



DEPARTMENT OF THE ARMY Mr. Nickelson/clf/AUTOVON
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY 584-3816
ABERDEEN PROVING GROUND, MARYLAND 21010

REPLY TO
ATTENTION OF
HSHB-EW-M/WP

1 AUG 1983

SUBJECT: Water Quality Information Paper No. 16

SOLE SOURCE AQUIFERS

I. PURPOSE. The purpose of this information paper is to provide an up-to-date list of US Environmental Protection Agency (EPA)-designated areas where an aquifer has been determined to be the principal or sole source of drinking water, to provide the installation with an interpretation and evaluation of the sole source aquifer regulations, and to specify the impact of these regulations on the installation.

II. REFERENCES. A list of references is provided in Inclosure 1.

III. DEFINITIONS. A list of definitions is provided in Inclosure 2.

IV. REGULATORY BACKGROUND AND EVALUATION.

A. Regulatory Impetus. The impetus behind the development of identifying the principal or sole source aquifers in the United States and its territories is the Safe Drinking Water Act [Public Law (PL) 93-523]. This Law identifies the requirement to establish a national drinking water regulation, primary drinking water standards, and secondary drinking water standards. Part C of this Law pertains specifically to the protection of underground sources of drinking water, to include establishing regulations on the injection of materials into subsurface aquifers and identifying those areas of the United States where only one aquifer (principal or sole source aquifer) exists. This latter condition, i.e., the subject of this paper, is presented in Section 1424(e) of PL 93-523. This section states the following:

"(e) If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of the determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health,

but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer."

B. EPA Response. Based on the above determination, the EPA published in the Federal Register (42 FR 51620-51625, 29 September 1977) the proposed regulation on sole source aquifers. Although proposed in 1977, this proposal has not, as yet, been promulgated. The proposal is being used as interim guidance until promulgation occurs. This proposal established guidance for the review of Federal financially assisted projects which may contaminate the aquifer and procedures for designating sole source aquifer areas. Therefore, before the review aspects of this proposal can be enacted, the aquifer and resource area must be designated as a sole source aquifer first.

1. Designation of a Sole Source Aquifer. Designation of an aquifer to be a sole source aquifer is made by the Administrator. The proposal can be initiated by the Administrator or by petition. Once a proposal is received or initiated by the Administrator, a notice of designation will appear in the Federal Register. The petition (submitted in duplicate) will include the following:

a. The name, address, and telephone number of the individual, organization, or other entity submitting the petition.

b. A brief statement of the petitioner's interest in the Administrator's determination.

c. A statement of why, in the petitioner's view, contamination of the aquifer would result in a significant hazard to public health.

d. All pertinent information known to the petitioner regarding:

(1) The aquifer and its location.

(2) The location of the area for which the petitioner alleges the aquifer is the sole or principal source of drinking water.

(3) The population in the area described under (2) above.

(4) Alternative sources of drinking water for the area described under (2) above.

(5) The recharge and stream flow source zone (or zones) for the aquifer and their location.

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(6) Projects which might contaminate the aquifer through the recharge zone.

(7) The public water systems utilizing water from the aquifer, the number of people served by each system, and the water treatment provided by each system.

e. Maps showing, to the best of the petitioner's knowledge and belief:

(1) The location and boundaries of the aquifer.

(2) The location and boundaries of the recharge zone or zones for the aquifer.

(3) The location of the source or sources of recharge to the aquifer.

2. Review of Projects. Once an area has been designated, the review process is implemented by the Regional Administrator with final determination to be made by the Administrator. It is important to remember that the review process can begin only when Federal financial assistance has been requested for a project. The review process is specifically aimed at determining if a project has the potential to contaminate an aquifer through its recharge zone, which is located in a designated area, the result of which may create a significant hazard to public health.

a. The term "Federal financial assistance" means any financial benefit provided directly as aid to a project by a department, agency, or instrumentality of the Federal Government in any form, including contracts, grants, and loan guarantees. Federal actions, such as dredging performed by the Army Corps of Engineers, which do not involve a grant of financial assistance to a project are not affected by the project review authority under Section 1424(e), PL 93-523. Similarly, Federal actions of programs performed by contractors for the Federal Government, such as construction of roads on Federal lands by a contractor under the supervision of the Bureau of Land Management, are not subject to project review. Although this type of Federal action does not fall within the scope of Section 1424(e), an obligation to evaluate the impact on ground-water quality may exist, based upon other authority. Some of these actions may be subject to provisions of the National Environmental Policy Act (NEPA), and preparation of an Environmental Impact Statement (EIS) may be required.

b. Published guidelines for the implementation of NEPA are available at all Federal installations. These guidelines provide the basis for determining if a project will have a significant impact on the environment. In addition, project review under section 1424(e) requires close scrutiny so as to determine whether a project will contaminate an aquifer through its

recharge zone and create a significant hazard to public health. Integration of the two types of review will allow EPA and other Federal agencies to avoid needless duplication of efforts under the two statutes and will prevent inefficient use of resources in carrying out ground-water impact evaluations. It will also permit EPA to take advantage of the Federal agencies' and the public's familiarity with the NEPA process. The heads of all Federal agencies had been advised by the Council on Environmental Quality (CEQ) in a memorandum dated 19 November 1976, that NEPA guidelines should be amended to place specific emphasis on the evaluation of the ground-water impact of projects which might affect the quality of an aquifer through its recharge zone and that projects should be submitted to a thorough ground-water impact evaluation in accordance with NEPA procedures.

c. An EIS prepared for a project which is subject to Section 1424(e) as well as NEPA should contain all the information which is necessary for EPA to properly evaluate a project impact on ground water under Section 1424(e). The EPA will routinely review all EIS's prepared for projects which are located in the recharge zone or stream-flow source zones.

d. The EPA will request that each project funding Federal agency submit a list of the projects for which EIS's will be prepared. In addition, these Federal agencies should also list which projects will be located in the recharge zone and which will be located in the stream-flow source zone. These lists will be periodically submitted to the appropriate Regional Administrator and made available to the public upon request. Once an area has been designated, the Regional Administrator has the authority to work with regional Federal agencies on any agreements or memoranda of understanding to supplement the general regulations and also to keep them informed of projects in the area. The Regional Administrators may assume the initiative in obtaining information or commitments of Federal financial assistance which are under consideration and in taking other steps to ensure that they are kept up-to-date on Federal funding of projects in the area.

e. Once an area has been delegated, the Regional Administrator may also work out memoranda of understanding with the states in order to determine their participation in the protection of ground water in the area. The EPA will rely upon existing state capabilities in protecting the ground-water quality; however, this reliance will in no way constitute a delegation of project review authority. State assistance can be valuable in providing the EPA with information and comments based on knowledge of local conditions.

3. Recapitulation. The Administrator has the authority to designate a sole or principal source aquifer area and to review Federal financially assisted projects which may contaminate the aquifer. Designation of a sole source aquifer area can be initiated directly by the Administrator or through submittal of a public petition. Upon receipt of the petition, a "Notice of

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Designation" is published in the Federal Register. If approved by the Administrator, any project in this designated area which has requested Federal financial assistance must be reviewed by the Administrator to determine if the project could contaminate an aquifer in a designated area through its recharge zone so as to create a significant hazard to public health. This project review is instigated only upon receipt of application for financial assistance for a project. Even though a project in a designated area does not require Federal financial assistance, the requirement to establish the ground-water impact of the project is governed by other authorities, i.e., NEPA and EIS.

C. Impact on US Army Installations. Since US Army installations receive funding for major and minor construction projects through the Department of Defense, the condition of "Federal financial assistance," as stipulated in PL 93-523 and 42 FR 51620, does not apply to US Army installations. Therefore, projects on military installations located in designated areas do not fall under the "Federal financial assistance" clause and will, therefore, not be reviewed by the Administrator as stipulated by Section 1424(e). However, because of the requirements established under NEPA (the requirement to expound on the ground-water impact of a project in the formulation of an EIS), the project will still be reviewed by EPA. Although funds cannot be withheld, the project could be delayed if it is determined that the project will contaminate an aquifer in a designated area and create a significant hazard to public health.

V. DESIGNATED SOLE SOURCE AQUIFERS.

A. To date a total of 10 areas of the United States or its territories have been designated as principal or sole source aquifer areas. They are, in order of approval, with Federal Register determination announcements, as follows:

1. Edwards Aquifer, San Antonio, Texas - 40 FR 58344, 16 December 1975 (Inclosure 3).
2. Spokane Valley--Rathdrum Prairie Aquifer in Idaho and Washington - 43 FR 5566, 9 February 1978 (Inclosure 4).
3. Northern Groundwater System of Guam - 43 FR 17868, 26 April 1978 (Inclosure 5).
4. Nassau and Suffolk Counties, Long Island, New York - 43 FR 26611, 21 June 1978 (Inclosure 6).
5. Groundwater System of Center Fresno County, California - 44 FR 52751, 10 September 1979 (Inclosure 7).

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6. Biscayne Aquifer System of Florida - 44 FR 58797, 11 October 1979 (Inclosure 8).

7. Aquifers Underlying Western Essex and Southeastern Morris Counties, New Jersey - 45 FR 30537, 8 May 1980 (Inclosure 9).

8. Maryland Piedmont Aquifer - 45 FR 57165, 27 August 1980 (Inclosure 10).

9. Whidbey and Camano Island, Washington - 47 FR 14779, 6 April 1982 (Inclosure 11).

10. Cape Cod Aquifer, Massachusetts - 47 FR 30282, 13 July 1982 (Inclosure 12).

Each of these areas are discussed in Inclosures 3 through 12. In each discussion a description of the aquifer, the recharge zone, and the stream-flow source zone are given to include a map outlining each area. In addition, a final paragraph delineates those military installations which are affected by these designated areas.

