholas	2,700	2,597	100	2.7	2.67	2.73	7,200	7,157	-	0.2
Ohio	7,700	7,585	100	1.8	2.76	2.83	21,600	21,765	-200	-0.8
Oldham	8,700	8,026	700	8.9	3.09	3.15	29,800	27,795	2,000	7.2
Owen	3,400	3,193	200	6.1	2.75	2.77	9,400	8,924	500	5.3
Owsley	1,900	1,890	-	0.9	2.91	3.02	5,600	5,709	-100	-2.5
Pendleton	3,700	3,734	-100	-1.3	2.95	2.92	10,900	10,989	-	-0.4
Perry	11,500	10,573	1,000	9.1	3.00	3.17	34,800	33,763	1,000	3.1
Pike	27,500	26,393	1,100	4.2	3.00	3.06	83,000	81,123	1,900	2.3
Powell	3,900	3,518	400	10.6	3.04	3.12	12,000	11,101	900	7.8
Pulaski	17,800	16,126	1,700	10.3	2.68	2.79	48,600	45,803	2,800	6.2
Robertson	800	808	-	-1.4	2.83	2.80	2,300	2,265	-	-0.4
Rockcastle	5,200	4,729	500	10.6	2.78	2.94	14,600	13,973	600	4.5
Rowan	6,400	5,952	500	8.0	2.60	2.72	19,300	19,049	200	1.2
Russell	5,500	4,935	600	11.6	2.71	2.76	15,000	13,708	1,300	9.7
Scott	7,700	7,268	400	5.5	2.74	2.86	21,900	21,813	100	0.5
Shelby	8,500	7,859	600	7.6	2.74	2.86	24,000	23,328	600	2.8
Simpson	5,500	5,224	200	4.6	2.74	2.79	15,100	14,673	400	2.8
Spencer	2,200	2,026	200	10.5	2.76	2.93	6,200	5,929	200	4.1
Taylor	8,100	7,559	500	6.7	2.68	2.74	22,000	21,178	800	3.9
Todd	3,900	4,133	-300	-6.7	2.78	2.85	10,800	11,874	-1,000	-8.8
Trigg	3,600	3,360	300	8.2	2.63	2.75	9,700	9,384	300	3.4
Trimble	2,200	2,124	-	1.9	2.84	2.91	6,200	6,253	-	-0.6
Union	5,800	5,399	400	8.1	2.64	2.86	17,800	17,821	-	-0.2
Warren	30,100	24,833	5,200	21.1	2.59	2.67	82,000	71,828	10,200	14.2
Washington	3,400	3,482	-100	-2.8	2.96	3.02	10,300	10,764	-500	-4.7
Wayne	6,100	5,817	300	5.1	2.86	2.90	17,700	17,022	700	3.8
Webster	5,600	5,415	200	3.2	2.63	2.71	14,900	14,832	-	0.3
Whitley	12,600	11,338	1,300	11.0	2.74	2.86	35,500	33,396	2,100	6.4
Wolfe	2,500	2,282	200	10.6	2.76	2.89	7,100	6,698	400	5.7
Woodford	6,700	5,947	800	12.9	2.73	2.93	18,700	17,778	900	5.2
Louisiana	1,557,000	1,411,788	145,000	10.3	2.82	2.91	4,486,000	4,205,900	280,000	6.7
Acadia Parish	19,400	18,117	1,300	7.0	3.04	3.08	59,600	56,427	3,100	5.6
Allen Parish	7,500	7,272	200	3.3	2.84	2.92	21,500	21,390	100	0.6
Ascension Parish	18,800	15,494	3,300	21.1	3.07	3.21	58,000	50,068	7,900	15.8
Assumption Parish	7,200	6,479	800	11.7	3.24	3.41	23,500	22,084	1,400	6.3
Avoyelles Parish	14,400	13,544	900	6.6	2.93	2.99	43,200	41,393	1,900	4.5
Beauregard Parish	10,700	9,507	1,200	12.3	2.94	3.01	32,500	29,692	2,900	9.6
Bienville Parish	6,100	5,849	300	4.3	2.74	2.79	16,800	16,387	400	2.5
Bossier Parish	31,200	26,677	4,500	16.8	2.82	2.94	90,500	80,721	9,800	12.2
Caddo Parish	100,800	90,714	10,100	11.1	2.66	2.75	272,100	252,358	19,700	7.8
Calcasieu Parish	60,200	56,395	3,800	6.7	2.85	2.93	174,300	167,223	7,000	4.2
Caldwell Parish	4,100	3,881	200	4.7	2.76	2.73	11,400	10,761	600	5.8
Cameron Parish	3,200	3,020	200	6.5	3.07	3.09	9,900	9,336	600	5.9
Catahoula Parish	4,200	4,085	100	2.4	3.01	2.97	12,700	12,287	500	3.7
Claiborne Parish	6,400	6,105	300	5.5	2.75	2.78	18,400	17,095	1,300	7.8
Concordia Parish	8,100	7,578	500	6.7	2.91	3.01	23,700	22,981	700	3.2

