NCDENR
North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John E. Skvarla, III
Secretary

received
9-2-14 KH

August 21, 2014

Ken Flatt, Public Utilities Director
Dare County Water Department
600 Mustain Street
Kill Devil Hills, NC 27948

Re: Wellhead Protection Plan (dated 03/24/2014)
Dare County Water Department
Approved WHP Plan No. 110-R1

Dear Mr. Flatt:

We are pleased to inform you that the above referenced Wellhead Protection (WHP) Plan has been approved. The effective date of this approval is July 8, 2014 and applies to the following water systems.

Public Water Supply System	Water Supply No.
Cape Hatteras	NC0428025
Dare County Regional (NRO and Skyco)	NC0428030
Joseph "Mac" Midgett (Rodanthe, Waves, Salvo)	NC0428035
Stumpy Point	NC0628002

State WHP Programs are intended to be a key part of a national groundwater protection strategy to prevent contamination of groundwaters used as public drinking water supplies. Based upon our review, the subject WHP Plan meets the requirements for approval established under North Carolina's WHP Program.

In North Carolina, development of a WHP Plan is not mandatory, but rather, is viewed as a valuable supplement to existing State groundwater protection programs. North Carolina's WHP Program is intended for city and county governments and water supply operators interested in providing added protection to their local groundwater supplies. Once implemented, the WHP Plan reduces (but does not eliminate) the susceptibility of wells to contaminants. Proper implementation, maintenance, and periodic updating are essential for the local WHP Plan to be successful. Additionally, documentation of such is necessary to maintain the Plan's status as "active" and is required in order to obtain WHP priority rating points for future loan and grant applications.

Enclosed with this letter are maps of the approved wellhead protection areas for the Dare County Water System's wells. Should you find these maps to be in error, please contact this office within 14 days of receipt of this letter.

1634 Mail Service Center, Raleigh, North Carolina 27699-1634
Phone: 919-707-9100 \ FAX: 919-715-4374 \ Lab Form FAX: 919-715-6637 \ Internet: www.ncwater.org/pws/

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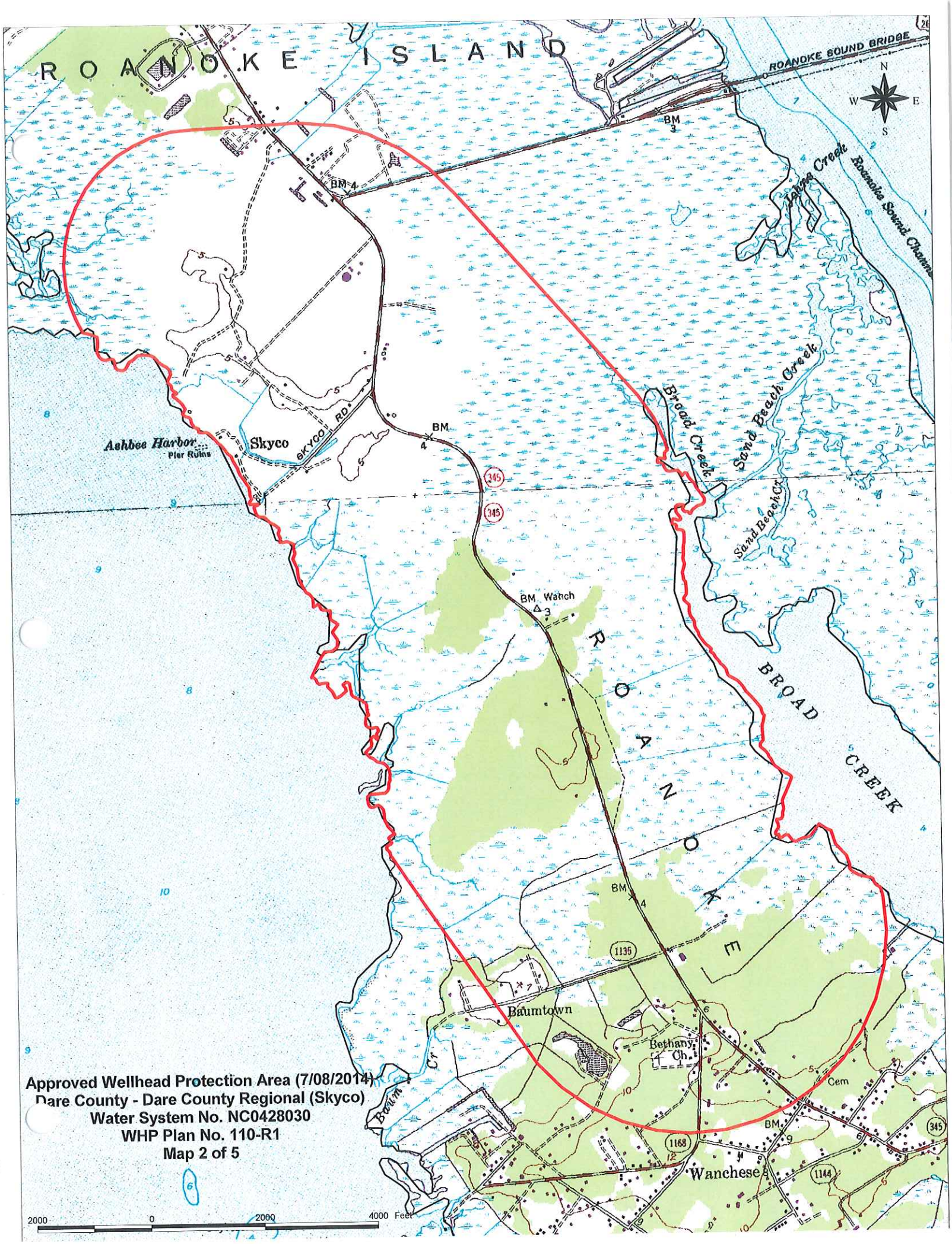
I would like to take this opportunity to thank Dare County and the Dare County Water Department for this effort to provide safe drinking water for its residents and visitors. I would also like to commend you for the priority that you and your staff have placed on Wellhead Protection. If you have any questions, please don't hesitate to contact me at (919) 707-9083.

Sincerely,

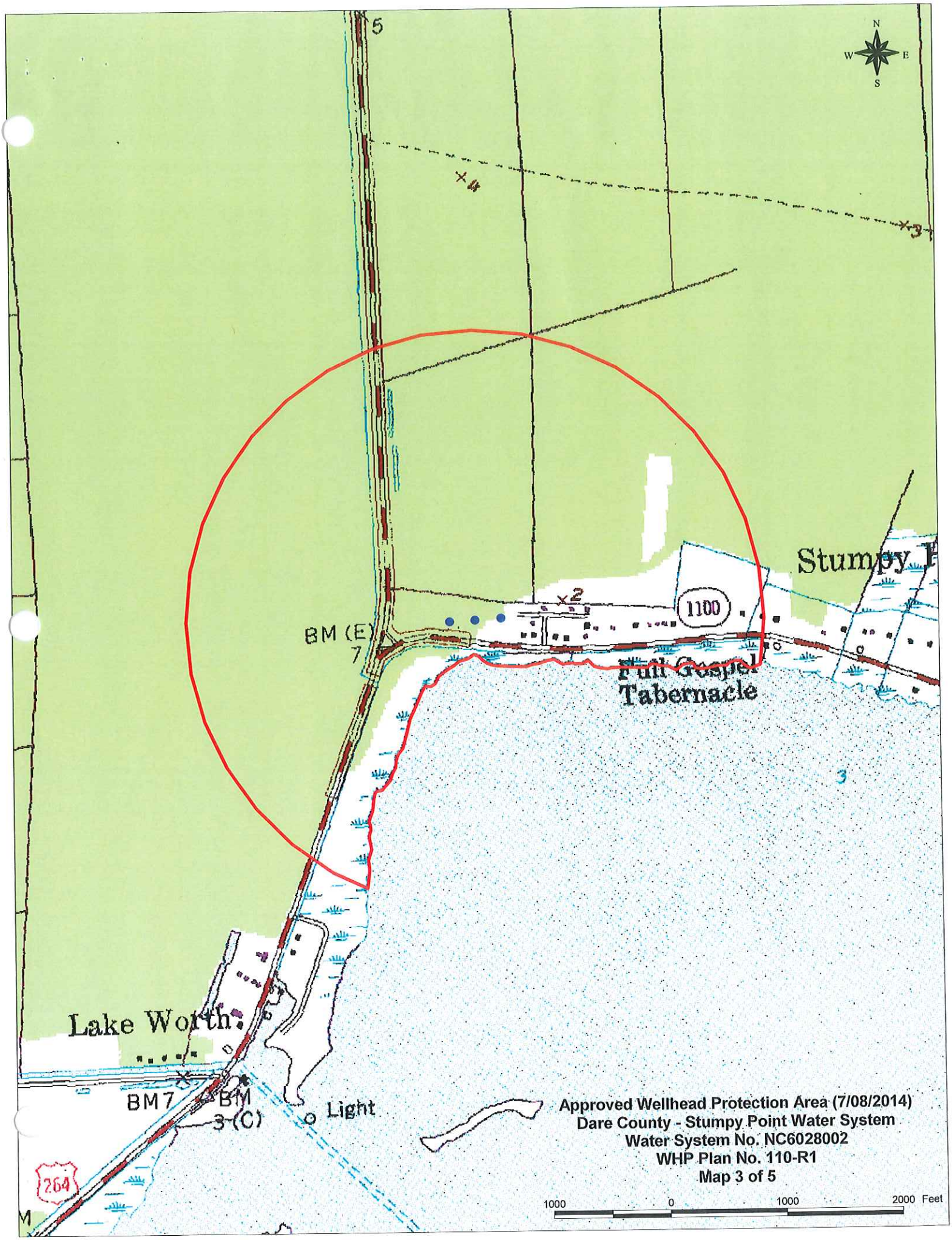
M. Gale Johnson, P.G., P.HG.
Wellhead Protection Program Manager

enclosures

cc: Washington Regional Engineer
Linda Smith, DWM
Keith Starner, NCRWA



Approved Wellhead Protection Area (7/08/2014)
Dare County - Dare County Regional (Skyco)
Water System No. NC0428030
WHP Plan No. 110-R1
Map 2 of 5