B. In addition to those areas already designated as sole source areas, there are 17 notices of designation pending determination. They are, in order of appearance in the Federal Register, as follows:

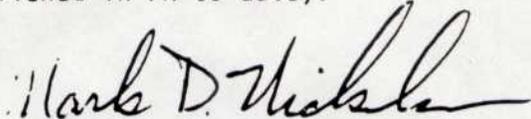
1. New Jersey Coastal Plains Aquifer - 44 FR 17208, 21 March 1979.
2. Kings/Queens County Aquifer, New York - 44 FR 50649, 29 August 1979.
3. Ridgewood Area Aquifer, New Jersey - 45 FR 2894, 15 January 1980.
4. Coastal Plain Aquifer, Delaware - 45 FR 26804, 21 April 1980.
5. Rockaway Area Aquifer, New Jersey - 45 FR 60010, 11 September 1980.
6. Delaware Basin Aquifer of Texas and New Mexico - 45 FR 68756, 16 October 1980.
7. Baton Rouge Aquifer, Louisiana - 46 FR 45185, 10 September 1981.
8. Aquifer System of Eastern Wisconsin - 46 FR 56039, 13 November 1981.
9. Seven Valleys Aquifer, York County, Pennsylvania - 47 FR 4737, 2 February 1982.

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10. Scotts Valley Aquifer, California - 47 FR 37953, 27 August 1982.
11. Santa Cruz and Avra-Altar Basin Aquifer, Arizona - 47 FR 42153, 24 September 1982.
12. Volusia-Floridan Aquifer, Florida - 47 FR 55303, 8 December 1982.
13. Schenectady Aquifer, New York - 48 FR 3650, 26 January 1983.
14. Snake Plain Aquifer, Idaho, 48 FR 6023, 9 February 1982.
15. Sardinia, New York (not published in FR to date).
16. Carrizo-Wilcox Aquifer, Texas (not published in FR to date).
17. Vestal, New York (not published in FR to date).

12 Incl
as



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- 10. Scotts Valley Aquifer, California - 47 FR 33923, 27 August 1982.
- 11. Santa Cruz and Arava-Ariza Basin Aquifer, Arizona - 47 FR 42121; 24 September 1982.
- 12. Volusia-Florida Aquifer, Florida - 47 FR 52303, 8 December 1982.
- 13. Schenectady Aquifer, New York - 48 FR 3650, 26 January 1983.
- 14. Snake Plain Aquifer, Idaho, 48 FR 6023, 9 February 1983.
- 15. Sardinia, New York (not published in FR to date).
- 16. Carrizo-Wicox Aquifer, Texas (not published in FR to date).
- 17. West, New York (not published in FR to date).



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REFERENCES

1. Public Law 93-523, Safe Drinking Water Act, 16 December 1974, 88 Stat. 1660 et seq., Section 1424(e).
2. 40 FR 10514-10515, 6 March 1975, Edwards Aquifer, San Antonio, Tex.; Proposal on EPA Determination.
3. 40 FR 58344-58345, 16 December 1975, Edwards Underground Reservoir; Notice of Determination.
4. 42 FR 51620-51625, 29 September 1977, Water Programs: Sole or Principal Source Aquifer Areas; Proposed Rule.
5. 42 FR 5749, 31 January 1977, Spokane Valley--Rathdrum Prairie Aquifer in Idaho and Washington; Proposal on EPA Determination.
6. 43 FR 5566-5567, 9 February 1978, Spokane Valley--Rathdrum Prairie Aquifer; Notice of Determination.
7. 41 FR 17419-17420, 26 April 1976, Northern Groundwater System of Guam; Request for EPA Determination Regarding Aquifers.
8. 43 FR 17868-17869, 26 April 1978, Guam--Sole on Principal Source Aquifer Area Designation; Notice of Determination.
9. 40 FR 25082, 12 June 1975, Nassau and Suffolk Counties, Long Island, New York; Proposal on EPA Determination Regarding Aquifers.
10. 43 FR 26611-26612, 21 June 1978, Aquifers Underlying Nassau and Suffolk Counties, New York; Notice of Determination.
11. 44 FR 7223-7225, 6 February 1979, Ground Water System of the Twin Cities Metropolitan Area, Minnesota; Request for EPA Determination Regarding Aquifers.
12. 41 FR 53368-53370, 6 December 1976, Groundwater System of Central Fresno County, California; Request for EPA Determination Regarding Aquifers.
13. 44 FR 52751, 10 September 1979, Safe Drinking Water; Fresno County, California; Notice of Determination.
14. 43 FR 40055-40056, 8 September 1978, Biscayne Aquifer System of Florida; Request for EPA Determination Regarding Aquifers.
15. 44 FR 58797-58798, 11 October 1979, Biscayne Aquifer; Notice of Determination.

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16. 44 FR 66061-66062, 16 November 1979, Designation of Biscayne Aquifer as Sole Source Aquifer; Notice of Meeting.

17. 44 FR 18732-18733, 29 March 1979, Region II; Groundwater System of the Buried Valley Aquifer System of Western Essex and Eastern Morris Counties, N.J.; Request for EPA Determination Regarding Aquifers.

18. 45 FR 30537-30538, 8 May 1980, Aquifers Underlying Western Essex and Southeastern Morris Counties, N.J.; Notice of Determination.

19. 45 FR 56178-56181, 22 August 1980, Region VIII - Ground Water System of the Shallow Aquifers in the Helena Valley, Lewis and Clark County, Mont.; Request for EPA Determination Regarding Aquifers.

20. 41 FR 22976-22979, 8 June 1976, Montgomery County, Maryland; Petition for EPA Determination Regarding Aquifer.

21. 44 FR 59288, 15 October 1979, Region III: Ground Water System of a Piedmont Aquifer in Maryland; Request for EPA Determination Regarding Aquifers; Public Hearing Notification.

22. 45 FR 57165-57168, 27 August 1980, Maryland Piedmont Aquifer; Notice of Determination.

23. 47 FR 14779-14780, 6 April 1982, Determination of Water Source; Whidbey and Camano Island; Final Determination.

24. 47 FR 30282-30284, 13 July 1982, Cape Cod Aquifer Determination; Final Determination.

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DEFINITIONS

Administrator - The Administrator of the US Environmental Protection Agency.

Aquifer - A geological formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells or springs.

Federal financial assistance - Any financial benefits provided directly as aid to a project by a department, agency, or instrumentality of the Federal Government in any form, including contracts, grants, and loan guarantees.

Recharge zone - Any area through which water enters the aquifer.

Sole or Principal Source Aquifer - An aquifer which supplies 50 percent or more of the drinking water for an area.

Stream-flow source zone - The upstream headwaters area which drains into the recharge zone.

DEFINITIONS

Administrator - The Administrator of the US Environmental Protection Agency.

Adopter - A geological formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells or springs.

Federal financial assistance - Any financial benefits provided directly or indirectly to a project of a department, agency, or instrumentality of the Federal Government in any form, including contracts, grants, and loan guarantees.

Recharge zone - Any area through which water enters the aquifer.

Safe or Principal Source Aquifer - An aquifer which supplies 25 percent or more of the drinking water for an area.

Stream-flow source zone - The uppermost headwaters area which drains into the recharge zone.

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EDWARDS AQUIFER, SAN ANTONIO, TEXAS

1. This notice is concerned with that section of the Edwards Aquifer which is referred to as the Edwards Underground Reservoir, a distinct hydrological unit within the Edwards Aquifer. It includes the Comanche Peak, Edwards, and Georgetown Limestones and extends from near Brackettville in Kinney County eastward through Uvalde, Medina, and Bexar Counties and northeastward through Comal County and to near Kyle in Hays County. The reservoir also underlies a small section of Atascosa, Guadalupe, and Kendall Counties.
2. The recharge zone in the case of the Edwards Underground Reservoir is located on the outcrop in Kinney, Uvalde, Medina, Bexar, Comal, and Hays Counties, together with that area within the 100-year floodplain of Cibolo Creek, beginning at Herff Falls in Kendall County and continuing downstream to the main outcrop area of the reservoir.
3. The stream-flow source zone includes the headwaters of the Nueces, San Antonio, and Guadalupe River basins above the recharge zone. The area includes much of Edwards, Real, Bandera, Kerr, and Kendall Counties, and parts of Kinney, Uvalde, Medina, Bexar, Comal, Hays, Gillespie, and Blanco Counties.
4. The US military installations that are affected by this designation are: Lackland, Kelley, Brooks, and Randolph Air Force Bases; the US Air Force Aerospace Medical Center; and Fort Sam Houston (Fifth US Army Headquarters). All of these installations obtain their water from this aquifer; however, none of these installations are located in the stream-flow source zone or the recharge zone.