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Minnesota—Continued										
Winona	16,100	15,606	500	3.3	2.68	2.73	46,500	46,256	300	0.6
Wright	20,500	18,426	2,000	11.1	3.04	3.15	63,000	58,681	4,300	7.4
Yellow Medicine	4,800	4,991	-200	-3.1	2.65	2.68	13,100	13,653	-600	-4.1
Mississippi	891,000	827,169	64,000	7.7	2.86	2.97	2,614,000	2,520,638	94,000	3.7
Adams	13,900	12,806	1,100	8.3	2.81	2.94	39,400	38,035	1,400	3.6
Alcorn	12,100	11,940	100	0.9	2.70	2.75	32,700	33,036	-400	-1.2
Amite	4,600	4,365	200	4.5	2.91	3.06	13,300	13,369	-100	-0.6
Attala	6,600	6,862	-200	-3.1	2.92	2.87	19,500	19,865	-300	-1.7
Benton	2,800	2,577	200	9.0	3.06	3.16	8,600	8,153	400	5.3
Bolivar	13,900	13,571	300	2.5	3.07	3.28	44,300	45,965	-1,700	-3.6
Calhoun	5,600	5,420	200	2.9	2.76	2.86	15,500	15,664	-100	-0.9
Carroll	3,400	3,203	100	4.6	2.89	3.05	9,700	9,776	-100	-1.0
Chickasaw	6,000	5,871	100	2.0	2.97	3.02	17,900	17,853	100	0.3
Choctaw	3,000	2,997	-	1.4	2.90	2.95	8,900	8,996	-100	-0.6
Claiborne	3,400	3,574	-100	-4.1	2.96	2.99	12,100	12,279	-200	-1.4
Clarke	6,000	5,764	300	4.8	2.80	2.94	16,900	16,945	-100	-0.3
Clay	7,100	6,776	300	5.0	2.99	3.04	21,800	21,082	700	3.2
Coahoma	11,600	11,692	-100	-0.4	3.00	3.12	35,400	36,918	-1,500	-4.0
Copiah	8,900	8,520	300	3.9	2.87	2.99	26,500	26,503	-	-
Covington	5,500	5,171	400	7.2	2.93	3.06	16,300	15,927	400	2.5
De Soto	19,600	16,331	3,200	19.8	3.12	3.29	61,100	53,930	7,200	13.3
Forrest	25,200	22,978	2,200	9.8	2.53	2.68	68,100	66,018	2,000	3.1
Franklin	3,100	2,916	100	4.9	2.81	2.79	8,700	8,208	400	5.4
George	5,300	4,828	500	9.4	3.03	3.14	16,100	15,297	800	5.4
Greene	3,000	3,065	-	-1.4	3.12	3.18	9,500	9,827	-300	-3.1
Grenada	7,700	7,111	600	8.7	2.81	2.94	22,000	21,043	900	4.3
Hancock	10,500	8,182	2,400	28.8	2.84	2.94	30,600	24,537	6,100	24.7
Harrison	60,300	52,202	8,100	15.6	2.69	2.85	170,500	157,665	12,900	8.2
Hinds	92,100	85,902	6,200	7.2	2.73	2.83	259,400	250,998	8,400	3.4
Holmes	7,300	7,034	300	3.6	3.10	3.19	23,100	22,970	100	0.6
Humphreys	4,300	4,269	-	0.5	3.21	3.25	13,800	13,931	-100	-0.7
Issaquena	800	764	-	-1.8	2.99	3.29	2,200	2,513	-300	-10.6
Itawamba	7,300	7,055	300	4.0	2.76	2.85	20,600	20,518	100	0.6
Jackson	42,400	37,589	4,800	12.8	2.95	3.10	126,800	118,015	8,800	7.5
Jasper	5,800	5,591	200	3.7	3.00	3.08	17,400	17,265	100	0.8
Jefferson	2,700	2,775	-100	-3.6	3.29	3.30	8,800	9,181	-400	-4.0
Jefferson Davis	4,700	4,358	300	7.3	3.05	3.15	14,400	13,846	500	3.8
Jones	22,700	21,549	1,100	5.2	2.70	2.80	62,800	61,912	900	1.4
Kemper	3,200	3,245	-	-0.1	3.11	3.12	10,100	10,148	-100	-0.6
Lafayette	10,400	9,623	800	8.3	2.59	2.72	30,800	31,030	-200	-0.7
Lamar	9,400	7,851	1,500	19.4	2.87	3.02	27,000	23,821	3,200	13.5
Lauderdale	28,600	26,903	1,700	6.4	2.62	2.76	77,900	77,285	600	0.8
Lawrence	4,400	4,158	300	6.1	2.93	3.00	13,000	12,518	500	3.8
Leake	6,500	6,378	100	1.5	2.88	2.92	18,800	18,790	-	0.1
Lee	22,500	19,970	2,500	12.5	2.71	2.83	61,500	57,061	4,400	7.7
Leflore	13,400	13,003	400	3.0	2.95	3.03	41,400	41,525	-100	-0.4
Lincoln	10,500	10,125	300	3.3	2.94	2.94	31,100	30,174	1,000	3.2
Lowndes	20,700	18,664	2,100	11.1	2.82	2.96	60,200	57,304	2,900	5.0
Madison	15,800	12,711	3,100	24.4	3.01	3.20	48,800	41,613	7,200	17.3
Marion	9,100	8,565	500	5.8	2.92	2.96	26,800	25,708	1,100	4.3
Marshall	9,800	8,518	1,300	15.0	3.25	3.36	32,900	29,296	3,600	12.2
Monroe	12,700	12,255	400	3.3	2.88	2.94	36,800	36,404	400	1.1
Montgomery	4,600	4,543	100	1.3	2.78	2.92	12,900	13,366	-500	-3.6
Neshoba	8,500	8,040	400	5.6	2.83	2.94	24,200	23,789	400	1.6
Newton	7,400	6,936	400	6.0	2.68	2.81	20,200	19,944	200	1.2