N
W
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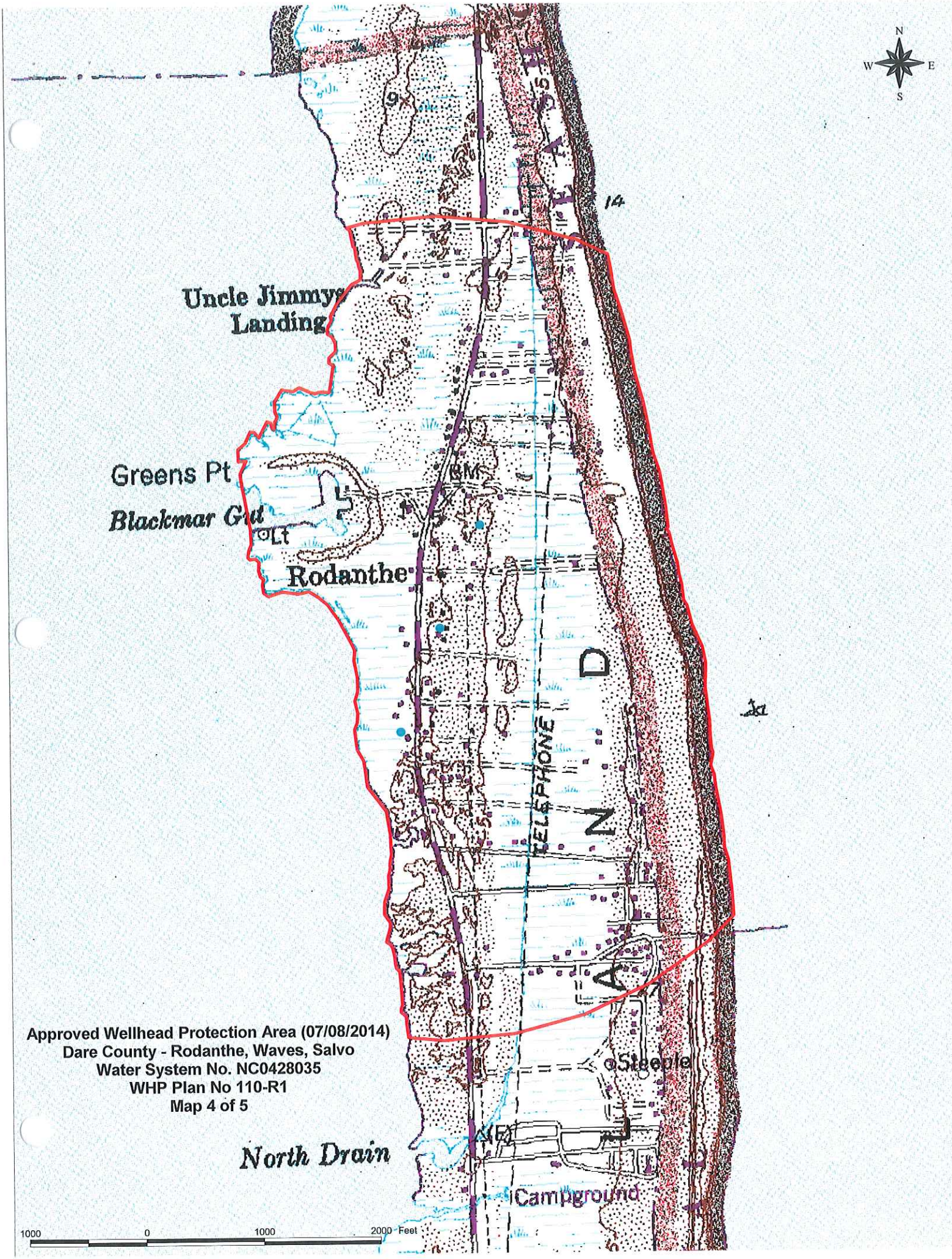
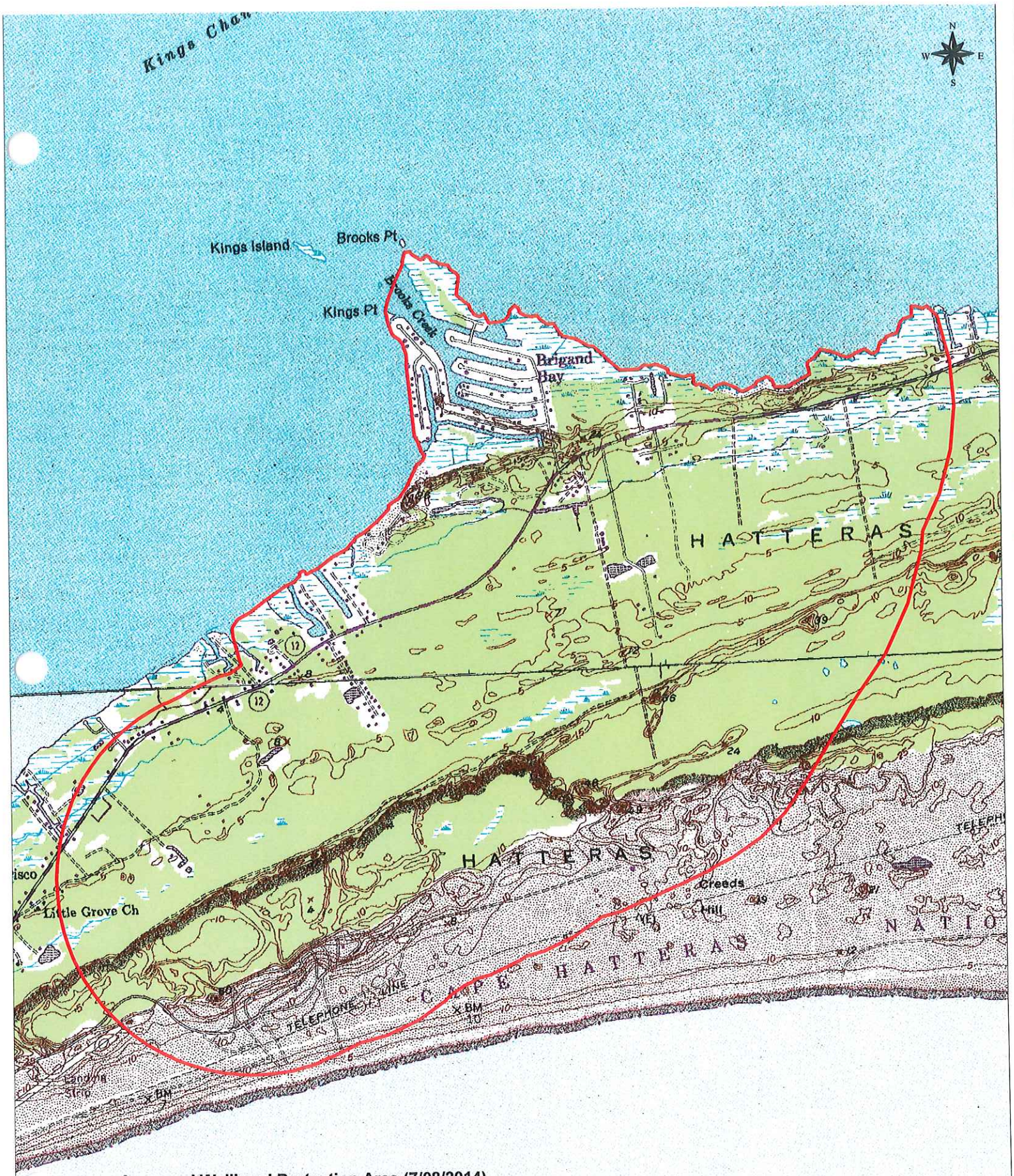
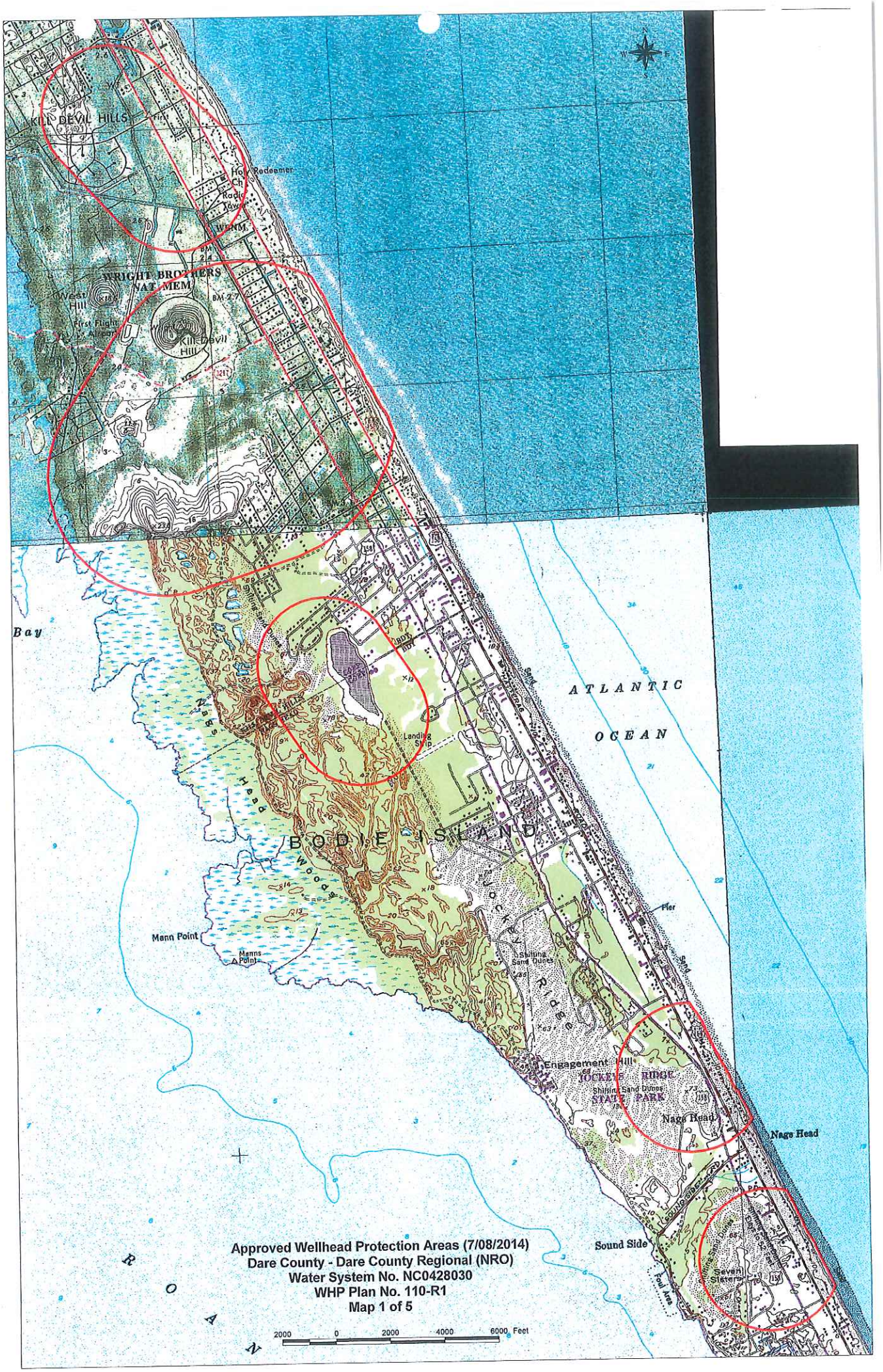
5
X4
X3
X2
1100
BM (E)
7
Full Gospel
Tabernacle
Stumpy P
3
Lake Worth
BM 7
BM
3 (C)
Light
264
Approved Wellhead Protection Area (7/08/2014)
Dare County - Stumpy Point Water System
Water System No. NC6028002
WHP Plan No. 110-R1
Map 3 of 5
1000
0
1000
2000 Feet