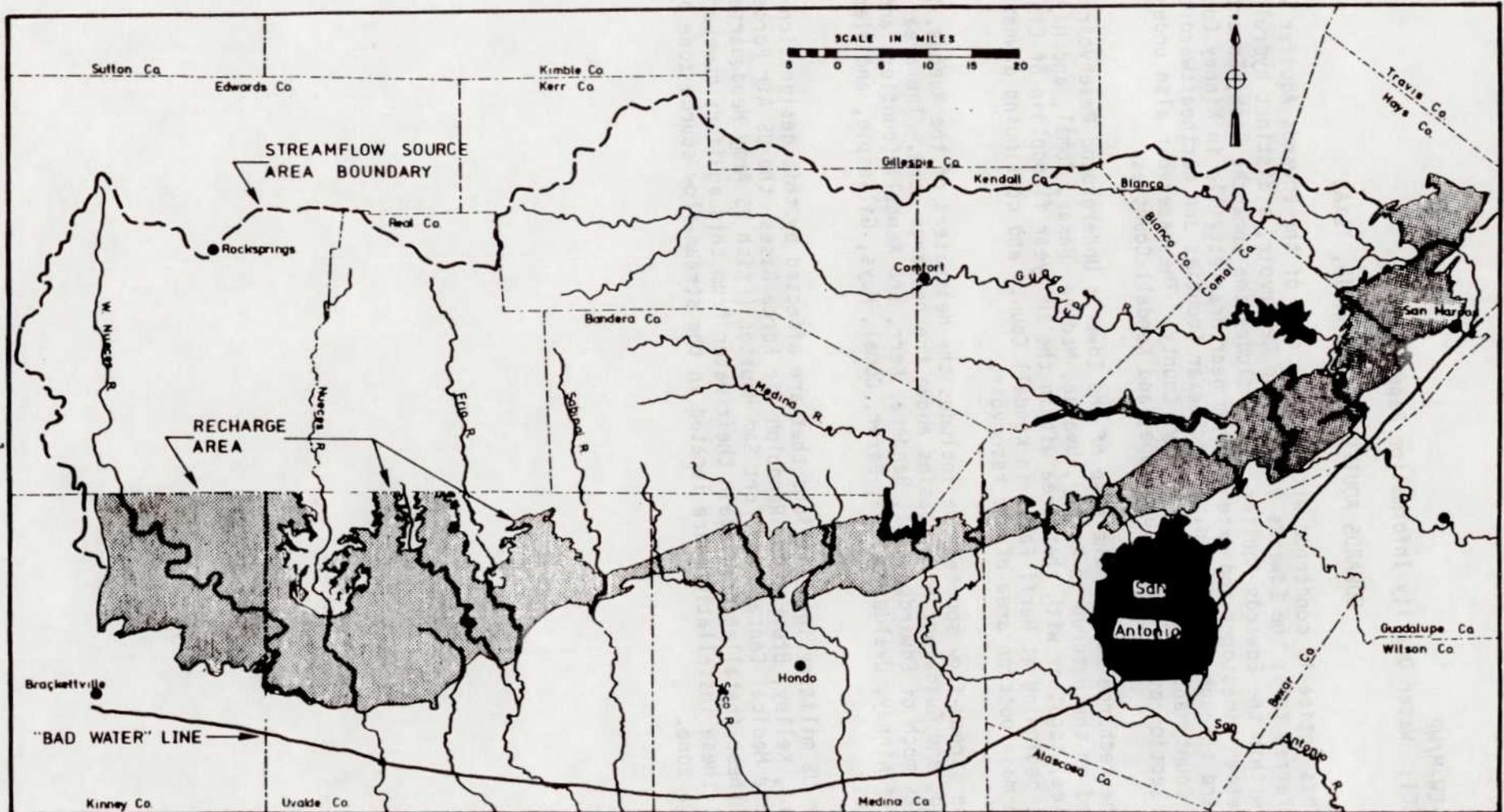


FIGURE. EDWARDS AQUIFER, SAN ANTONIO, TEXAS

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SPOKANE VALLEY--RATHDRUM PRAIRIE AQUIFER IN IDAHO AND WASHINGTON

1. This aquifer extends from near Spirit and Pend Oreille Lakes in Bonner and Kootenai Counties, Idaho, southwest across the Rathdrum Prairie and down the Spokane Valley to the Little Spokane and Spokane Rivers in Spokane County, Washington. It includes the cities of Spirit Lake, Athol, Rathdrum, Hyden Lake, Coeur d'Alene, Post Falls, Spokane, and several other small towns.
2. The recharge zone is the land area directly overlying and adjacent to the aquifer.
3. The stream-flow source zone includes the drainage area of the Spokane River-Coeur d'Alene Lake Basin (approximately 5,000 square miles).
4. Fairchild Air Force Base, which is located west of Spokane, Washington, might be affected by this designation.



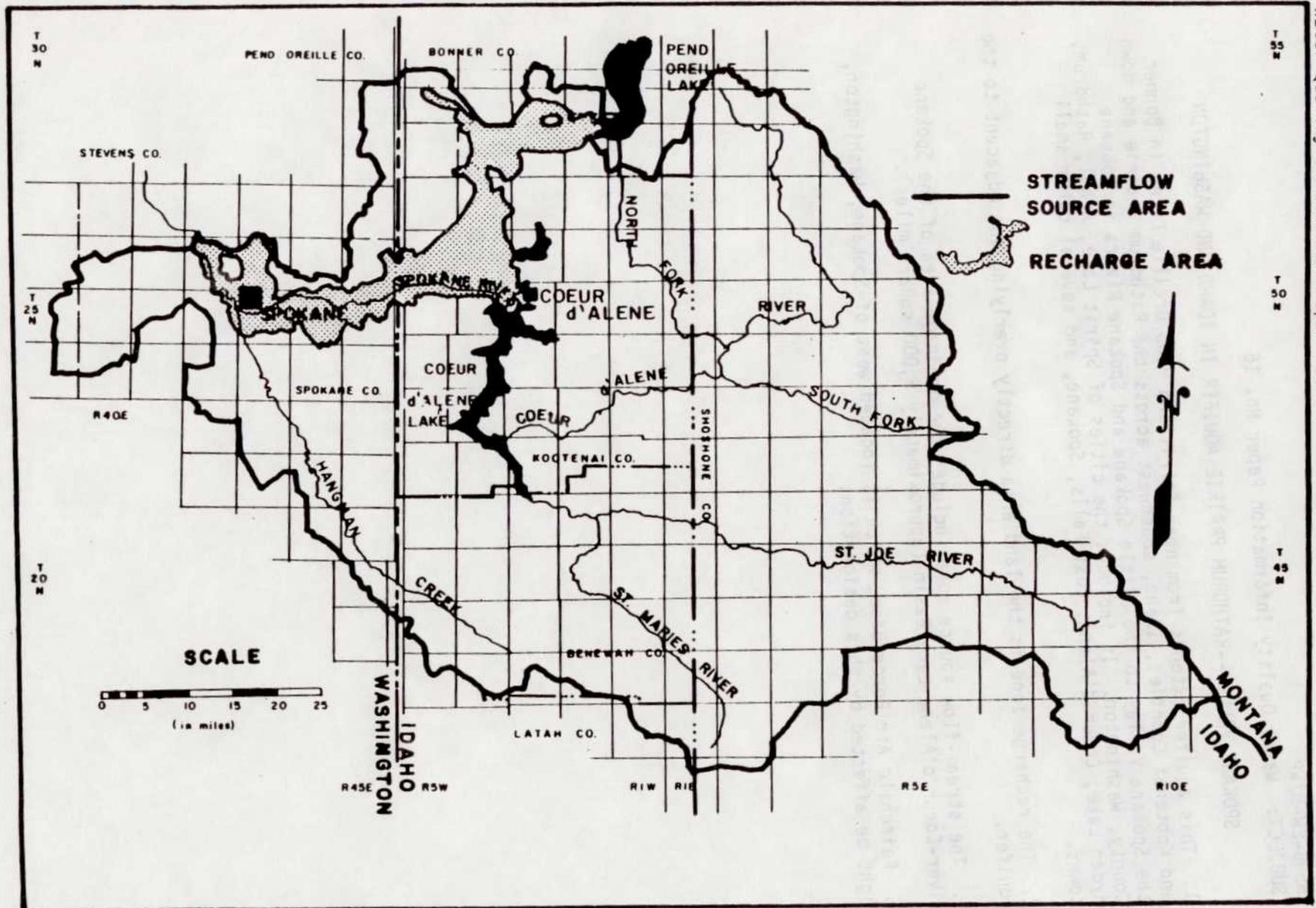


FIGURE. SPOKANE VALLEY — RATHDRUM PRAIRIE AQUIFER

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GUAM - SOLE OR PRINCIPAL SOURCE AQUIFER AREA DESIGNATION

1. This notice is concerned with those ground waters north of the southern municipal boundaries of Agana, Agana Heights, and Chalan Pago-Ordot, with dissolved solids concentrations less than 10,000 parts per million.
2. The recharge zone is the area north of the Adelup-Pago Fault, which is closely approximated by the municipal boundaries of Agana, Agana Heights, and Chalan Pago-Ordot. The zone is interrupted by the Agana River Basin, a portion of the Fonte River Basin, and raised volcanic intrusive formations in the Mataguac Hill and Mount Santa Rosa areas. Water from the Agana and Fonte Rivers may enter the ground waters through seepage from channel beds, and runoff from the exposed volcanic formations in the Mataguac Hill and Mount Santa Rosa areas enters the ground waters through infiltration. The Pago River flows along the eastern portion of the Adelup-Pago Fault. Although precise measurements are not available, some water from the Pago River may enter the northern ground waters through seepage from the stream bed.
3. The stream-flow source zone is the portions of the Pago and Fonte River Basins south of the Adelup-Pago Fault. Water from these areas may enter the northern ground waters through stream bed seepage.
4. The US military installations that are affected by this designation are Anderson Air Force Base, the US Naval Communications Stations at Fingayan and Barrigada, and the US Naval Air Station at Agana.