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Mississippi—Continued										
Noxubee	4,000	4,020	-	0.6	3.19	3.28	12,900	13,212	-300	-2.3
Oktibbeha	11,700	10,980	700	6.3	2.76	2.87	36,700	36,018	700	1.9
Panola	9,700	8,880	800	8.8	3.00	3.15	29,200	28,164	1,000	3.5
Pearl River	12,900	11,004	1,900	17.6	2.94	3.02	38,600	33,795	4,800	14.3
Perry	3,500	3,160	300	10.0	2.91	3.12	10,100	9,864	300	2.7
Pike	12,900	12,348	600	4.7	2.85	2.89	37,400	36,173	1,200	3.3
Pontotoc	8,000	7,378	600	8.3	2.75	2.82	22,100	20,918	1,200	5.7
Prentiss	8,700	8,298	400	5.1	2.78	2.84	24,700	24,025	700	2.8
Quitman	3,600	3,930	-300	-8.7	3.14	3.21	11,300	12,636	-1,300	-10.5
Rankin	26,400	21,741	4,700	21.6	2.93	3.07	80,100	69,427	10,700	15.4
Scott	8,500	8,015	500	6.3	3.01	3.05	25,700	24,556	1,200	4.8
Sharkey	2,300	2,262	-	2.0	3.35	3.52	7,700	7,964	-200	-3.0
Simpson	8,300	7,673	700	8.6	2.86	3.00	24,300	23,441	800	3.5
Smith	5,300	5,016	200	4.8	2.93	3.00	15,400	15,077	300	2.2
Stone	3,300	2,996	300	9.7	2.87	3.02	10,100	9,716	300	3.5
Sunflower	10,000	9,685	300	3.0	3.21	3.33	36,500	34,844	1,600	4.6
Tallahatchie	5,200	5,287	-100	-2.5	3.17	3.24	16,300	17,157	-800	-4.7
Tate	6,800	6,033	800	12.4	3.01	3.15	21,400	20,119	1,300	6.6
Tippah	6,500	6,409	100	1.7	2.85	2.87	18,900	18,739	200	1.0
Tishomingo	6,800	6,727	-	0.4	2.66	2.74	18,000	18,434	-500	-2.5
Tunica	2,800	2,814	-	-0.7	3.27	3.42	9,200	9,652	-500	-5.2
Union	8,200	7,774	400	4.9	2.71	2.78	22,200	21,741	500	2.1
Walthall	4,300	4,419	-100	-3.2	3.14	3.09	13,500	13,761	-200	-1.7
Warren	18,200	17,355	800	4.9	2.80	2.94	51,600	51,627	-	-
Washington	23,100	22,948	100	0.5	3.06	3.13	71,000	72,344	-1,300	-1.8
Wayne	6,500	6,187	300	5.5	3.05	3.08	20,000	19,135	900	4.5
Webster	3,800	3,591	200	4.9	2.71	2.82	10,400	10,300	100	0.7
Wilkinson	3,300	3,190	100	4.0	3.05	3.11	10,200	10,021	200	1.9
Winston	6,500	6,552	-	-0.8	2.94	2.95	19,200	19,474	-200	-1.2
Yalobusha	4,700	4,583	100	2.5	2.78	2.85	13,100	13,139	-	-0.2
Yazoo	9,100	8,818	300	3.3	2.96	3.07	27,200	27,349	-100	-0.5
Missouri	1,895,000	1,793,399	102,000	5.7	2.59	2.67	5,035,000	4,916,686	119,000	2.4
Adair	9,300	8,947	300	3.5	2.31	2.44	24,400	24,870	-500	-1.8
Andrew	5,300	4,932	400	8.4	2.72	2.79	14,800	13,980	800	5.9
Atchison	3,100	3,297	-200	-4.6	2.43	2.50	8,100	8,605	-500	-5.5
Audrain	9,800	9,779	-	-0.3	2.57	2.63	25,800	26,458	-700	-2.5
Barry	10,000	9,305	700	7.7	2.59	2.60	26,200	24,408	1,800	7.2
Barton	4,400	4,407	-	-0.4	2.57	2.52	11,400	11,292	200	1.3
Bates	6,100	6,096	-	-0.6	2.54	2.56	15,600	15,873	-200	-1.5
Benton	5,100	4,847	300	6.1	2.45	2.49	12,800	12,183	600	4.7
Bollinger	3,800	3,717	100	3.6	2.73	2.75	10,600	10,301	300	2.7
Boone	38,800	35,296	3,500	9.8	2.41	2.51	104,900	100,376	4,500	4.5
Buchanan	33,300	32,917	400	1.2	2.51	2.60	85,700	87,888	-2,200	-2.5
Butler	15,100	14,181	900	6.5	2.52	2.62	38,600	37,693	900	2.4
Caldwell	3,000	3,301	-300	-7.8	2.64	2.59	8,200	8,660	-500	-5.9
Callaway	11,200	10,658	500	5.0	2.65	2.75	32,000	32,252	-200	-0.7
Camden	10,000	7,989	2,000	25.0	2.44	2.49	24,500	20,017	4,500	22.5
Cape Girardeau	22,100	20,968	1,100	5.3	2.57	2.63	60,500	58,837	1,700	2.8
Carroll	4,600	4,769	-200	-4.2	2.49	2.53	11,400	12,131	-700	-5.8
Carter	2,000	1,962	100	3.7	2.80	2.74	5,800	5,428	300	5.9
Cass	19,800	17,423	2,400	13.8	2.80	2.91	55,800	51,029	4,800	9.4
Cedar	5,000	4,791	200	5.1	2.37	2.44	12,200	11,894	300	2.4
Chariton	3,900	4,045	-200	-4.3	2.56	2.55	10,100	10,489	-400	-4.0
Christian	9,600	7,979	1,600	20.0	2.67	2.80	25,700	22,402	3,300	14.7
Clark	3,000	3,110	-100	-2.4	2.63	2.69	8,100	8,493	-400	-4.2

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
New York—Continued										
Ulster	59,600	55,862	3,800	6.7	2.62	2.72	162,800	158,158	4,600	2.9
Warren	20,600	19,420	1,200	6.2	2.63	2.78	55,200	54,854	300	0.6
Washington	18,800	17,887	900	5.1	2.88	2.95	56,400	54,795	1,600	2.9
Wayne	30,600	28,443	2,200	7.7	2.79	2.92	86,600	84,581	2,100	2.4
Westchester	316,200	307,450	8,800	2.8	2.65	2.74	866,300	866,599	-300	-
Wyoming	13,100	12,771	300	2.3	2.90	2.96	40,500	39,895	700	1.6
Yates	7,800	7,713	100	0.7	2.67	2.71	21,100	21,459	-300	-1.6
North Carolina	2,294,000	2,043,291	251,000	12.3	2.64	2.78	6,261,000	5,380,415 ~~5,881,766~~	379,000	6.4
Alamance	38,900	35,962	3,000	8.3	2.57	2.71	102,400	99,319	3,100	3.1
Alexander	9,600	8,528	1,000	12.2	2.76	2.91	26,700	24,999	1,700	6.7
Alleghany	3,800	3,596	200	4.6	2.55	2.64	9,700	9,587	100	1.3
Anson	8,900	8,386	500	5.8	2.93	3.03	26,300	25,649	600	2.5
Ashe	8,900	8,028	900	10.6	2.63	2.77	23,400	22,325	1,100	4.9
Avery	5,600	4,826	800	15.7	2.53	2.80	15,000	14,409	600	4.2
Beaufort	16,200	14,253	2,000	13.7	2.66	2.82	43,300	40,355	3,000	7.4
Bertie	7,300	6,897	400	5.1	2.94	3.04	21,400	21,024	300	1.6
Bladen	10,600	10,113	500	5.2	2.86	2.98	30,800	30,491	300	1.0
Brunswick	16,500	12,411	4,100	33.0	2.75	2.87	45,600	35,777	9,800	27.5
Buncombe	66,500	60,274	6,300	10.4	2.47	2.61	168,400	160,934	7,500	4.7
Burke	28,200	25,338	2,900	11.3	2.58	2.73	75,700	72,504	3,200	4.3
Cabarrus	34,300	30,610	3,700	11.9	2.65	2.77	92,200	85,895	6,300	7.4
Caldwell	25,800	23,331	2,400	10.4	2.71	2.88	70,300	67,746	2,600	3.8
Camden	2,000	1,931	100	4.8	2.87	3.02	5,800	5,829	-	-0.2
Carteret	19,100	15,128	4,000	26.5	2.49	2.66	48,800	41,092	7,700	18.8
Caswell	7,700	6,516	1,100	17.4	2.89	3.12	22,400	20,705	1,700	8.4
Catawba	41,900	37,308	4,600	12.4	2.65	2.77	112,700	105,208	7,500	7.1
Chatham	13,900	12,063	1,900	15.5	2.52	2.74	35,400	33,415	2,000	6.0
Cherokee	7,600	6,847	800	11.1	2.64	2.74	20,200	18,933	1,300	6.6
Chowan	4,700	4,350	300	7.9	2.78	2.85	13,200	12,558	600	4.9
Clay	2,700	2,490	200	7.8	2.62	2.66	7,000	6,619	400	6.2
Cleveland	31,400	28,458	2,900	10.4	2.70	2.88	86,200	83,435	2,800	3.4
Columbus	18,600	17,266	1,300	7.6	2.78	2.92	52,100	51,037	1,100	2.2
Craven	28,100	23,499	4,600	19.5	2.65	2.84	79,400	71,043	8,300	11.7
Cumberland	81,600	74,934	6,600	8.9	2.83	2.98	255,500	247,160	8,300	3.4
Currituck	4,800	3,897	900	23.2	2.66	2.80	12,900	11,089	1,800	16.5
Dare	7,200	5,359	1,800	34.4	2.38	2.48	17,300	13,377	3,900	29.2
Davidson	43,700	40,010	3,600	9.1	2.69	2.80	118,600	113,162	5,400	4.8
Davie	10,100	8,540	1,500	18.0	2.72	2.85	27,700	24,599	3,100	12.7
Duplin	14,800	13,993	800	5.5	2.80	2.90	41,600	40,952	700	1.7
Durham	61,700	55,614	6,100	11.0	2.49	2.61	161,700	~~152,785~~ 152,235	8,900	5.8
Edgecombe	20,400	18,397	2,000	10.8	2.84	3.01	58,500	55,988	2,500	4.5
Forsyth	100,800	90,146	10,600	11.8	2.49	2.62	258,900	243,683	15,200	6.2
Franklin	11,400	9,983	1,400	14.0	2.79	2.91	32,800	30,055	2,700	9.0
Gaston	62,200	56,362	5,900	10.4	2.74	2.86	172,000	162,568	9,400	5.8
Gates	3,200	2,889	300	10.1	2.92	3.03	9,400	8,875	500	5.9
Graham	2,700	2,481	200	7.0	2.71	2.91	7,200	7,217	-	-0.4
Granville	12,000	10,445	1,600	15.0	2.82	2.99	36,700	34,043	2,700	7.8
Greene	5,100	5,059	100	1.1	3.10	3.14	16,500	16,117	400	2.6
Guilford	125,300	114,084	11,200	9.9	2.52	2.67	327,000	317,154	9,800	3.1
Halifax	19,400	18,286	1,100	6.2	2.82	2.96	56,000	~~55,286~~ 55,070	700	1.2
Harnett	22,700	20,148	2,500	12.6	2.67	2.83	63,100	59,570	3,500	5.9
Haywood	18,400	16,997	1,400	8.0	2.57	2.70	47,900	46,495	1,400	3.1
Henderson	26,600	22,389	4,200	18.7	2.46	2.59	66,200	58,580	7,700	13.1
Hertford	8,000	7,499	500	7.0	2.87	2.97	23,900	23,368	600	2.5
Hoke	6,900	6,024	900	15.4	3.13	3.28	22,600	20,383	2,200	10.8