Approved Wellhead Protection Area (07/08/2014)
Dare County - Rodanthe, Waves, Salvo
Water System No. NC0428035
WHP Plan No 110-R1
Map 4 of 5



Approved Wellhead Protection Area (7/08/2014)
Dare County - Cape Hatteras
Water System No. NC0428025
WHP Plan No 110-R1
Map 5 of 5


KILL DEVIL HILLS
WRIGHT BROTHERS NAT MEM
West Hill
Kill Devil Hill
Bay
ATLANTIC OCEAN
BODIE ISLAND
Mann Point
Manns Point
Engagement Hill
JOCKEYS RIDGE STATE PARK
Nags Head
Nags Head
Sound Side
Seven Sisters
Pier
Landing Strip
Approved Wellhead Protection Areas (7/08/2014)
Dare County - Dare County Regional (NRO)
Water System No. NC0428030
WHP Plan No. 110-R1
Map 1 of 5
2000 0 2000 4000 6000 Feet

WELLHEAD PROTECTION PLAN

for

Dare County Water Department
Dare County, North Carolina

Public Water Supply Identification Numbers:

- Dare County Regional, 04-28-030
- Joseph "Mac" Midgett, 04-28-035
- Cape Hatteras, 04-28-025
- Stumpy Point WSD, 60-28-002

March 24, 2014
Revision 3

Mr. Ken Flatt, Public Utilities Director
Dare County Water Department
600 Mustain Street
Kill Devil Hills, North Carolina 27948
(252) 475-5606,
Fax (252) 441-2239

BACKGROUND

In 1986, Safe Drinking Water Act amendments added Section 1428, "State Programs to Establish Wellhead Protection Areas," which requires each state to develop a program to "protect wellhead areas within their jurisdiction from contaminants which may have any adverse affects on the health of persons". The term wellhead protection area (WHPA) is defined in the law as "the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield". North Carolina's EPA-approved Wellhead Protection Program provides technical support to local governments and public water supply systems in their endeavors to develop and implement their own Wellhead Protection Plans (WHPPs).

North Carolina's objective in developing a protection plan is to provide a process for public water system operators to learn more about their groundwater systems and how to protect them. Wellhead Protection Plans allow communities to take charge of protecting the quality of their drinking water by identifying and carefully managing areas that supply groundwater to their public wells. Implementation of a WHPP in North Carolina is voluntary.

INTRODUCTION

Dare County is located entirely within the Tidewater Region of central eastern North Carolina. While most of the land area in the county is on the easternmost portion of the North Carolina mainland, the majority of the state's barrier islands are also within the county limits. Manteo, the County Seat, is located on Roanoke Island, between the mainland and the Outer Banks. Figure 1 shows the location of the county's five water treatment plants. This plan was developed as a five-year update of the 2006 WHPP.

Elevations in the county range from sea level to a height of 138 feet at Jockey's Ridge State Park, which is the largest natural sand dune in the eastern United States. The average elevation in the county is 11 feet above sea level. Surface sediments are of Pleistocene to recent age and consist of sands, clays, gravels, and peats, which were deposited in marine environments. With the exception of the dune ridges along the Outer Banks, the terrain in Dare County is flat with slopes of only a few feet per mile. Drainage in the area is directly to the ocean and sounds.

The economy in Dare County is driven by the tourist industry and because of Dare's beautiful beaches and attractions, the population is highly seasonal. There are approximately 34,573 year-round residents as of 2012 (US Census Bureau). During the peak summer vacation season, the population swells to more than 225,000. The county has numerous cultural and historical places of interest, including parks, gardens, and museums, which draw thousands of visitors to the Outer Banks each year. The county is

home to the famous Cape Hatteras and Bodie Island Lighthouses, the Wright Brothers National Memorial, Jockey's Ridge State Park, and the Bonner Bridge spanning Oregon Inlet. The adjacent Atlantic Ocean and sounds, with their prolific numbers of game fish of many species, make it a year-round attraction for fishermen.

The Dare County Water Department service area extends from the Town of Duck on the northern Outer Banks, to Cape Hatteras in the south. The system's water plants also serve Roanoke Island and a small area on the mainland. The population served by the Water Department is highly variable due to seasonal tourism. The average daily usage for the five water plants which comprise the Water Department is 8.15 million gallons per day. Dare County's water systems have a total of over 357 miles of distribution lines and the water supply comes entirely from groundwater.

The county water system is composed of four separate water systems, each with unique Public Water Supply identification numbers (PWSIDs):

- Dare County Regional Water System (composed of the Skyco ion exchange and North Reverse Osmosis water treatment plants);
- Joseph "Mac" Midgett reverse osmosis plant (formerly the RWS plant);
- Cape Hatteras reverse osmosis-ion exchange plant; and
- Stumpy Point WSD reverse osmosis plant.

Two of the service areas (Mac Midgett and Hatteras) are on the barrier islands, one is on the mainland (Stumpy Point), and one system serves portions of Roanoke Island and the northern Outer Banks (Dare Regional). Water sources include the confined Tertiary-age Yorktown aquifer, and the unconfined surficial aquifer of the Buxton Woods area, which is unique to the Hatteras water treatment plant. The County systems use a variety of techniques to purify and desalinate raw water. Table 1 lists available data for wells in the Dare County water systems. The well construction record for Skyco 14 well is included in the appendix, as the well was added since the last revision of this plan.