FIGURE 1. NORTHERN GROUND WATER SYSTEM OF GUAM

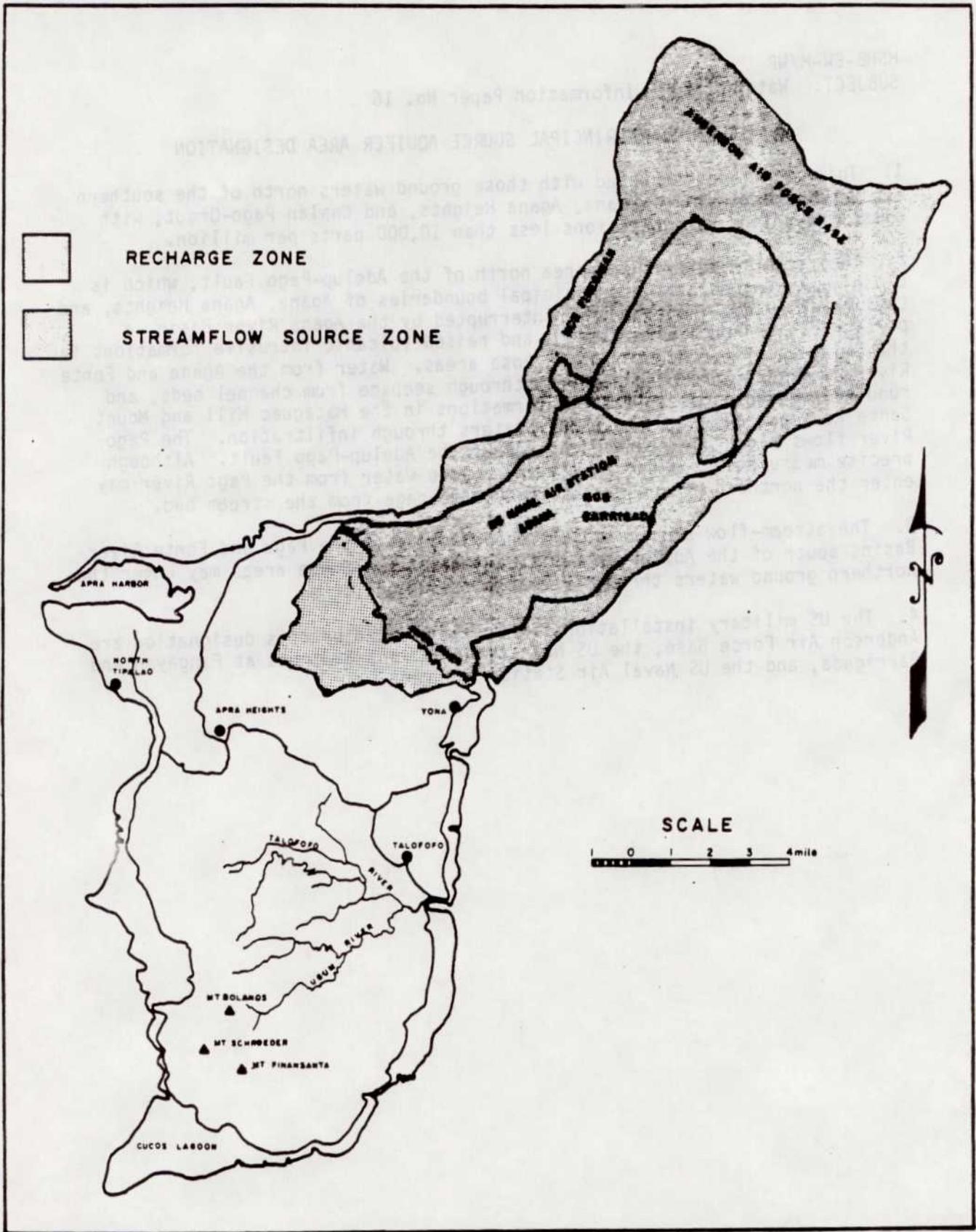


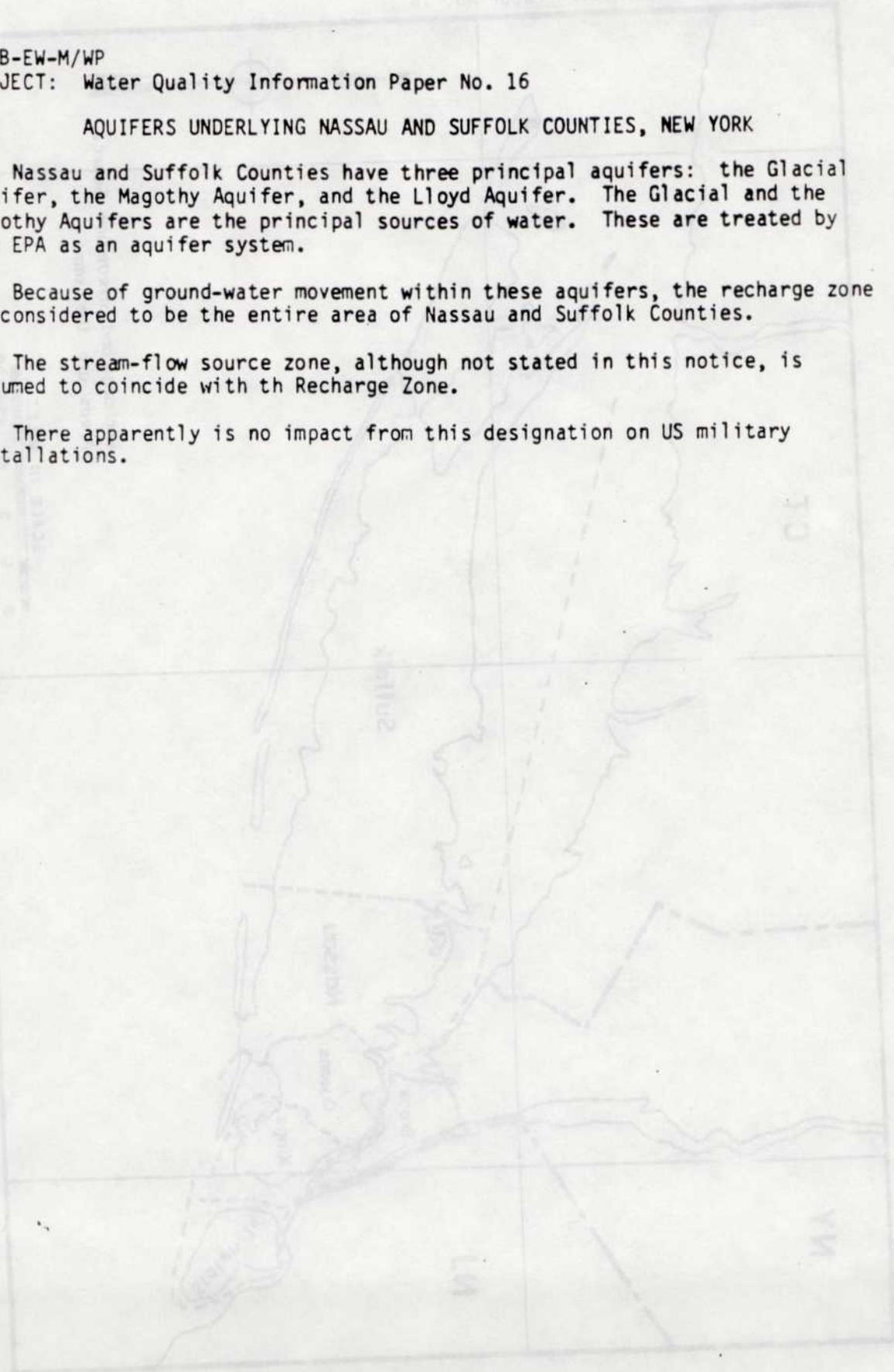
FIGURE. NORTHERN GROUND WATER SYSTEM OF GUAM

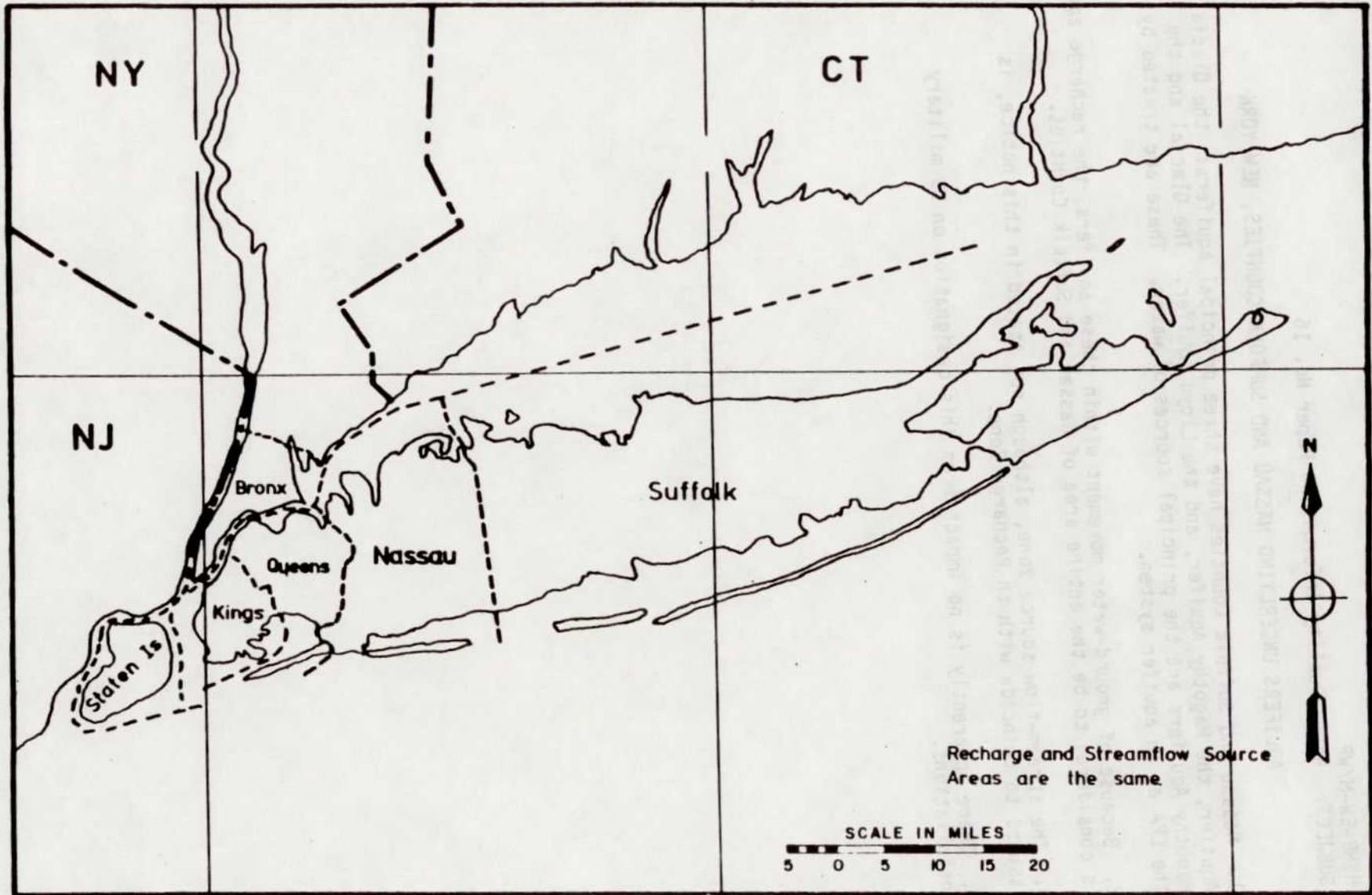
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AQUIFERS UNDERLYING NASSAU AND SUFFOLK COUNTIES, NEW YORK

1. Nassau and Suffolk Counties have three principal aquifers: the Glacial Aquifer, the Magothy Aquifer, and the Lloyd Aquifer. The Glacial and the Magothy Aquifers are the principal sources of water. These are treated by the EPA as an aquifer system.
2. Because of ground-water movement within these aquifers, the recharge zone is considered to be the entire area of Nassau and Suffolk Counties.
3. The stream-flow source zone, although not stated in this notice, is assumed to coincide with the Recharge Zone.
4. There apparently is no impact from this designation on US military installations.