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
North Carolina—Continued										
Hyde	2,100	2,029	100	3.5	2.84	2.89	6,000	5,873	100	1.7
Iredell	32,200	29,128	3,100	10.7	2.69	2.81	87,400	82,538	4,900	5.9
Jackson	9,500	8,502	1,000	11.7	2.54	2.67	27,000	25,811	1,200	4.6
Johnston	28,500	25,157	3,300	13.2	2.68	2.78	76,900	70,599	6,300	8.9
Jones	3,400	3,203	200	6.6	2.86	3.03	9,800	9,705	100	0.9
Lee	15,000	12,914	2,100	16.2	2.68	2.81	40,600	36,718	3,900	10.6
Lenoir	21,900	20,674	1,200	5.8	2.68	2.80	60,500	59,819	700	1.1
Lincoln	16,400	14,674	1,700	11.7	2.77	2.87	45,700	42,372	3,300	7.8
McDowell	13,300	12,224	1,000	8.6	2.69	2.83	36,300	35,135	1,200	3.3
Macon	9,000	7,701	1,300	17.5	2.53	2.59	23,100	20,178	2,900	14.4
Madison	6,300	5,844	400	7.1	2.65	2.72	17,200	16,827	400	2.3
Martin	9,100	8,615	500	5.8	2.89	2.98	26,700	25,948	700	2.8
Mecklenburg	170,300	146,967	23,300	15.9	2.54	2.69	443,300	404,270	39,000	9.6
Mitchell	5,500	5,263	200	3.7	2.67	2.74	14,600	14,428	100	1.0
Montgomery	8,300	7,760	600	7.2	2.76	2.85	23,800	22,469	1,300	6.0
Moore	21,200	18,582	2,600	14.1	2.55	2.67	54,900	50,505	4,400	8.6
Nash	25,900	23,470	2,400	10.3	2.71	2.83	70,900	67,153	3,700	5.5
New Hanover	43,000	37,691	5,400	14.2	2.55	2.69	112,300	103,471	8,800	8.5
Northampton	7,400	7,097	300	4.7	2.85	3.03	22,400	~~22,584~~ 22,195	-200	-0.9
Onslow	37,400	30,307	7,100	23.3	2.66	2.96	122,700	112,784	9,900	8.8
Orange	30,600	27,044	3,600	13.2	2.38	2.50	82,600	77,055	5,500	7.1
Pamlico	4,100	3,678	500	12.3	2.66	2.82	11,000	10,398	600	5.9
Pasquotank	10,700	9,723	1,000	10.3	2.63	2.78	29,400	28,462	1,000	3.3
Pender	8,800	7,511	1,300	17.2	2.73	2.91	24,400	~~22,215~~ 22,262	2,200	10.0
Perquimans	3,700	3,283	400	11.7	2.78	2.85	10,300	9,486	800	8.9
Person	10,600	9,858	800	8.0	2.81	2.93	30,300	29,164	1,100	3.8
Pitt	33,700	30,198	3,500	11.7	2.65	2.76	95,900	90,146	5,800	6.4
Polk	5,900	5,023	900	17.2	2.42	2.55	14,400	12,984	1,400	11.1
Randolph	36,400	32,917	3,500	10.7	2.66	2.77	97,400	~~91,728~~ 91,900	5,600	6.1
Richmond	17,000	15,809	1,200	7.5	2.67	2.83	46,200	45,481	700	1.5
Robeson	34,700	31,372	3,300	10.6	3.01	3.19	106,100	101,610	4,500	4.4
Rockingham	31,900	29,616	2,300	7.8	2.66	2.80	85,500	83,426	2,100	2.5
Rowan	39,100	35,949	3,200	8.8	2.57	2.68	103,600	99,186	4,400	4.4
Rutherford	21,200	19,221	1,900	10.1	2.66	2.76	57,000	53,787	3,200	6.0
Sampson	17,900	16,646	1,300	7.5	2.79	2.95	50,400	49,687	700	1.5
Scotland	11,500	10,343	1,100	11.0	2.84	3.03	33,600	32,273	1,400	4.2
Stanly	18,800	17,378	1,400	8.3	2.62	2.73	50,200	48,517	1,700	3.6
Stokes	12,400	11,252	1,200	10.6	2.82	2.92	35,400	33,086	2,300	7.0
Surry	22,800	21,301	1,500	7.1	2.64	2.76	60,900	59,449	1,500	2.5
Swain	4,000	3,565	400	11.6	2.65	2.82	10,700	10,283	400	4.3
Transylvania	9,600	8,200	1,400	17.6	2.57	2.75	25,600	23,417	2,200	9.3
Tyrrell	1,500	1,381	100	7.2	2.79	2.88	4,100	3,975	200	3.9
Union	26,900	22,921	4,000	17.4	2.85	3.00	78,200	70,380	7,800	11.1
Vance	13,200	12,239	1,000	8.2	2.85	2.95	38,300	36,748	1,600	4.3
Wake	134,200	106,525	27,700	26.0	2.51	2.67	354,200	~~301,327~~ 301,429	52,900	17.6
Warren	5,500	5,257	300	5.4	2.93	3.05	16,400	16,232	200	1.3
Washington	4,900	4,729	100	2.8	2.96	3.10	14,600	14,801	-200	-1.6
Watauga	12,100	10,746	1,400	12.6	2.45	2.56	34,200	31,666	2,600	8.1
Wayne	34,900	32,300	2,600	8.0	2.72	2.88	98,800	97,054	1,700	1.8
Wilkes	22,200	20,522	1,700	8.1	2.72	2.84	60,800	58,657	2,200	3.7
Wilson	23,300	21,549	1,700	8.1	2.70	2.85	64,400	63,132	1,300	2.1
Yadkin	11,000	10,211	800	7.5	2.64	2.75	29,400	28,439	900	3.3
Yancey	5,800	5,277	500	9.4	2.67	2.79	15,600	14,934	700	4.6
North Dakota	248,000	227,664	20,000	8.9	2.65	2.75	685,000	652,717	32,000	4.9
Adams	1,400	1,333	100	4.8	2.55	2.63	3,600	3,584	100	1.7