North RO Water Plant and Skyco Ion Exchange Water Plants

The Dare County Regional system (PWSID 04-28-030) is composed of the North reverse osmosis (NRO) plant, which serves the northern outer banks and all towns north of Oregon Inlet, and the Skyco plant, which serves portions of Roanoke Island. The Regional System serves approximately 22,800 persons.

The Skyco ion exchange plant (Figure 2), was brought on line in 1979. It can produce 6 million gallons of finished water from its ten water supply wells in the confined aquifer, and serves Manteo and the Dare beaches. One well has been constructed since the 2006 Wellhead Protection Plan in the northern portion of the Skyco wellfield. Skyco 14's location slightly enlarged the wellhead protection area, but included no new potential contaminant sources. The system has two million gallons of ground storage capacity, and a 200,000 gallon elevated storage tank. Skyco is interconnected to the NRO plant by a 24-inch main running under the Roanoke Sound. Auxiliary generators can operate the entire plant during power outages.

The NRO plant (Figures 3A through 3D), brought on line in 1989, is also part of the Dare Regional system. This plant is capable of producing 5 million gallons per day, and serves the northern Outer Banks towns of Duck, Southern Shores, and Kitty Hawk, with wholesale service to the towns of Nag's Head and Kill Devil Hills. The NRO plant has 14 water supply wells screened in the Yorktown aquifer, and two 5 million gallon ground storage tanks. Elevated water storage tanks are located in Duck (1 MG), Southern Shores (0.5 MG), and Colington (0.5 MG). Auxiliary diesel generators can support the production of two million gallons per day in the event of a power outage.

Stumpy Point Reverse Osmosis Water Plant

The Stumpy Point Reverse Osmosis plant (PWSID 60-28-002) has two deep wells that supply water to 138 accounts on the mainland (Figure 4). The system began operation in late 2002, and has a 75,000 gallon elevated storage tank. The system has a finished water production capacity of 60,000 gallons per day, and serves approximately 125 residences. Emergency generators can support operations for the entire plant. There are no interconnections with other systems.

Joseph "Mac" Midgett Reverse Osmosis Water Plant

The Joseph "Mac" Midgett (formerly the Rodanthe, Waves, and Salvo Plant) reverse osmosis drinking water plant (PWSID 04-28-035), located on the southern Outer Banks, was brought on line in 1996. Figure 5 shows the location of the Mac Midgett water plant wellhead protection area. The system has two deep wells screened in the mid-Yorktown aquifer, one-million gallons of ground storage, and a 200,000 gallon elevated storage tank at Chicomacomico. The plant is capable of producing 1.25 million gallons per day. Portable generators can support plant operations in the event of power outages. The system has no interconnections and serves approximately 1,800 customers.

Cape Hatteras Reverse Osmosis and Anion Exchange Water Plant

The Hatteras reverse osmosis and anion exchange water treatment plant (PWSID 04-28-035) is located on Hatteras Island, and is capable of producing 2 million gallons per day. The plant serves Avon, Buxton, Frisco, and Hatteras and uses two separate treatment processes: Anion exchange and filtration, and reverse osmosis. Figure 6 depicts the WHPA for the Cape Hatteras wellfield. The system has a total of 23 water supply wells, four of which are deep wells screened in the confined Yorktown aquifer, which are connected to the reverse osmosis plant, and 19 wells that produce fresh water from the surficial aquifer after treatment in the anion exchange/filtration system. The system began operation in early 2000. There is a 400,000 gallon elevated storage tank in the town of Avon, two elevated tanks in Buxton (100,000, and 400,000 gallons), and a 300,000 gallon tank in Hatteras. The system has two auxiliary generators and one portable generator that can support the production of one million gallons per day during power disruptions. There are no interconnections with other systems, and the plant serves approximately 5,500 customers.

Dare County Water Department Mission Statement

"Our water system personnel are dedicated to providing the community with safe, clean, healthy, fresh water for drinking and other purposes, 24 hours a day, for a reasonable cost."

Dare County is a beautiful vacation area and a valuable natural resource of state and national importance. The County water department prides itself on delivering safe, high quality drinking water to its year-round citizens and the thousands of tourists that visit each year.

I. THE WELLHEAD PROTECTION COMMITTEE

A Wellhead Protection Committee (WPC) was formed to develop a Wellhead Protection Plan for Dare County. The Committee consists of:

- Mr. Ken Flatt, Public Utilities Director,
- Mr. Ryan Brower, Dare County Public Utilities,
- Mr. Lawrence Battaile, Plant Superintendent, NRO Plant,
- Mr. Terry Goldman, Plant Superintendent, Cape Hatteras Plant,
- Mr. Jerry Lofland, Plant Superintendent, Mac Midgett Plant, and,
- Mr. Keith Starner, North Carolina Rural Water Association.

The Public Utilities Director and the Assistant Utilities Director are responsible for implementing the plan. They have accepted the recommendations made in the plan by the WPC. Dare County will begin implementation of the plan immediately following approval by the Public Water Supply Section of NCDENR and will complete implementation within ninety (90) days.

Upon completion of the implementation phase of the Wellhead Protection (WHP) Plan, the Utilities Director will submit notification to the Public Water Supply Section in accordance with the schedule set forth in the approved WHP Plan.

The purpose of this Wellhead Protection Plan is to protect the County's groundwater resources by effective management of potential contaminants through public education, and to obtain additional preference points for construction grants and loans.

II. DELINEATING THE WELLHEAD PROTECTION AREA

The majority of the wells in the Dare County Water System draw water from the confined Yorktown aquifer, which is isolated from the land surface by a clay sedimentary unit confining layer. The wellhead protection areas for these wells were delineated using a ten-year time of travel aquifer source volume method. The delineations resulted in a

single large wellhead protection area for the Skyco wellfield, a set of five WHPAs for the NRO wells, and a single, circular WHPA for the Stumpy Point and Mac Midgett wellfields.

The nineteen shallow wells located on Hatteras Island draw water from the Buxton Woods unconfined surficial aquifer. This aquifer receives water directly from recharge in the form of precipitation, and there are no clay confining units to isolate and protect the aquifer. The protection area was delineated using a version of the calculated fixed radius method, resulting in an ellipse-shaped WHPA. The Hatteras water plant also has deep wells screened into the Yorktown confined aquifer. The wellhead protection area for the shallow wells intersected the WHPA of the deep wells, resulting in a single large protection area.

The WHPAs around the wells in the confined and unconfined aquifers were delineated using techniques outlined in publications from the Public Water Supply Section of the North Carolina Division of Environmental Health [1, 2]. The Public Water Supply Section reviewed and commented on the delineation during the development of the 2006 Wellhead Protection Plan. Figures 2 through 6 show the location of the wells, the resulting wellhead protection areas, and the approximate location of potential sources of contamination.

A. Wellhead Protection Area delineation in the confined aquifer

A ten-year time of travel aquifer source volume method was used to establish wellhead protection areas for wells screened in the confined Yorktown aquifer. This technique was used for the wells in the Dare County Regional System (both the NRO and Skyco plants), the Mac Midgett plant, the Stumpy Point wells, and the deep reverse osmosis wells in the Hatteras wellfield. The size of the wellhead protection area was determined by estimating the volume of aquifer material in cubic feet (V_a) required to support water withdrawals over a ten-year period.

The volume of the aquifer that supplies withdrawals for a specified period of time can be estimated with the following equation:

$$V_P = Q\left(\frac{gal}{\min}\right) \times t_d\left(\frac{\min}{day}\right) \times \left(\frac{ft^3}{7.48\ gal}\right) \times \left(\frac{365.25\ days}{year}\right) \times \frac{P\ (years)}{n}$$

[1] Ralph C. Heath and M. Gale Johnson, Proposed Revisions to the North Carolina Wellhead Protection Program, North Carolina Public Water Supply Section, July, 2001.

[2] North Carolina State University Water Quality Group, Wellhead Protection Guidebook, North Carolina Public Water Supply Section, 2003.

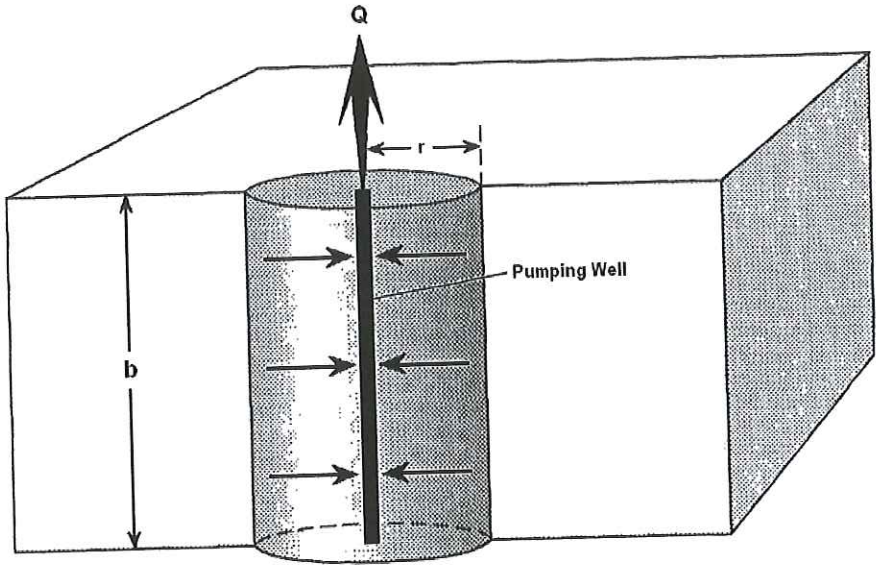
Where: V_P = the volume of aquifer in ft^3 that supplies withdrawals for period P,
Q = the well yield in gallons per minute,
t_d = the daily pumping period in minutes per day,
P = the period of withdrawals in years, and
n = the estimated porosity, dimensionless.