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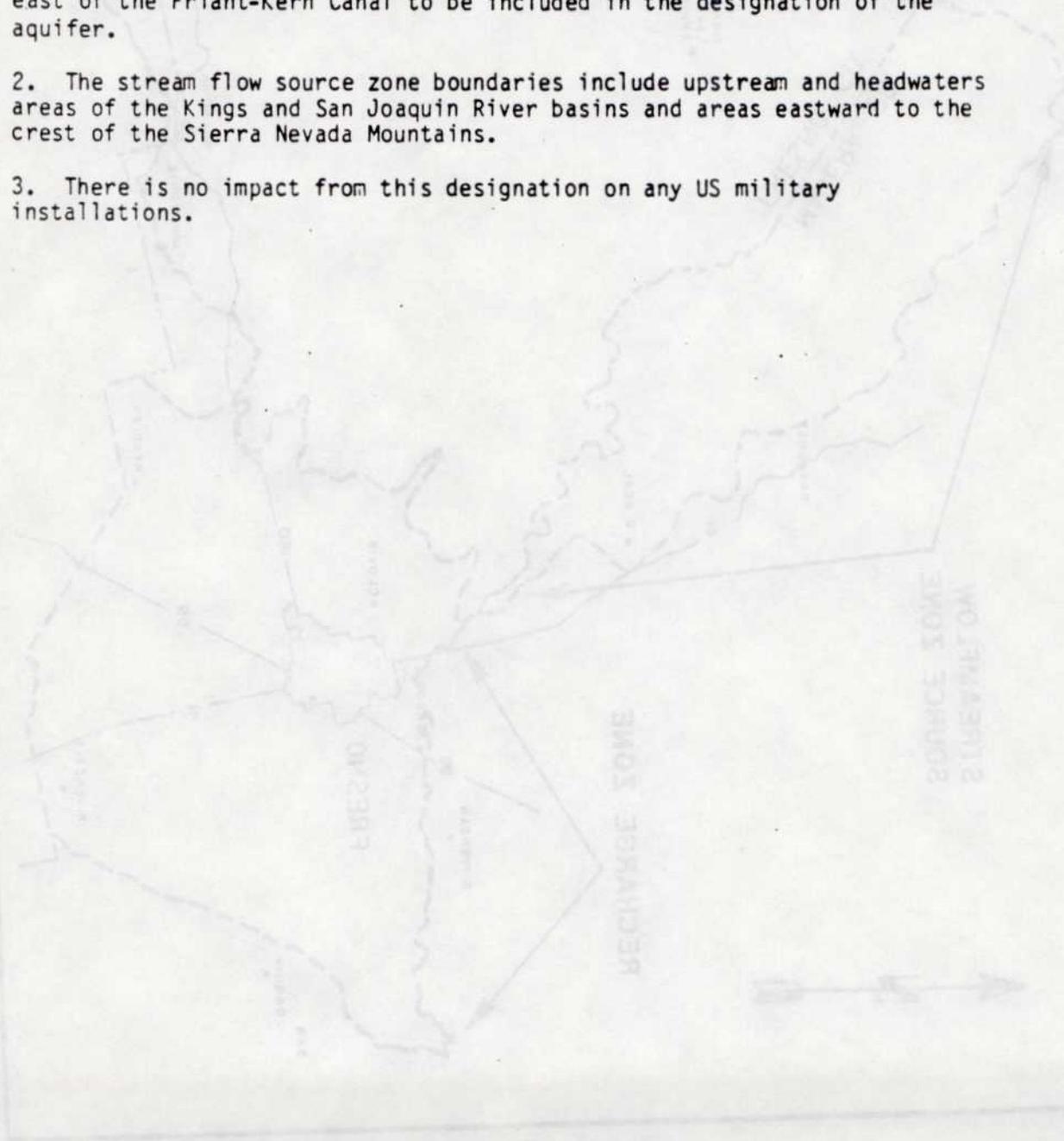
FIGURE. NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK

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GROUNDWATER SYSTEM OF CENTRAL FRESNO COUNTY, CALIFORNIA

1. The portion of the aquifer which has been designated, includes consolidated and unconsolidated bounded by the Fresno County boundary on the south, the middle of the San Joaquin River on the north, the Friant-Kern Canal on the east, and the Fresno Slough Bypass on the west. Because of the geology and hydrology of the area, the area designated as the aquifer is the recharge zone. Although the actual recharge zone extends to the foothills of the Sierra Nevada Mountains, the applicant did not request the recharge zone east of the Friant-Kern Canal to be included in the designation of the aquifer.
2. The stream flow source zone boundaries include upstream and headwaters areas of the Kings and San Joaquin River basins and areas eastward to the crest of the Sierra Nevada Mountains.
3. There is no impact from this designation on any US military installations.



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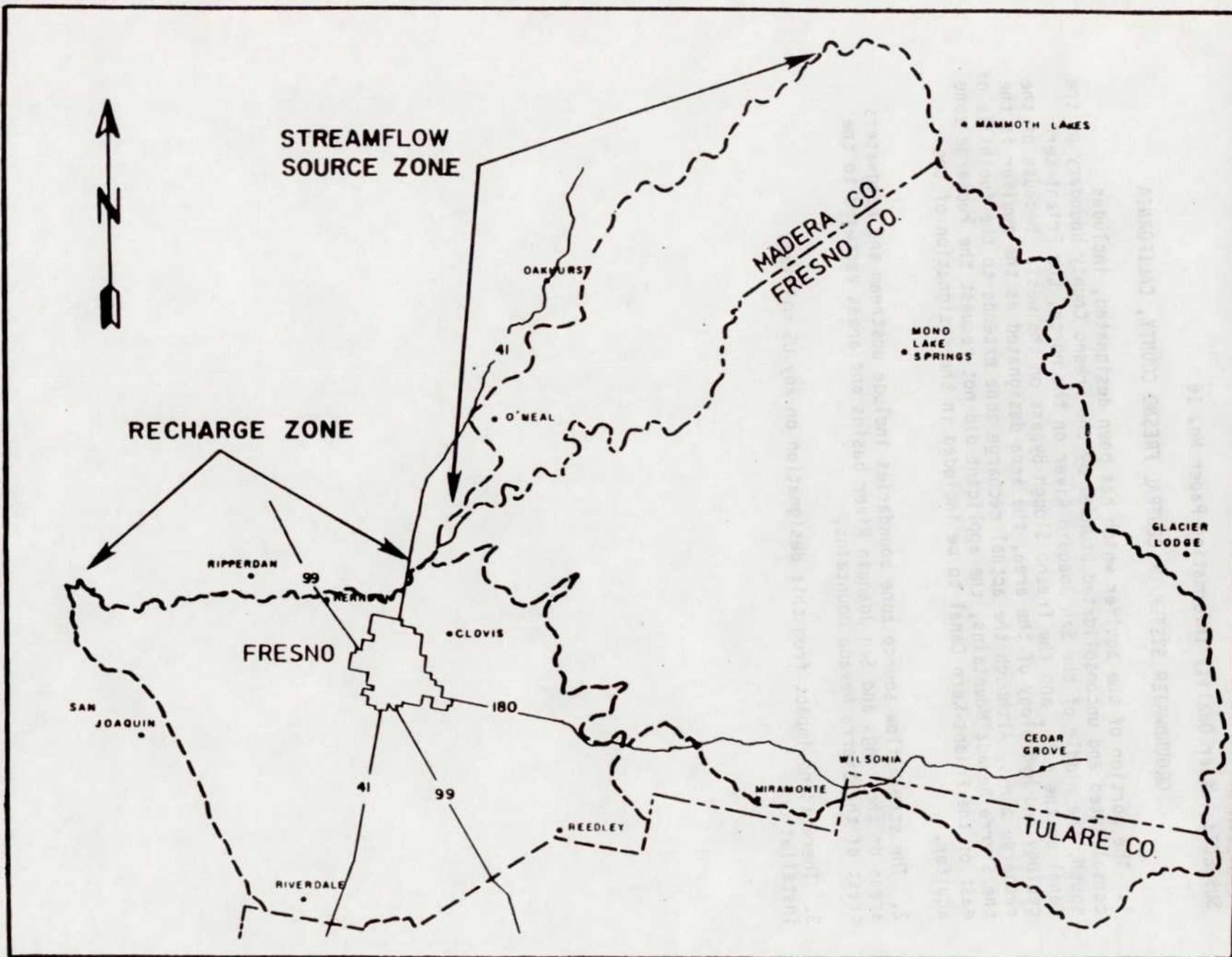


FIGURE. GROUND-WATER SYSTEM OF CENTRAL FRESNO COUNTY

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BISCAYNE AQUIFER SYSTEM OF FLORIDA

1. The aquifer is highly permeable and vulnerable to contamination through its recharge zone. The Biscayne Aquifer lies within an area of southern Florida, bounded by the Atlantic Ocean and the Gulf of Mexico, between Whitewater Bay in Monroe County and Delray Beach in Palm Beach County, and by a line drawn from the mouth of Whitewater Bay northeasterly and northerly to the intersection of the northern boundary of Monroe County and western boundary of Dade County, and thence northerly and northeasterly to the intersection of the North New River Canal and the boundary line separating Broward and Palm Beach Counties, and finally east-northeasterly to Delray Beach. The enclosed area includes all of Dade County and parts of Broward, Monroe, and Palm Beach Counties.
2. The stream-flow source zone includes parts of Broward, Charlotte, Collier, Dade, Glades, Hendry, Highlands, Lake, Lee, Martin, Monroe, Okeechobee, Orange, Osceola, Palm Beach, Polk, and St. Lucie Counties.
3. This designation could have an impact on the US Naval and Marine Corps Recruit Training Command at Orlando, the Security Group Activity at Homestead, and Homestead Air Force Base.