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
South Carolina	1,155,000	1,029,981	125,000	12.1	2.80	2.93	3,333,000	3,120,730 ~~3,121,820~~	212,000	6.8
Abbeville	8,000	7,699	300	3.8	2.78	2.86	22,700	22,627	100	0.2
Aiken	40,700	36,456	4,200	11.6	2.82	2.88	115,600	105,625	10,000	9.4
Allendale	3,500	3,448	100	2.4	2.97	3.08	10,600	10,700	-100	-1.3
Anderson	50,600	46,944	3,700	7.8	2.72	2.81	139,400	133,235	6,200	4.7
Bamberg	5,900	5,624	200	4.3	2.93	3.06	18,200	18,118	100	0.5
Barnwell	6,900	6,471	500	7.4	2.94	3.04	20,600	19,868	800	3.9
Beaufort	27,600	20,112	7,400	37.0	2.69	2.84	80,400	65,364	15,000	23.0
Berkeley	37,100	28,940	8,200	28.3	3.16	3.25	118,300	94,727	23,600	24.9
Calhoun	4,100	3,911	200	5.6	2.94	3.12	12,200	12,206	-	-0.3
Charleston	100,100	90,570	9,600	10.5	2.69	2.86	285,800	~~276,074~~ 276,593	8,900	3.2
Cherokee	14,300	13,687	600	4.3	2.84	2.96	41,000	40,983	100	0.1
Chester	10,400	9,976	400	3.9	2.94	3.01	30,600	30,148	500	1.6
Chesterfield	13,700	12,848	900	6.6	2.81	2.96	38,600	38,161	400	1.1
Clarendon	9,000	8,369	600	7.6	3.09	3.26	28,000	27,464	600	2.1
Colleton	11,500	10,334	1,200	11.5	2.94	3.05	34,100	31,776	2,300	7.3
Darlington	21,300	20,060	1,200	6.2	2.98	3.09	64,300	62,717	1,600	2.6
Dillon	10,100	9,338	700	7.6	3.21	3.30	32,600	31,083	1,500	4.7
Dorchester	23,300	18,365	5,000	27.0	3.08	3.16	72,900	~~58,761~~ 59,028	14,100	24.0
Edgefield	5,800	5,536	200	3.9	3.09	3.15	17,900	17,528	300	2.0
Fairfield	6,900	6,355	500	8.6	3.03	3.21	21,200	20,700	500	2.6
Florence	38,800	35,705	3,100	8.6	2.95	3.05	115,700	110,163	5,600	5.0
Georgetown	15,000	13,333	1,700	12.8	3.06	3.17	46,200	42,461	3,800	8.8
Greenville	112,200	101,579	10,700	10.5	2.63	2.76	303,100	287,913	15,200	5.3
Greenwood	21,400	20,308	1,100	5.3	2.65	2.79	58,000	~~57,847~~ 55,800	200	0.3
Hampton	6,200	5,946	300	4.3	2.99	3.04	18,600	18,159	400	2.5
Horry	46,500	34,798	11,700	33.5	2.69	2.87	126,500	101,419	25,000	24.7
Jasper	4,800	4,563	200	5.4	3.08	3.16	14,900	14,504	400	2.7
Kershaw	14,700	13,131	1,500	11.6	2.86	2.96	42,100	39,015	3,100	7.9
Lancaster	19,200	17,820	1,300	7.5	2.88	2.98	55,400	53,361	2,100	3.9
Laurens	18,500	17,001	1,500	8.8	2.74	2.89	53,200	52,214	1,000	1.9
Lee	5,700	5,599	100	2.5	3.25	3.38	18,700	18,929	-300	-1.5
Lexington	56,500	47,617	8,900	18.7	2.79	2.92	158,700	140,353	18,400	13.1
McCormick	2,400	2,400	-	-0.1	2.99	3.17	7,400	7,797	-400	-5.7
Marion	11,200	10,757	400	3.9	3.09	3.16	34,700	34,179	500	1.5
Marlboro	10,400	9,820	600	6.2	3.04	3.20	32,000	31,634	300	1.1
Newberry	11,800	10,901	900	8.6	2.65	2.80	31,900	31,242	600	2.0
Oconee	19,000	17,373	1,600	9.4	2.71	2.78	51,800	48,611	3,200	6.6
Orangeburg	27,900	25,643	2,300	9.0	2.97	3.08	86,400	82,276	4,100	5.0
Pickens	29,000	25,986	3,000	11.6	2.70	2.80	85,500	79,292	6,200	7.9
Richland	94,600	85,461	9,100	10.7	2.62	2.77	277,100	~~269,735~~ 269,600	7,300	2.7
Saluda	5,700	5,272	400	7.8	2.98	3.03	17,100	16,150	1,000	6.0
Spartanburg	77,600	69,934	7,700	11.0	2.67	2.83	211,700	~~201,881~~ 203,023	9,800	4.9
Sumter	30,800	27,268	3,500	12.8	2.97	3.13	94,400	88,243	6,200	7.0
Union	11,000	10,562	500	4.5	2.76	2.90	30,500	30,751	-200	-0.7
Williamsburg	11,900	11,300	600	5.7	3.22	3.37	38,600	38,226	400	1.0
York	40,900	34,861	6,000	17.2	2.81	2.98	118,300	106,720	11,600	10.8
South Dakota	260,000	242,523	18,000	7.3	2.63	2.74	708,000	690,768	17,000	2.5
Aurora	1,200	1,244	-	-1.6	2.63	2.76	3,400	3,628	-200	-6.1
Beadle	7,400	7,337	-	0.5	2.45	2.56	18,400	19,195	-800	-4.3
Bennett	1,100	960	100	12.2	3.07	3.17	3,300	3,044	300	8.9
Bon Homme	2,500	2,859	-300	-11.4	2.58	2.60	6,900	8,059	-1,200	-15.0
Brookings	8,600	8,033	600	7.1	2.51	2.64	24,700	24,332	300	1.4
Brown	14,100	13,357	700	5.4	2.50	2.64	36,700	36,962	-200	-0.7
Brule	2,100	1,877	200	11.1	2.58	2.74	5,500	5,245	200	4.5