The well yield is the maximum sustained pumping rate possible for the well (not the daily pumping rate) as determined from a 24-hour drawdown test pursuant to North Carolina Administrative Code 15A NCAC 18C.0402(g). If well yield information is unavailable, the maximum capacity of the pump installed on the well may be substituted. The daily pumping period (t_d) is the number of minutes per day that the well is pumped and should equal 720 (the number of minutes in 12 hours). This value is used because State regulations require that the yield of a public water supply well provide the average daily demand in 12 hours. If the actual pumping period exceeds 12 hours, then the actual pumping period in minutes per day should be used. Using a daily pumping period t_d of 720 minutes per day, a period of withdrawal P of 10 years and an estimated porosity of 0.2, the above equation, rounded, reduces to:

$$V_{10} = 1{,}800{,}000 \times Q$$

Where: V_{10} = the volume of aquifer in ft^3 that supplies 10 years of withdrawals.

For ease (convenience) in applying the ASV method, it is assumed that the volume is contained in a cylinder centered on the well.



Aquifer Source Volume

$$r = \sqrt{\frac{V_{10}}{\pi b}}$$

Before the radius of the cylinder, and therefore the WHPA, can be determined, it is first necessary to determine or to estimate the thickness (b) of the aquifer (or the thickness of the part of the aquifer) that supplies water to the well. The actual thickness of the aquifer that supplies water to the well may be greater than the length of the screened sections in the well. For this reason and for convenience in applying the ASV method it was preferable to assume aquifer thickness based on pumping rates. The results of this approach are the recommended radii of WHPAs presented in Table 1 of the *North Carolina Wellhead Protection Guidebook.*

The radius for each well was determined by substituting aquifer thickness, along with the calculated volume (V_{10}) into the following equation:

$$r = \sqrt{\frac{V_{10}}{\pi b}}$$

Where: r = the radius in feet,
V_{10} = the volume of the aquifer, in ft^3, that supplies 10 years of withdrawals,
π = 3.1416, and
b = aquifer thickness or the length of screened section, in feet.

Overlap of WHPAs delineated around the individual wells was ignored, resulting in sets of intersecting circles around the Skyco, NRO, and Hatteras deep wells. Straight-line segments were then constructed tangent to the outer edges of the circles to remove scalloped edges. WHPAs were truncated at the shore lines.

The exceptions to this technique are the Stumpy Point and Mac Midgett systems. Each of these plants has two wells located in close proximity to one another. Because of their proximity, the well yields were added, and a point between the two wells was selected to delineate a single, circular WHPA. The aquifer thickness for the Stumpy Point wells was 20 feet for both wells. Of the Mac Midgett wells, RWS 1 has a screen length of 90 feet, and RWS 2 has a screen length of 70 feet. Seventy feet was used as the aquifer thickness to delineate a larger, more protective area for the Mac Midgett WHPA.

One additional well was constructed since the November 9, 2006 wellhead protection plan for Dare County. Skyco well 14 was drilled in the northern portion of the Skyco wellfield, and the WHPA was enlarged to accomodate the protection radius. Table 2 shows the wellhead protection area calculations for the wells screened in the confined aquifer.

B. Wellhead Protection Area delineation in the surficial aquifer

The Wellhead Protection Delineation Guidebook[3] specifically addresses the shallow wells in Hatteras wellfield: "The Frisco Wellfield at Cape Hatteras, … consists of 19 wells in a line located in a swale near the base of a high dune ridge. The length of the line is about 9,200 feet, so the distance between wells is about 500 feet. The yield of the well field, based on a 12-hour (720 minute) pumping schedule is 1,200,000 gallons per day. The recharge to the surficial unconfined aquifer that supplies the wellfield is estimated to be about 1,000,000 gallons per day per square mile south of the wellfield and about 200,000 gallons per day per square mile north of the wellfield. Summing those rates and dividing by two give an average recharge rate of 600,000 gallons per day per square mile.

Because the wellfield consists of wells in a line, the WHPA is anticipated to be an elongated ellipse with a length of at least 11,200 feet long, that is, 2,000 feet (four times the well spacing) longer than the length of the well line. Using twice the well spacing to determine the boundary of the ellipse at each end of the wellfield is arbitrary". Heath's description was used to delineate this portion of the Hatteras WHPA.

The size of the wellhead protection area for the Hatteras wells located in the surficial aquifer was determined using the relationship between the combined yield of the wells over a 12-hour period (Q), and the recharge rate (W) of the aquifer[4].

The area that requires protection (A, in square miles) was determined using the combined yield for the wells, based on a 12-hour pumping cycle, by the formula:

$$A = \frac{Q}{W}$$

Q = 1,118,000 gallons per day, the combined yield of the surficial wells, from Table 3.
W = 600,000 gpd/mi^2, the recharge rate
A = 1.98 mi^2 = 55,199,232 ft^2

Heath defines the size of the Hatteras wellfield ellipse as follows: "If the… semi-major axis (a) is 5,600 feet in length, what is the length of the semi-minor axis (b)? The equation for the area of an ellipse is:"

$$A = \pi ab.$$

[3] Heath, p. 32, and Figure 9.

[4] Ralph C. Heath, Recharge Reaching the Water Table in North Carolina, Division of Water Quality, NCDENR, July 2001.

Rearranging the terms to solve for b,

$$b = \frac{A}{\pi a} = \frac{55{,}199{,}232 \text{ ft}^2}{3.1416 \times 5{,}600 \text{ ft}} = 3{,}137 \text{ ft}$$

The dimensions of the ellipse about the linear Hatteras are 5,600 feet by 3,137 feet. The resulting ellipse intersects the WHPA of the deep reverse osmosis wells. Because the shallow and deep wells in the Hatteras wellfield are in different aquifers, the overlap of the intersecting areas was ignored. Table 3 shows the calculations for determining the wellhead protection area of the Hatteras surficial wells.

III. INVENTORY OF POTENTIAL CONTAMINANT SOURCES

A database and literature search was conducted to determine potential contamination sources within the protection areas. The Public Water Supply Section's Source Water Assessment Program (SWAP) interactive viewer revealed potential sources of contamination within Dare County's Wellhead Protection Areas. The EPA's EnviroMapper interactive mapping program identified or confirmed several other potential sources. State databases online located and obtained information on Groundwater Incidents and registered Underground Storage Tanks (USTs) within the protection areas.

Finally, the sites listed in the inventory of contaminant sources in the 2006 wellhead protection plan [5], were compared to the current potential source inventory. Several businesses in the original inventory had closed. A table of the database, file, and previous inventory results is included in the appendix.

Records of the local fire department and county emergency management services were searched for any past incidents, spills, or potential contaminant sources within the wellhead protection area. Files at the Washington Regional Office of NCDENR were researched for animal waste operations, well abandonment records, injection well permits, and federally registered USTs.

Groundwater pollution incidents within the wellhead protection areas were researched, and a number of sites with USTs were identified. Waste handling facilities, landfills, and hazardous waste site records on file with the Washington region Solid and Hazardous Waste Section were also researched. Files were also searched for NPDES and non-NPDES permits.

[5] Debbie Maner, Wellhead Protection Plan for Dare County, Dare County Water Department, December, 1999, and Wellhead Protection for Dare County Revision 2, Dare County Water Department, 2006

A map reconnaissance identified land use activities and other terrain features on 1:24,000 scale, 7.5-minute topographic maps and 2013 infrared aerial photos. The state land use image layer was used to assist in the estimation. Determining land use activities identified terrain features, activities, and occupants that can affect the concentration and distribution of potential contaminant sources. Table 4 shows the estimated land use categories within the wellhead protection area.

On-site visits were conducted at the potential contaminant sources listed in the inventory to obtain contact and potential contaminant information. The "Inventory of Potential Contaminant Sources" survey forms are included in the appendix, which list owner contact information and data collected during visits. Similar types of potential contaminant sources were categorized to assist in plotting the site locations on the map. The categories of potential sources and map symbols are listed in Table 5. Table 5 also includes a risk category ranking used in the risk analysis.

The windshield and walk-through surveys identified the remainder of the potential contaminant sources, and obtained or verified owner contact information and data regarding the type and quantity of contaminants. All the potential contaminant sources identified in the database, literature, file, and on-site surveys are presented in the contaminant source inventory in Table 6.

Table 6 lists the potential contaminant sources and the symbols used to identify them on the map. Figures 2 through 6 illustrate the location of the potential contaminant sources within the wellhead protection areas.