FIGURE 1. BISCAYNE AQUIFER SYSTEM OF FLORIDA

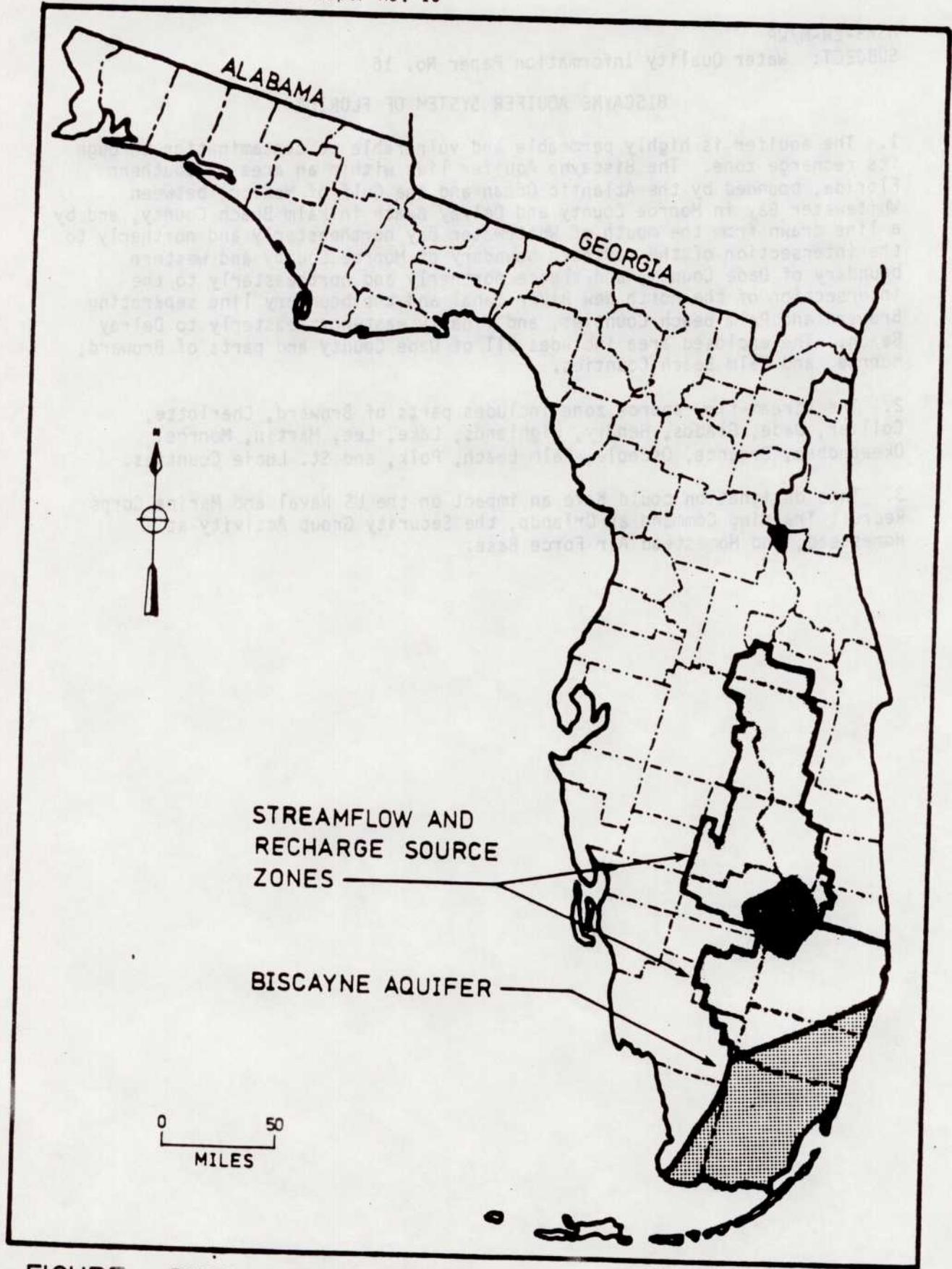


FIGURE. BISCAYNE AQUIFER SYSTEM OF FLORIDA

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AQUIFERS UNDERLYING WESTERN ESSEX AND SOUTHEASTERN MORRIS COUNTIES, NEW JERSEY

1. This aquifer lies in northern New Jersey and occupies portions of southeastern Morris and western Essex Counties. It is locally referred to as the Buried Valley Aquifer System. Geologically, the aquifer is a series of interlayered glacial sand, silts, and gravels deposited in an erosional valley underlain by shales and sandstones of the Brunswick Formation. The specific area designated as a sole source aquifer parallels the area known as the Central Basin of the Passaic River Watershed. The aquifer supplies water to approximately 600,000 people.

2. The surface boundary of the aquifer's recharge zone is identical with the boundary of the aquifer. The recharge zone is defined by the outside boundary of the following municipalities: On the south - Bernards and Warren Townships; on the east - Berkeley Heights, New Providence, Summit Millburn, and Livingston Townships and the towns of Roseland, Essex Falls, Caldwell, West Caldwell, and North Caldwell; on the north - towns Fairfield and Montville; on the west - Parsippany-Troy Hills, Morris Township, and Harding Township.

3. The stream-flow source zone for the aquifer lies within the boundaries of the Rockaway River Subbasin which is part of the Passaic River Basin. It includes all or part of the following municipalities: Bernardsville, Boonton Town, Boonton Township, Denveille, Dover, Jefferson, Kinnelon, Lincoln Park, Mendham Borough, Mendham Township, Mine Hill, Mountain Lakes, Mount Arlington, Randolph, Rockaway Borough, Rockaway Township, Roxbury Sparta, Victory Gardens, and Wharton.

4. The ARRADCOM Picatinny Arsenal Support Activity, Dover, New Jersey is located in the recharge zone of this aquifer. It also receives its water from this aquifer.