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
South Dakota—Continued										
Walworth	2,600	2,554	-	-	2.54	2.66	6,700	7,011	-300	-4.4
Yankton	7,000	6,624	400	5.4	2.54	2.65	18,900	18,952	-	-
Ziebach	700	600	100	17.9	3.52	3.85	2,500	2,308	200	8.0
Tennessee	1,757,000	1,618,505	138,000	8.5	2.65	2.77	4,767,000	4,591,120	176,000	3.8
Anderson	26,900	24,616	2,300	9.2	2.53	2.70	68,900	67,346	1,600	2.3
Bedford	10,600	9,943	600	6.2	2.70	2.77	28,900	27,916	1,000	3.4
Benton	5,800	5,577	200	3.2	2.59	2.64	15,100	14,901	200	1.3
Bledsoe	3,100	2,979	200	5.3	2.77	2.88	9,600	9,478	100	1.4
Blount	30,800	28,177	2,700	9.4	2.61	2.72	81,600	77,770	3,900	5.0
Bradley	25,900	23,026	2,900	12.5	2.71	2.87	71,700	67,547	4,100	6.1
Campbell	12,900	12,087	800	6.9	2.74	2.88	35,600	34,923	700	1.9
Cannon	3,800	3,625	200	6.0	2.78	2.80	10,800	10,234	500	5.3
Carroll	10,500	10,321	200	1.9	2.63	2.70	28,200	28,285	-100	-0.2
Carter	19,000	17,868	1,200	6.6	2.66	2.76	51,400	50,205	1,200	2.3
Cheatham	8,200	7,063	1,100	16.1	2.91	3.04	24,000	21,616	2,400	10.9
Chester	4,600	4,210	400	8.3	2.62	2.75	12,800	12,727	100	0.8
Claiborne	9,500	8,295	1,200	14.7	2.75	2.91	26,800	24,595	2,200	9.1
Clay	2,900	2,731	200	6.5	2.69	2.79	7,900	7,676	200	2.9
Cocke	11,000	10,154	900	8.5	2.65	2.83	29,300	28,792	500	1.8
Coffee	15,100	13,649	1,500	10.7	2.67	2.77	40,800	38,311	2,500	6.4
Crockett	5,400	5,380	-	-	2.64	2.76	14,300	14,941	-600	-4.3
Cumberland	11,200	9,887	1,300	13.6	2.75	2.88	31,100	28,676	2,400	8.5
Davidson	194,100	177,737	16,400	9.2	2.44	2.58	492,000	477,811	14,200	3.0
Decatur	4,200	4,081	200	3.9	2.61	2.64	11,100	10,857	300	2.7
DeKalb	5,300	4,956	300	6.1	2.68	2.72	14,200	13,589	600	4.4
Dickson	11,800	10,468	1,300	12.3	2.70	2.85	31,900	30,037	1,900	6.2
Dyer	13,100	12,696	400	3.2	2.61	2.71	34,400	34,663	-200	-0.7
Fayette	8,100	7,431	700	9.0	3.11	3.35	25,600	25,305	300	1.3
Fentress	5,600	5,027	500	10.4	2.80	2.94	15,600	14,826	700	5.0
Franklin	11,600	10,792	800	7.8	2.79	2.87	33,400	31,983	1,400	4.4
Gibson	18,900	18,202	700	4.0	2.55	2.69	48,900	49,467	-600	-1.2
Giles	9,400	8,825	600	6.4	2.62	2.75	25,000	24,625	400	1.6
Grainger	6,100	5,694	400	6.4	2.83	2.92	17,300	16,751	600	3.5
Greene	20,700	19,157	1,500	7.9	2.65	2.76	56,500	54,422	2,000	3.7
Grundy	4,900	4,510	400	8.2	2.96	3.05	14,500	13,787	700	5.2
Hamblen	19,600	17,257	2,300	13.4	2.68	2.84	52,900	49,300	3,600	7.3
Hamilton	107,500	103,319	4,200	4.1	2.58	2.71	284,300	287,740	-3,400	-1.2
Hancock	2,400	2,351	-	0.7	2.91	2.93	6,900	6,887	-	-0.1
Hardeman	8,200	7,623	600	7.6	2.83	3.00	23,900	23,873	100	0.3
Hardin	8,100	7,970	100	1.9	2.73	2.77	22,400	22,280	100	0.3
Hawkins	16,500	15,288	1,200	7.9	2.74	2.86	45,200	43,751	1,500	3.3
Haywood	7,100	6,513	600	8.7	2.92	3.10	20,700	20,318	400	2.1
Henderson	8,300	7,686	600	7.5	2.69	2.76	22,400	21,390	1,000	4.9
Henry	11,400	10,914	500	4.6	2.54	2.60	29,300	28,656	600	2.2
Hickman	5,500	5,094	400	7.3	2.74	2.84	15,900	15,151	800	5.2
Houston	2,500	2,410	100	3.4	2.79	2.83	7,000	6,871	100	2.1
Humphreys	5,900	5,634	200	4.0	2.70	2.82	15,900	15,957	-	-0.3
Jackson	3,400	3,363	100	2.1	2.70	2.78	9,300	9,398	-100	-1.0
Jefferson	11,800	10,623	1,200	11.2	2.66	2.81	33,000	31,284	1,700	5.6
Johnson	5,200	4,840	400	8.5	2.67	2.83	14,100	13,745	300	2.3
Knox	126,700	117,951	8,800	7.4	2.51	2.61	329,400	319,694	9,700	3.0
Lake	2,800	2,575	300	10.3	2.71	2.84	7,900	7,455	400	5.5
Lauderdale	8,700	8,281	400	5.0	2.77	2.86	24,900	24,555	400	1.5
Lawrence	12,600	11,867	700	6.1	2.74	2.85	34,800	34,110	700	2.0
Lewis	3,400	3,055	400	11.9	2.72	2.84	10,400	9,700	700	7.3