Risk Analysis

Geological conditions and land use settings were examined to provide an overview of the risk of well contamination the various wellfields of the Dare County Water Department. Wells in the unconfined aquifer are at greater risk of contamination than wells screened in the confined aquifer. Wells located in areas with greater population densities, and more potential sources are at greater risk of contamination than their more rural counterparts.

In geological terms, the nineteen wells of the Hatteras wellfield that are finished in the surficial aquifer are at the greatest risk of contamination of any wells in the Dare County system. These wells are shallow, and have no protective clay confining layer, and are highly susceptible to spills or leaks at land surface that could enter the water table and contaminate the aquifer. These wells have historically been unaffected by storm surges and saltwater intrusion at their current pumping rates. The wellhead protection area is bordered on the east by the Buxton Woods Coastal Reserve, and on the south by the Cape Hatteras National Seashore. The wells are located along a swale between dune ridges in an area that is inaccessible to the public, and mostly away from potential sources. The protection area is bounded on the north and west by Hwy 12, and the traffic and businesses along this major road pose the greatest threat to the Hatteras wells.

The majority of the wells in the Dare County Water Department are screened in confined Yorktown aquifer. The clay confining bed above the aquifer acts to retard downward percolation or leakance of contaminants into the aquifer, should a surface release occur. The land use area estimate showed that the NRO and Skyco plants were located in areas with greater business and residential land usage. The Skyco and NRO wellfields are extensive in size, and have more potential contamination sources. Sand mining and dredging operations other than for beach nourishment are no longer permitted in North Carolina estuarine and near shore ocean waters as of October, 2004.

Although the NRO wellfield located in Kill Devil Hills, and the Skyco wellfield use wells in the confined aquifer, they are next most at risk because of their location in areas with high seasonal tourist traffic. This high turnover of population increases traffic flow, places greater demand on logistics, and causes rapid turnover of business inventories, which all increase the likelihood that a release will occur. The Mac Midgett and Stumpy Point wellfields are located in more rural areas with fewer potential sources of contamination, and are least at risk.

For each WHPA, the potential contamination sources were ranked according to the threat each presented to the nearest water supply well or wells. The following method was used to rank each potential source in each WHPA:

Each potential source was assigned a risk category of higher, moderate, or lower based on information adapted from the EPA (1993), and from the Oregon Wellhead Protection Program (see appendix). Table 5 lists the risk category for each type of potential source identified during the contaminant source inventory. Each potential contamination source was assigned a numerical "category" score to correspond with the risk category (e.g., higher-3, moderate-2, and lower-1). Each site of potential contamination was then assigned a "proximity" score calculated with the following equation:

Proximity score = 1 – (distance in feet from the well ÷ radius of the WHPA)

The overall risk ranking was obtained by multiplying the category score by the proximity score for each potential contaminant site. This resulted in a relative ranking of each potential source of contamination (PCS) within a given WHPA based on the threat posed to the water supply well or wells. This risk analysis provided information that was used to determine which water supply wells are at greater risk of contamination and which PCS should be considered first with regard to wellhead protection.

The risk analysis shown in Table 7 lists the potential sources of contamination for each protection area ranked according to the threat each PCS poses to the wells. Wells in the NRO wellfield are at greater risk of contamination due to their location near high traffic areas and businesses along Virginia Dare Trail and Highway 12. Wells in the Skyco wellfield are also more at risk than the more rural wells in the Hatteras, Mac Midgett, and Stumpy Point wellfields, as shown by the total estimated risk scores for each wellfield in Table 7.

Facilities with underground storage tanks or groundwater pollution incidents that resulted from leaking tanks pose the greatest risk to the wells in the Dare County Water System. Public facilities, such as recycling centers, lift stations, landfills, and water treatment plants present some risk to wells in the system. Businesses and residential areas are concentrated along the mostly north-south road networks in the area. Wells located near these major roads are at higher risk.

IV. MANAGING THE WELLHEAD PROTECTION AREA

Dare County chose a public education approach to protect the wellhead areas. The Public Utilities Director has primary responsibility for implementing the public education program; the alternate responsibility lies with the Assistant Utilities Director. The Wellhead Protection Committee may be consulted as required.

A Wellhead Protection Brochure (tri-fold) will be made available to each resident, farming operation, business, and industry within the Wellhead Protection Areas. Copies of this brochure will be made available at the Dare County Water Department, and at bill-paying locations, for public education on Wellhead Protection. In general, the brochure will convey to each citizen/business the following information:

- An explanation of what groundwater is and the number of wells in their particular system,
- An explanation of what a Wellhead Protection Program is,
- Sources of groundwater pollution,
- Tips on protecting their water supply,
- Proper disposal of household hazardous waste,
- Septic tank maintenance, and
- Phone numbers to contact for more information.

Dare County will provide information to each business, industry, and farm located within the WHPAs on waste handling practices, best management practices, standard operating procedures, and waste oil disposal methods which could be employed to reduce the potential for groundwater contamination. Dare County will also provide information regarding the North Carolina Division of Environmental Assistance and Customer Service (DEACS) to each business and industry located within the WHPAs. Owners/operators of potential contamination sources will be encouraged to contact the DEACS.

Personnel at County owned and/or operated facilities will be educated on Wellhead Protection and steps they can take to reduce the potential for contamination (e.g., information about best management practices, standard operating procedures, waste handling practices, etc.). The water system will also contact DEACS to investigate steps that Dare County can take to reduce the amount of waste released into the air and water

and on or near the protected area.

DEACS provides free technical and other non-regulatory assistance to reduce the amount of waste released into the air, water, and on the land. DEACS serves as a central repository for waste reduction and pollution prevention information. DEACS emphasizes waste reduction through pollution prevention, encourages companies and government agencies to go beyond compliance, and provides information about the environmental permitting process. This information is provided at no charge to North Carolina businesses, industries, government agencies, and the general public upon request. For additional information, DEACS may be contacted at (919) 715-6500 or (800) 763-0136.

Dare County will contact all facilities and agricultural operations within the WHPAs that store pesticides, or are otherwise involved with the application of pesticides, to ensure that they licensed by the State of North Carolina and that proper records are maintained to ensure observance of NC Pesticide Laws. Dare County will provide information to these facilities or agricultural operations regarding waste handling practices, best management practices, standard operating procedures, and proper waste disposal methods which could be employed to reduce the potential for groundwater contamination. These facilities will also be provided with information regarding the North Carolina Division of Environmental Assistance and Customer Service (DEACS).

In the event of a spill, the Dare County Emergency Management Agency will be contacted at the following number:

Dare County Emergency Management Agency: (252) 473-3355

Owners of improperly constructed or abandoned wells identified within the WHPAs will be provided information regarding the threat posed to the water supply by these wells, and wells that could potentially be flooded during hurricane conditions. Owners of improperly constructed or abandoned wells will be encouraged to have these wells properly abandoned in accordance with state well construction standards found in 15A NCAC 2C, "Criteria and Standards Applicable to Water Supply and Certain Other Wells". If information exists that a well is improperly constructed or is contributing to the contamination of groundwater, Dare County will notify the Aquifer Protection Section of the Division of Water Resources.

All owners/operators of regulated USTs and other facilities subject to federal and/or state regulations located within the WHPAs will be requested to supply documentation that their facility is in compliance with said regulations. Operators of USTs will be asked to supply the system with a copy of their UST permit. If any UST sites are found to be non-compliant, the Underground Storage Tank Section of the State Division of Waste Management will be notified.

If an abandoned UST site is found, the County will contact the North Carolina Division of Waste Management, UST Section, to determine if a closure report was submitted demonstrating that no soil or groundwater contamination was identified during

closure. If a closure report was not submitted, Dare County will notify the UST Section of the location of the facility within the WHPA and its proximity to a public water supply well.

For soil or groundwater contamination incidents occurring within the WHPAs, Dare County will contact the State agencies with oversight responsibilities for remediation to determine if remediation efforts are proceeding in a timely fashion and in accordance with any schedules established by these agencies. Through this process, the County will bring to the attention of the State agencies with oversight responsibilities for remediation, any failures by the responsible parties to comply with required monitoring and correction action. The County will also notify the State agencies with oversight responsibilities for remediation, of the location of the facility within the WHPAs and its proximity to a public water supply well. Dare County will also contact the State agencies with oversight responsibilities for the contamination incidents and notify them of the locations of the sites issued notices of "No Further Action" occurring within the WHPAs and will request a review of this assessment.

Dare County will notify any individual, industry, business, or government agency installing or planning to install a regulated UST within the wellhead protection areas of the following regulation: North Carolina Underground Storage Tank Regulation 15A NCAC 2N .0301 stipulates specific siting and secondary containment requirements for UST systems installed after January 1, 1991. The rule is summarized as follows:

- No UST system may be installed within 100 feet of a public water supply well or within 50 feet of any other well used for human consumption.
- Secondary containment is required for UST systems within 500 feet of a well serving a public water supply or within 100 feet of any other well used for human consumption.

Violations of this regulation will be reported to the Division of Waste Management, Underground Storage Tank Section. The UST Section will also be notified of the location of the facility within the WHPAs and its proximity to a public water supply well or any other well used for human consumption.