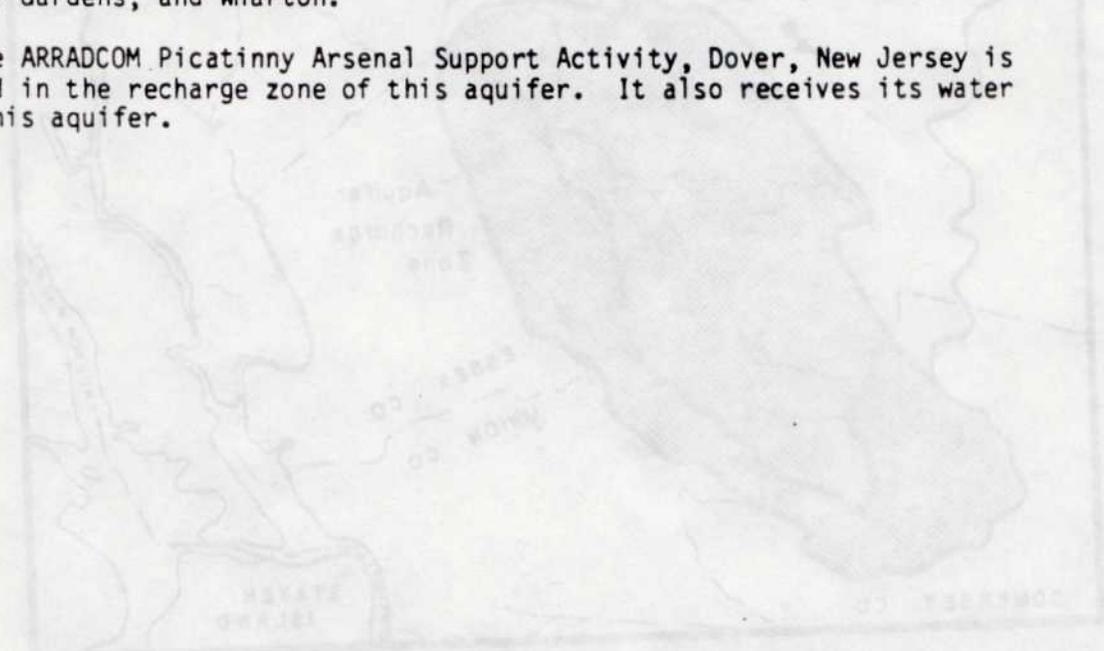


FIGURE 1
AQUIFERS UNDERLYING WESTERN ESSEX
AND SOUTHEASTERN MORRIS COUNTIES,
NEW JERSEY

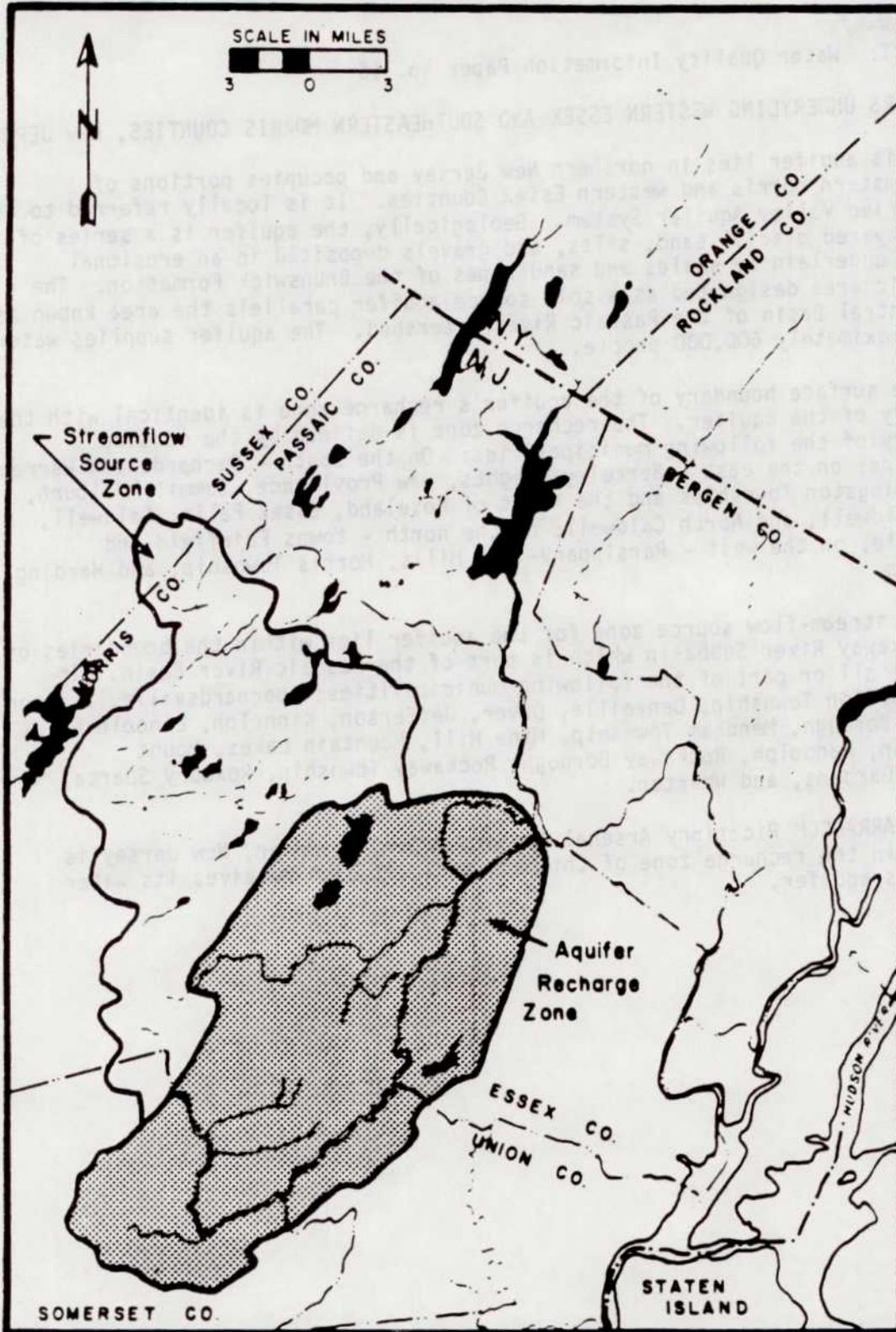


FIGURE. AQUIFERS UNDERLYING WESTERN ESSEX AND SOUTHEASTERN MORRIS COUNTIES, NEW JERSEY

MARYLAND PIEDMONT AQUIFER

1. The designation of this portion of the Piedmont Aquifer as a principal or sole source aquifer is unique in that the water-bearing strata are not unlike the rest of the Piedmont located along most of the east coast of the United States. The metamorphic rocks of this area provide ground water and ground-water flow through fractures. These ground-water aquifers are very ill-defined throughout much of the Piedmont because of their uncertain stratigraphic and structural arrangements in the subsurface; i.e., these metamorphic rocks have been heavily folded, faulted, and contorted to the point that only very small areas can be defined as having a uniform geology and hydrogeology. So complex is the hydrogeology that the designated area has been defined by drainage basin. Therefore, the designated aquifer, recharge zone, and stream-flow source zone are the same.
2. The designated area is defined by the arrangement and relationships which exist between seven drainage basins and subdrainage basins. The designated area, recharge zone, and stream-flow source zone are defined as follows:
 - a. Little Seneca Creek Basin - From the headwaters of Little Seneca Creek to the confluence with Great Seneca Creek, including the Ten Mile Creek and Bucklodge Creek drainage basins.
 - b. Little Monocacy River Basin.
 - c. Little Bennett Creek Basin - From the headwaters of Little Bennett Creek to the confluence with Bennett Creek.
 - d. Bennett Creek Basin - From the headwaters of Bennett Creek to the confluence with Little Bennett Creek.
 - e. Fahrney Branch Creek Basin - From the headwaters of Fahrney Branch Creek to the confluence with Bennett Creek.
 - f. Patuxent River Basin - From the headwaters of the Patuxent River to the confluence with Cabin Branch Creek.
 - g. South Branch Patapsco River Basin - From the headwaters of the South Branch Patapsco River to the confluence with Gillis Falls.
3. The nearest US Army installation, Fort Detrick, is located approximately 8 miles to the northwest of the designated area. It, therefore, falls outside of the designated area and has no impact on the area since it is located in a different hydrogeological environment.

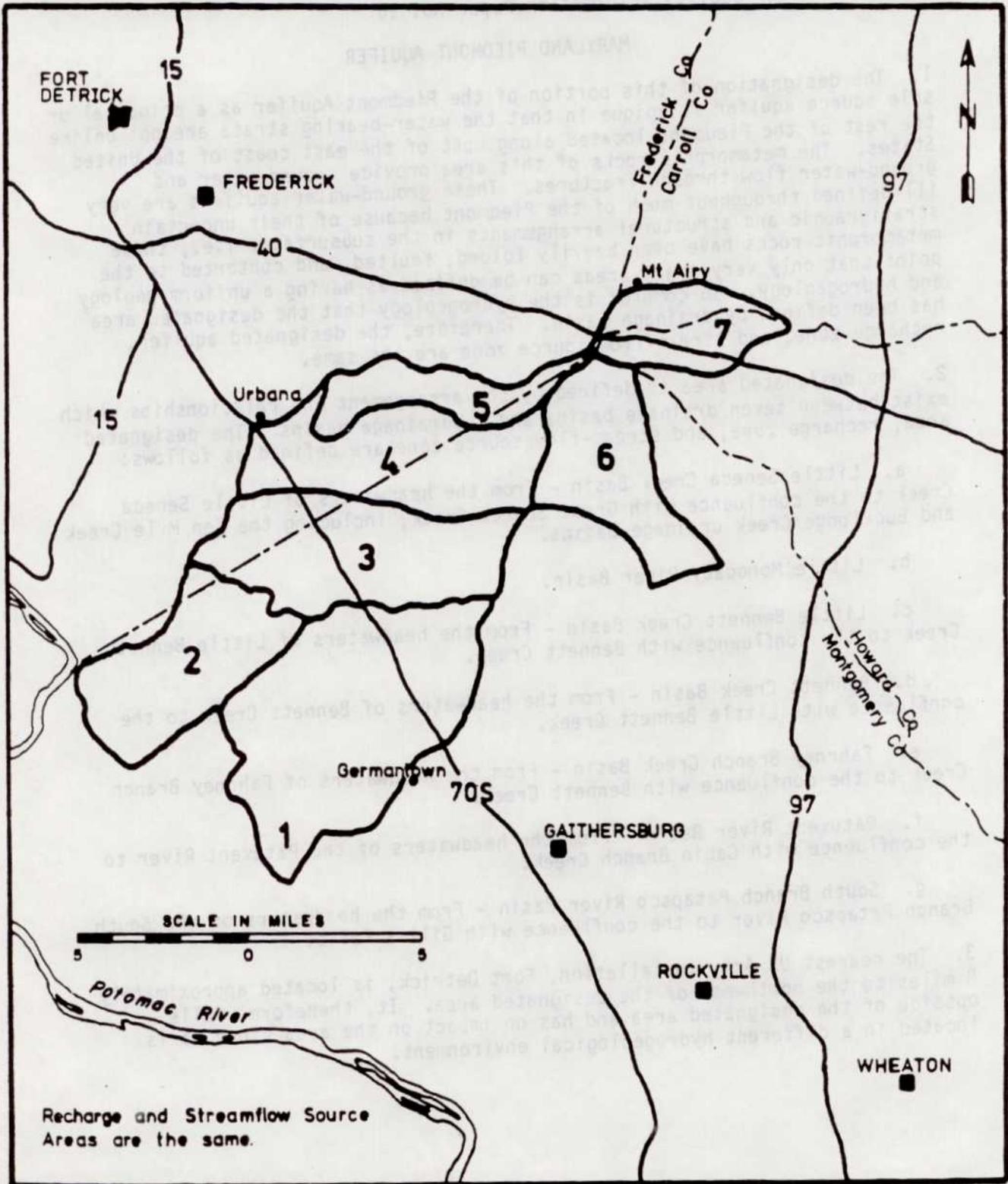


FIGURE. MARYLAND PIEDMONT AQUIFER

CAPE COD AQUIFER, MASSACHUSETTS

1. Cape Cod is located within Barnstable County in southeastern Massachusetts. It is a peninsula which extends 40 miles into the Atlantic Ocean and constitutes 440 square miles. It is separated from the mainland by the Cape Cod Canal. The Cape Cod Aquifer, recharge zone, and stream-flow source zone are one and the same. The aquifer is considered to be a single, continuous aquifer. It is of glacial origin and consists of unconsolidated sand, gravel, silt, and clay deposits. It is highly permeable and receives recharge principally from precipitation events.
2. The boundaries of the aquifer and, therefore, its recharge zone are the Cape Cod Canal, Cape Cod Bay, Atlantic Ocean, Nantucket Sound, and Buzzards Bay.
3. There are no US Army installations which would impact on the quality of ground water.