Table 1. Estimates of Households, for Counties: July 1, 1985—Continued

(A dash (-) represents zero or rounds to zero. Estimates are consistent with special censuses since 1980. Corrections to 1980 census counts are not included. See text concerning rounding and average population per household)

State and county	Households				Average population per household		Population			
	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent	July 1, 1985 (estimate)	April 1, 1980 (census)	July 1, 1985 (estimate)	April 1, 1980 (census)	Change, 1980-85 Number	Change, 1980-85 Percent
Tennessee—Continued										
Lincoln	10,000	9,533	500	4.7	2.67	2.75	26,900	26,483	500	1.7
Loudon	11,300	10,289	1,000	10.2	2.65	2.75	30,400	28,553	1,800	6.4
McMinn	15,800	14,727	1,100	7.2	2.71	2.81	43,200	41,878	1,300	3.1
McNairy	8,800	8,179	700	8.1	2.63	2.73	23,400	22,525	900	4.0
Macon	5,800	5,645	200	3.1	2.71	2.75	15,900	15,700	200	1.4
Madison	28,900	26,713	2,200	8.2	2.61	2.71	77,800	74,546	3,200	4.3
Marion	8,800	8,270	500	6.3	2.79	2.93	24,700	24,416	300	1.4
Marshall	7,600	7,144	500	6.3	2.68	2.72	20,600	19,698	900	4.8
Maury	19,900	18,180	1,700	9.6	2.64	2.78	53,300	51,095	2,200	4.2
Meigs	2,700	2,520	200	8.0	2.86	2.95	7,800	7,431	400	4.8
Monroe	10,500	9,637	900	9.2	2.81	2.93	30,200	28,700	1,500	5.4
Montgomery	31,600	27,198	4,400	16.1	2.67	2.87	89,800	83,342	6,500	7.8
Moore	1,800	1,534	300	17.5	2.76	2.94	5,000	4,510	500	10.4
Morgan	5,800	5,389	400	7.0	2.87	3.00	16,900	16,604	300	2.0
Obion	12,800	12,079	800	6.4	2.57	2.70	33,200	32,781	400	1.3
Overton	6,300	6,122	200	3.3	2.79	2.85	17,800	17,575	200	1.4
Perry	2,600	2,240	300	14.2	2.53	2.71	6,500	6,111	400	6.8
Pickett	1,600	1,542	100	5.2	2.78	2.82	4,500	4,358	200	3.6
Polk	4,800	4,607	100	3.2	2.86	2.95	13,700	13,602	-	0.4
Putnam	18,600	16,706	1,900	11.5	2.50	2.65	50,700	47,690	3,000	6.2
Rhea	8,800	8,285	500	6.2	2.74	2.85	24,700	24,235	500	1.9
Roane	18,300	17,078	1,200	7.3	2.70	2.82	49,700	48,425	1,300	2.7
Robertson	13,700	12,532	1,200	9.4	2.85	2.93	39,400	37,021	2,400	6.5
Rutherford	34,100	28,002	6,100	21.9	2.74	2.84	98,600	84,058	14,600	17.3
Scott	6,900	6,200	700	10.8	3.00	3.09	20,700	19,259	1,400	7.5
Sequatchie	3,000	2,891	200	5.3	2.87	2.93	8,900	8,605	300	3.1
Sevier	17,000	14,741	2,300	15.6	2.72	2.79	46,600	41,418	5,200	12.5
Shelby	291,500	269,186	22,300	8.3	2.68	2.81	803,600	777,113	26,500	3.4
Smith	5,300	5,392	-100	-1.5	2.72	2.76	14,500	14,935	-400	-2.7
Stewart	3,500	3,104	400	11.3	2.68	2.79	9,300	8,665	600	7.1
Sullivan	54,600	52,022	2,600	5.0	2.64	2.75	145,600	143,968	1,600	1.1
Sumner	33,400	28,557	4,900	17.1	2.79	2.99	93,900	85,790	8,100	9.4
Tipton	12,000	10,778	1,200	11.6	2.91	3.04	35,200	32,930	2,300	6.9
Trousdale	2,100	2,227	-100	-4.5	2.73	2.73	5,800	6,137	-300	-4.7
Unicoi	6,300	5,948	300	5.1	2.68	2.74	16,900	16,362	500	3.0
Union	4,300	3,947	400	9.4	2.82	2.96	12,200	11,707	500	4.2
Van Buren	1,700	1,590	100	6.6	2.88	2.97	4,900	4,728	200	3.4
Warren	12,700	11,869	800	7.0	2.62	2.74	33,500	32,653	800	2.6
Washington	33,400	31,191	2,300	7.2	2.59	2.71	92,600	88,755	3,800	4.3
Wayne	5,100	4,792	300	5.9	2.76	2.88	14,200	13,946	200	1.5
Weakley	11,600	11,567	-	0.1	2.57	2.60	33,200	32,896	300	1.0
White	7,500	6,988	500	7.3	2.64	2.78	19,900	19,567	300	1.7
Williamson	22,900	18,723	4,200	22.6	2.97	3.08	68,700	58,108	10,600	18.2
Wilson	21,900	18,863	3,000	16.1	2.81	2.94	62,500	56,064	6,400	11.4
Texas	5,796,000	4,929,267	867,000	17.6	2.76	2.82	16,385,000	14,229,191	2,156,000	15.2
Anderson	14,300	12,386	2,000	15.8	2.70	2.70	46,800	38,381	8,500	22.1
Andrews	5,300	4,423	900	19.9	3.08	2.99	16,400	13,323	3,100	23.4
Angelina	23,700	21,781	1,900	8.7	2.84	2.88	68,700	64,172	4,600	7.1
Aransas	6,500	5,168	1,400	26.7	2.69	2.75	17,600	14,260	3,400	23.6
Archer	2,800	2,644	100	5.2	2.78	2.73	7,800	7,266	500	7.2
Armstrong	700	750	-100	-8.7	2.67	2.59	1,900	1,994	-100	-5.8
Atascosa	9,000	8,036	1,000	12.5	3.11	3.09	28,400	25,055	3,300	13.3
Austin	7,300	6,434	900	13.4	2.80	2.71	20,800	17,726	3,000	17.1
Bailey	2,700	2,681	-	-0.2	3.06	3.02	8,300	8,168	100	1.2
Bandera	3,600	2,802	800	28.3	2.46	2.48	9,000	7,084	1,900	27.1

No city found Please RETURN to try again

REFERENCE 26

II TRACE
========

STATE COUNTY STATE NAME COUNTY NAME

37 81 North Carolina Guilford Co

CENTER POINT OF STATE : 37 North Carolina
COUNTY : 81 Guilford Co

Please RETURN key to continue. .