A regulated UST system is any underground storage tank and associated piping that contains petroleum (including gasoline, diesel and used oil) or a hazardous substance as defined by the State rules (15A NCAC 2N). Tanks containing heating oil for use on the premises where stored are not regulated.

Facilities with an underground buried storage capacity of more than 42,000-gallons of oil, or an aggregate above ground storage capacity greater than 1,320-gallons of oil, or an above ground storage capacity of a single container in excess of 660-gallons are subject to the Oil Pollution Prevention regulations contained in Federal Regulations found in 40 CFR 112. These facilities must prepare and implement a Spill Prevention Control and Countermeasures (SPCC) Plan. The County will verify the status of the SPCC Plan for each subject facility located within the WHPA. The North Carolina

General Statutes require registration of any facilities storing more than 21,000-gallons of petroleum product. Subject facilities not in compliance with these regulations will be notified of their regulatory responsibility under this regulation. The County will also notify the Division of Water Resources, Aquifer Protection Section if such facilities do not promptly come into compliance.

Dare County will contact the Division of Water Resources Water Quality Program regarding facilities permitted to discharge wastewater to the land surface (non-NPDES Permitted Facilities) to ensure that any such operations located within the WHPAs are in compliance with applicable regulatory and permit requirements pertaining to environmental protection, such as routine monitoring and reporting requirements.

Dare County operates an annual household hazardous waste collection day when funds permit, in cooperation from the NC Department of Agriculture. Notification of this service through the local paper will be made to businesses, industries, farming operations, and residents within the wellhead protection area several days prior to the event, which will advise the public how to label and package the waste for disposal, and where the collection points are located.

Sites with geothermal injection wells or vertical closed loop heat pump systems will be provided with educational materials on the importance of proper well construction to prevent the accidental injection of performance enhancing additives used in the aqueous coolant. Information from the County will be mailed to owners of injection wells regarding the location of nearby public water supply wells, and the importance of proper maintenance to prevent leaks which could contaminate either the surficial or the confined source aquifer.

The County of Dare will maintain a copy of any state permit files, including maps, of closed (no longer used), unlined landfills within the wellhead protection areas. Water system operators regularly test the water supply for coliform bacteria, pesticides, volatile organics, and semi-volatiles, and make information available to consumers annually in the Consumer Confidence Report (CCR). The County will continue to monitor drinking water standards as required by state and federal regulations to ensure water quality is not affected by landfill(s). System officials will plot the detected concentrations to watch for any trends that might serve as an early warning. Also, being watchful of any trends in the data might serve as an early warning if any of the contaminants from the dump were to migrate toward the well. Plotting the test results from test to test would help the water system remain vigilant with regard to the possible threat posed by landfills.

The County will use the public access television channel to promote awareness of the Wellhead Protection Program using materials developed by the Water Department and the Wellhead Protection Committee.

V. EMERGENCY CONTINGENCY PLAN

The Public Utilities Director is the primary individual responsible for implementing contingency plans. The alternate responsibility lies with the Assistant Utilities Director. The WPC may be involved in decision-making in the event that response actions are required.

For emergencies, refer to the County's Water Emergency Management Plan[6]. This is the primary document to refer to in case of water disruptions or emergencies. Portions of the plan's appendix for hurricane preparation include:

Plan overview,
Organizational charts and contact information,
Facilities and equipment,
Implementation criteria,
Specific emergencies,
Recordkeeping,
Return to normal operations,
Training exercises, and plan update.

The plan also defines the levels of emergencies from highest (3) to lowest (1). Contingencies for equipment failure, reduction of supply due to contamination, chemical over or under dosing, or spills and leaks are addressed. Other emergency situations that have plans for emergency operations include:

Contamination or failure of raw water wells,
Power failure,
Plant system failure,
Malfunction of process control computers or SCADA systems,
Loss or contamination of finished water storage tanks,
Failure of high service pumps,
Chemical or diesel fuel spills,
Main breaks or discharge transmission mains.

Short Term (less than 48 hours) Contingency

A copy of the latest Rules Governing Public Water Systems, NCAC Title 15A, Subchapter 18C, Water Supplies, are readily available at each water treatment plant. Paragraph .1523 identifies three Tiers of violations and the public notice requirements for each Tier. Tier 1 public notice is required as soon as possible, but not later than 24 hours after the system learns of the violation. Dare County will also consult with the Washington Regional Office Public Water Supply Section as soon as possible, but no later than 24 hours after discovery in the event of a Tier I violation. The Rules further define conditions and actions to be taken by Dare County upon discovery of violations.

[6] County of Dare, Water Emergency Management Plan, County of Dare Water Department, 2002.

Public notification must be made using the appropriate broadcast media in the contacts listed in Table 8.

Should a major oil or chemical spill occur within any of the Wellhead Protection Areas, the local volunteer fire departments and Dare County Emergency Coordinator will be notified first:

Fire Department 911

Dare County Emergency Management Agency (252) 473-3355

Refer to the Dare County Water Department Emergency Spill Program [7], in the event of a dangerous spill. The emergency spill program document addresses fuel or chemical spills, and the handling and transfer of materials. A short extract of emergency contact phone numbers for applicable agencies and personnel are listed in Table 8. Refer to the current contact list in the Water Emergency Management Plan during emergencies.

If evidence exists that a well is contaminated, it will immediately be taken off-line and not returned to service until it is determined that the well's water quality is in compliance with standards governing public water supplies. If the well becomes contaminated, it will be isolated from the rest of the system by the Public Utilities Director or his representative, by closing the gate valve at the wellhead. A schematic diagram of the existing system is available at each of the five water treatment plants to assist in identifying the valve locations and waterline sizes.

If it is determined that contaminants entered the distribution system, residents shall be notified not to drink the water until further notice, by using the emergency notification plan. Media contacts will be used to rapidly get information to the water users supplied by Dare County. High-risk water users, such as the schools, day care centers, and churches, will be notified by telephone. For long-term contamination or water outages, public notice will be mailed to all utility customers.

If contamination occurs, the regional office of the Public Water Supply Section shall be notified immediately of the situation and asked for assistance. Sampling (i.e. bacteriological, VOCs, SOCs, etc.) will begin to determine the contaminant involved and the extent of contamination. A systematic flushing of the distribution system will begin with follow-up sampling conducted as needed until the system was determined to be free of contamination and in compliance with standards governing public water supplies. After consultation with the Public Water Supply Section and any appropriate sampling, residents will be notified that Dare County water is once again safe for consumption.

[7] County of Dare, Dare County Water Department Emergency Spill Program, County of Dare Water Department, February 2006.

Long-Term (greater than 48 hours) Contingency

The Rules Governing Public Water Supply Systems NCAC Title 15A, Subchapter 18C also defines public notification requirements for Tier 2 and 3 violations. Tier 2 violations, as defined in the rule, require public notice as soon as practical, but not later than 30 days after discovery of the violation. Tier 3 violations require public notice no later than one year after discovery of the violation. Additional instructions and conditions are outlined in the rule.

In addition to contamination, long-term disruptions (greater than 48 hours) in service could result from:

- Long-term power outages,
- Pump failure,
- Decreased well yield,
- Water line breaks, or other system failures.

Ice storms, hurricanes, and floods can potentially disrupt water service. Elevated storage tanks will be filled before any major weather events that could disrupt service. County personnel will place a priority on restoring well operation once an outage is identified. The *Water Emergency Management Plan* identifies available logistical, technical, and financial resources. Should the well become inoperative, there are three mutually controlled interconnections, two of them metered, to Dare County Public Works Department. The Dare County Public Works Building maintains schematics of the interconnection locations.

NEW PUBLIC WATER SUPPLY WELLS

Dare County will amend its Wellhead Protection Plan to include any new wells added to its water systems. The following steps will be taken to address any new wells:

1. Develop a preliminary WHPA for the proposed well to determine the area of vulnerability.
2. Develop a contaminant source inventory for the preliminary WHPA.
3. Information obtained in items 1 and 2 above will be submitted to the Wellhead Protection Committee (WPC). Any information required by the Public Water Supply Section (PWSS) relating to the development and construction of new public water supply (PWS) wells must also be submitted.
4. If the WPC grants provisional approval of the proposed Wellhead Protection Plan, and the PWSS grants approval to construct or expand the PWS well or well system, then work may proceed with well construction.
5. Finalize the WHPA delineation for the new well.
6. Finalize the contaminant source inventory for the WHPA.
7. Submit finalized WHPA and contaminant source inventory to the WPC.

8. Once approval is received, implement any necessary regulatory and or non-regulatory potential source management practices.
9. Submit the amended WHP Plan and all necessary supporting information to the Public Water Supply Section for review and approval.

PUBLIC PARTICIPATION

Dare County incorporated public participation into the Wellhead Protection Plan by:

- Using public education as a method of managing the WHPAs.
- Informing local business owners and industry of best management practices and providing information on groundwater protection.
- Keeping this plan in the Dare Water Department for public review at any time.

After the plan is approved:

- A tri-fold brochure showing the Wellhead Protection Area, including the information listed in Section III, will be delivered to all residents living in the WHPA.

The Draft Wellhead Protection Plan was made available for a period of thirty days for review and comment after publishing a notice in the local paper. A copy of the public notice as printed is included in the appendix. No comments were received. However, the plan will be kept available for public review in the corporation offices. Any substantive comments received from the public will be incorporated into the plan, after review by the WPC.