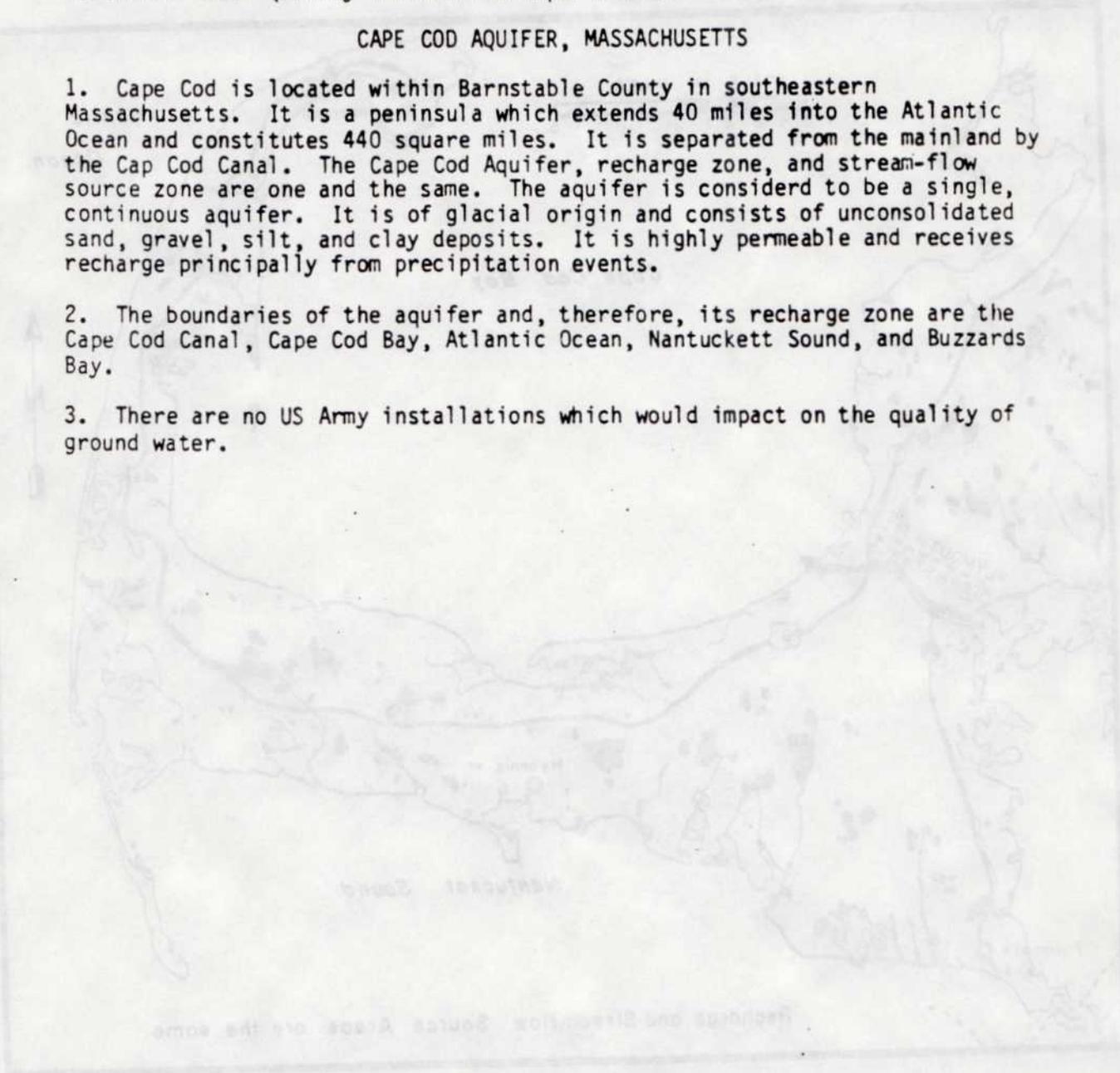


FIGURE 1. CAPE COD AQUIFER, MASSACHUSETTS

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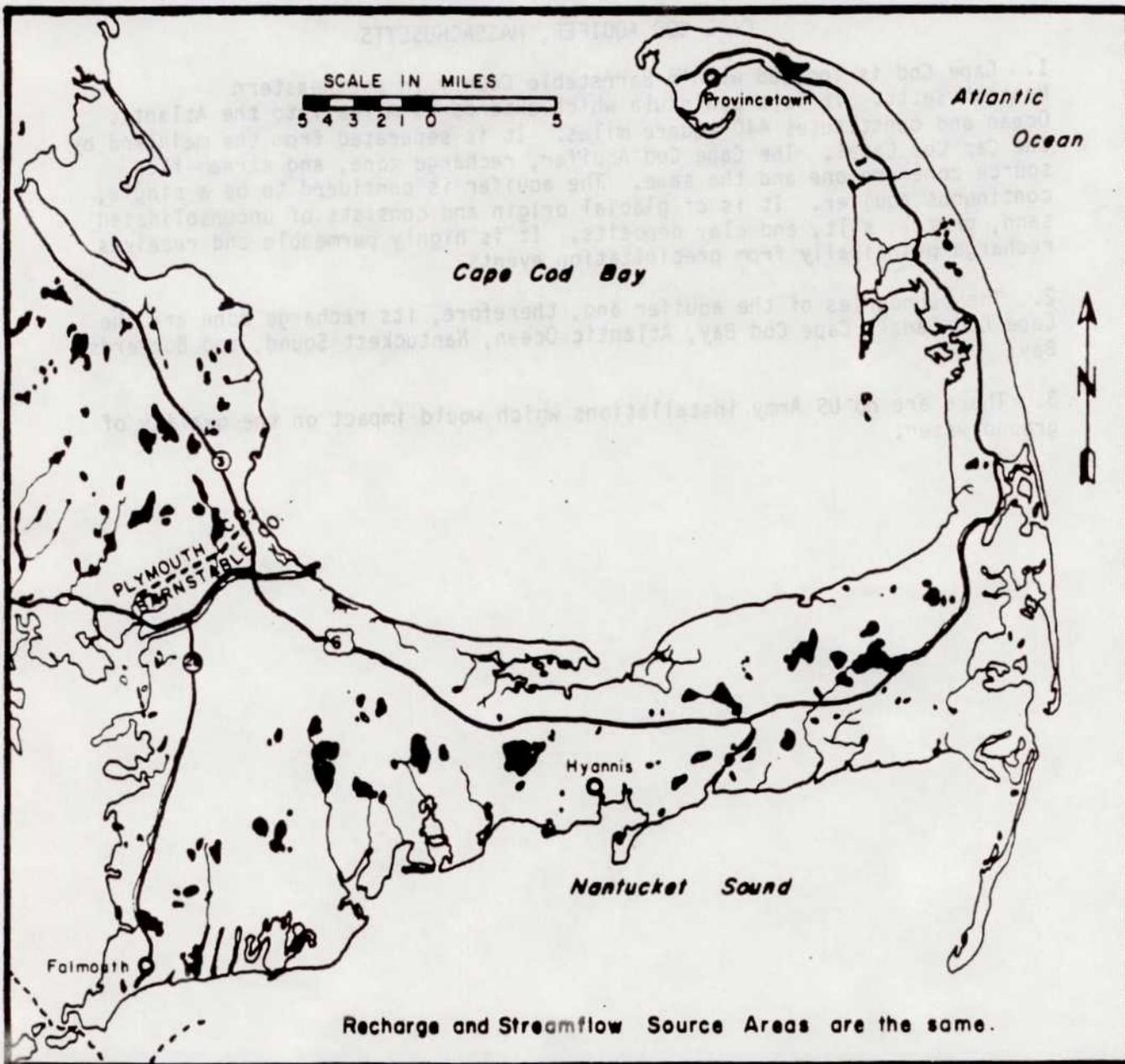


FIGURE. CAPE COD AQUIFER, MASSACHUSETTS

HSHB-EW-M/WP

SUBJECT: Water Quality Information Paper No. 16

WHIDBEY AND CAMANO ISLAND, WASHINGTON

1. Whidbey and Camano Islands are located in the northern reaches of Puget Sound, Washington, near the east end of the Strait of Juan de Fuca. Total land area of both islands is 212 square miles, with Whidbey Island constituting 81 percent of this land area. Although Whidbey and Camano are two distinct and separate islands, due to their similar origin and hydrogeology, they have been included together in the same announcement. They are of glacial origin and are composed of a series of interlayered and intercalated beds of glacial sands and gravel, with semipermeable glacial till layers and discontinuous clay lenses. Even though the subsurface contains many different layers of materials, it behaves hydraulically as a single complex unit.
2. Since the entire island (in either case) is composed of these glacial layers, the area of designation, recharge zone, and stream-flow source zone are the same. Recharge occurs totally by infiltration from precipitation events. Therefore, the boundaries of the area of designation is the shoreline. Although, the aquifer does extend beyond the shoreline, salt water intrusion reduces the use of these areas as a source of drinking water.
3. There are no US Army installations that would impact on the ground-water conditions of either island.



FIGURE WHIDBY AND CAMANO ISLAND, WASHINGTON

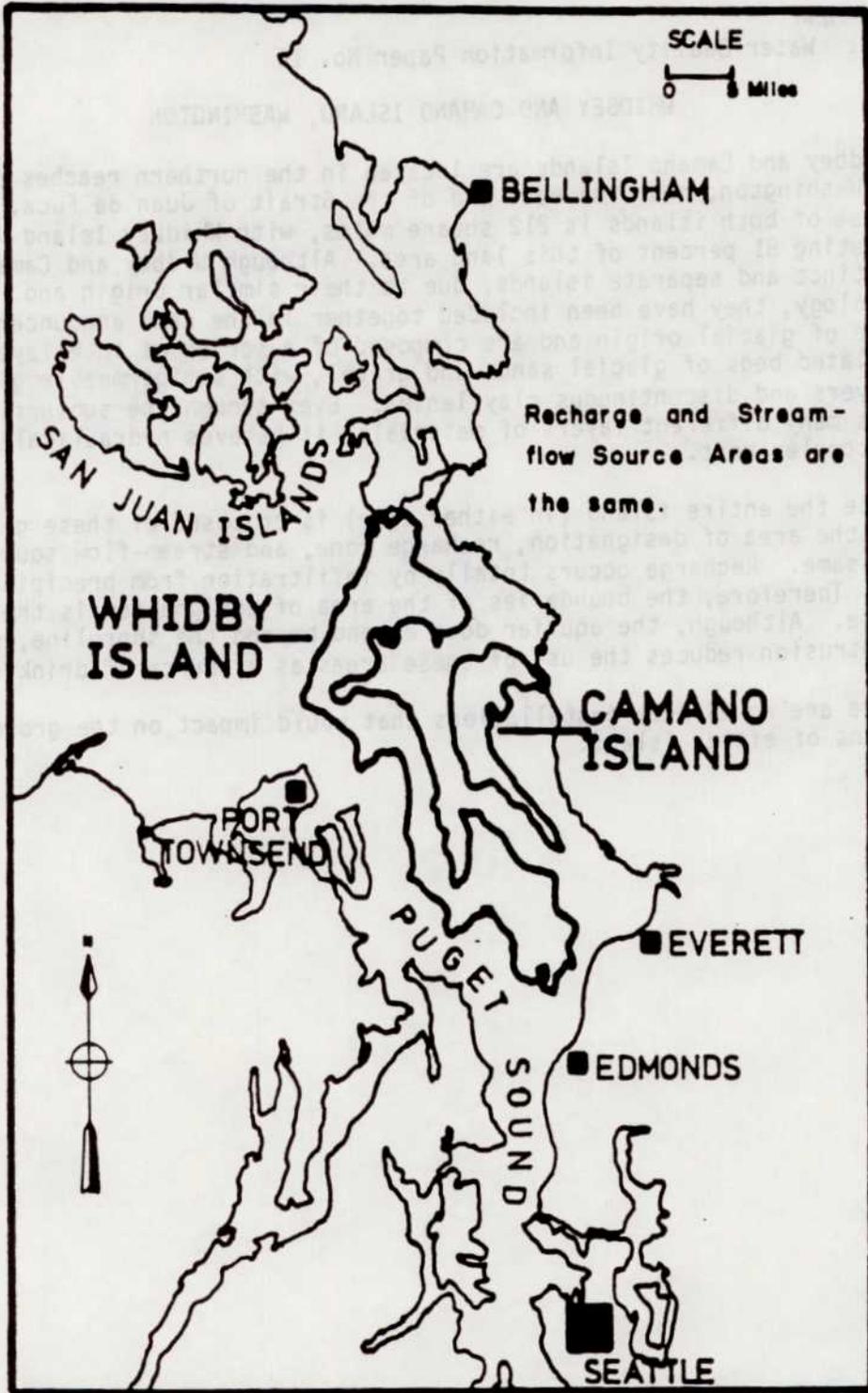


FIGURE. WHIDBY AND CAMANO ISLAND, WASHINGTON