REGION OF THE COUNTRY
=====================

Zipcode found: 27409 at a distance of 3.9 mi

STATE	CITY NAME	COMMUNITY	ZIPCODE	LATITUDE	LONGITUDE
NC	GREENSBORO	GUILFORD	27081	36.0833	79.3900

Please RETURN key to continue ...

CENSUS DATA
===========

Sun Oil Co. S.I. Terminal
LATITUDE 36:4:37 LONGITUDE 79:55:26 1990 POPULATION

YM	.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.30-6.40	SECTOR TOTALS
	0	0	0	0	0	0	0
E 2	0	0	0	4310	1751	525	1535
E 3	0	0	0	0	4249	6703	10952
	0	0	0	1344	1299	4577	7211
	0	0	0	0	3152	0	3152
E 6	0	0	0	0	3679	0	3679
	0	0	0	145	0	0	145
	0	0	0	0	0	520	520
SUMS TOTALS	0	0	0	5799	12119	12325	30243

Please RETURN key to continue ...

STAR STATION
============

INDEX	LATITUDE	LONGITUDE	PERIOD OF STABILITY	DISTANCE

[illegible]

[illegible]

Press RETURN key to continue ...

[illegible]

U.S. CITY

[illegible]

[illegible] Geodata Handling Data List procedures

[illegible]

1.	Site level retrieval of data	(SITERET)
[illegible]	Access Census Data	(CENSUS)
[illegible]	Determine County Coverage	(COVERAGE)
[illegible]	Geographic Data Management	(GEOGM)
[illegible]	HUCODE/SOIL locator	(HUCODE)
[illegible]	Convert to Lat/Long	(LATLON)
[illegible]	Lookup/Examine Star Station Data	(STAR)
8.	Find US cities	(USCITY)
[illegible]	Find Soil Survey Status of Counties	(SSURVEY)

[illegible]

Enter an option number or a procedure name (in parentheses)
[illegible] command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR
[illegible]

Enter an option number or a procedure name (in parentheses)
[illegible] command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR
[illegible]

Enter an option number or a procedure name (in parentheses)
[illegible] command: HELP, HELP option, BACK, CLEAR, EXIT, TUTOR
GEMS> EXIT

[illegible] YES to confirm the EXIT command; type NO to restart GEMS
[illegible]: YES
[illegible]

[illegible]

[illegible] Connect time: [illegible] 21-FEB-1990 [illegible]

[illegible] Detailed resource charges for this session follows:

[illegible]

[illegible]: [illegible]713 START TIME: 21-FEB-1990 [illegible]

[illegible]: [illegible]TIENLOS FINISH TIME: 21-FEB-1990 [illegible]

[illegible]: [illegible] BILLING PERIOD: [illegible]

[illegible]: [illegible] WEEKDAY: TUESDAY

[illegible]: TERMINAL MODEL: VT-134

DESCRIPTION OF CHARGE	QUANTITY	EXPENDITURE
ALL CHARGE LEVELS		
CPU time	Seconds 159	0.6725
CPU TIME	(Seconds 5	0.3967
TOTAL FOR THIS SESSION		$ 1.0692

[illegible] 1:57 HOST [illegible] DISCONNECTED BY HOST

Please log in: [illegible]

[illegible]. Type user name:

EXPLANATION OF SPECIES STATUS CODES

The attached output from the N.C. Natural Heritage Program database is a listing of the elements (rare species, geologic features, natural communities, special animal habitats) known to occur in your geographic area of interest. Following is an explanation of the four columns of status codes on the righthand side of the printout.

STATE STATUS

Plants:

From Sutter, R.D., L. Mansberg, and J.H. Moore. 1983. Endangered, threatened, and rare plant species of North Carolina: a revised list. ASB Bulletin 30:153-163, and updated lists of the Natural Heritage and Plant Conservation Programs.

E = Endangered
T = Threatened
SC = Special Concern
PP = Primary Proposed
SR = Significantly Rare

E,T,and SC species are protected by state law (the Plant Protection and Conservation Act, 1979); the other two categories indicate rarity and the need for population monitoring, as determined by the Plant Conservation and Natural Heritage Programs.

Animals:

From Cooper, J.E., S.S. Robinson, and J.B. Funderburg (Eds.). 1977. Endangered and Threatened Plants and Animals of North Carolina. N.C. Museum of Natural History, Raleigh, NC. 444 pages + i-xvi, and updated lists of the Natural Heritage Program.

E = Endangered
T = Threatened
SR = Significantly Rare
SC = Special Concern
UNK= Undetermined
EX = Extirpated

FEDERAL STATUS

From Endangered & Threatened Wildlife and Plants, April 10, 1987. 50 CFR 17.11 & 17.12. Department of Interior. Established by the Endangered Species Act of 1973, as amended.

E = Taxa currently listed as Endangered
T = Taxa currently listed as Threatened
PE = Taxa currently proposed for listing as Endangered
PT = Taxa currently proposed for listing as Threatened

Taxa under review for possible listing ("candidate species"):

C1 = Taxa with sufficient information to support listing
C2 = Taxa without sufficient information to support listing

GLOBAL RANK (STATE RANK)

The Nature Conservancy's system of measuring rarity and threat status. "Global" refers to worldwide, "State" to statewide.

G1 = Critically imperiled globally because of extreme rarity or otherwise very vulnerable to exinction throughout its range.

G2 = Imperiled globally because of rarity or otherwise vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range, or found locally in a restricted area.

G4 = Apparently secure globally, though it may be quite rare in parts of its range (especially at the periphery).

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range (especially at the periphery).

GU = Possibly in peril but status uncertain; need more information.

GX = Believed to be extinct throughout range.

Q = a suffix attached to the Global Rank indicating questionable taxonomic status.

T_ = an additional status for the subspecies or variety; the G rank then refers only to the species as a whole.

State rank codes follow the same definitions, except substitute the words, "in the state," for "globally" or "throughout its range."

NORTH CAROLINA NATURAL HERITAGE PROGRAM ELEMENT LIST

scientific and common name	state stat	fed stat	state rank	glob rank
ETHEOSTOMA COLLIS	SC		S3	G3
CAROLINA DARTER				
MEANDER SCARS				
CAMBARUS CATAGIUS	T	C2		G1G3
GREENSBORO BURROWING CRAYFISH				
HESPERIA LEONARDUS	UNK		S2?	G4
LEONARD'S SKIPPER				
DENTARIA MULTIFIDA	SR		S1	G5Q
DIVIDED TOOTHWORT				
EPILOBIUM LEPTOPHYLLUM	PP		S2	G5
NARROWLEAF WILLOWHERB				
NESTRONIA UMBELLULA	T	C2	S3	G3G4
NESTRONIA				