WELLHEAD PROTECTION PROGRAM REVIEW

Dare County is aware that an effective local Wellhead Protection (WHP) Program is an ongoing process requiring monitoring of the Wellhead Protection Areas, and periodic review and updating of an approved WHP Plan. Therefore, the County's WHP Committee will monitor the WHPAs for any new or previously unidentified potential contaminant sources (PCSs) and activities occurring within the approved WHPAs. The County will amend the PCS inventory and other Plan components (e.g. the management strategies, emergency contingency plan, etc.) as necessary to incorporate any new threats to the County's groundwater source of drinking water. Additionally, the PCS inventory will be updated annually using the same procedures used to develop the original PCS inventory. The County will also fully update the WHP Plan every five years or at any time a new well is constructed for use with the County's water supply system or a major land use change occur within the WHPAs. The individual responsible for implementation of the WHP Plan will submit notification to the Public Water Supply

Section annually upon completion of the PCS inventory update or immediately following the completion of a major revision. Any amended or revised sections of the approved WHP Plan resulting from an update or revision will also be submitted upon completion.

Additional reviews will be conducted for new construction or development projects, such as new wells or well fields, shopping centers, industrial parks or subdivisions to determine whether any substantial changes to the plan are required.

Fig. 1 Dare County Water Department Water Treatment Plants

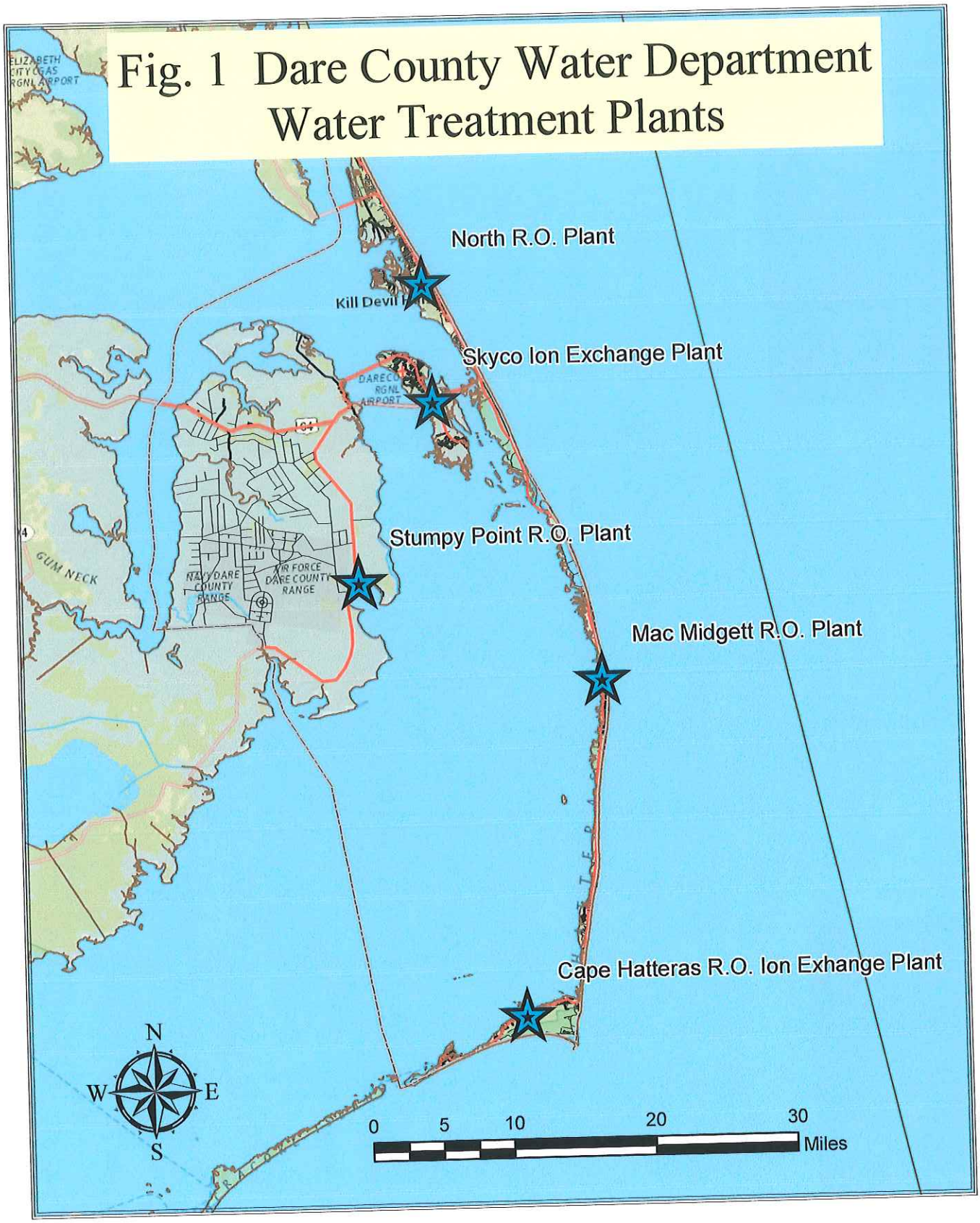


Fig. 2 Skyco Plant Wellhead Protection Area

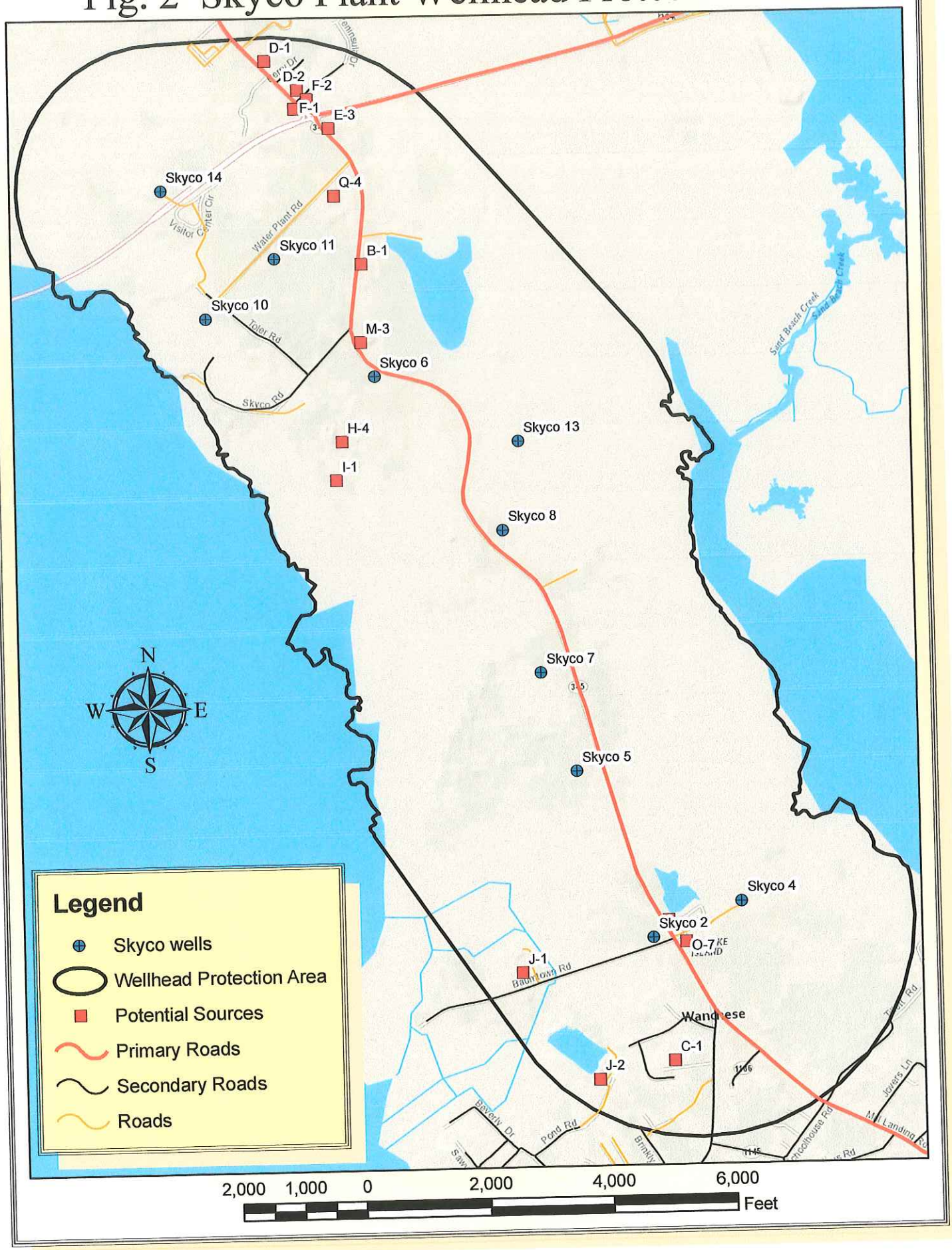


Fig. 3A NRO North WHPA

Fig. 3B NRO Main WHPA

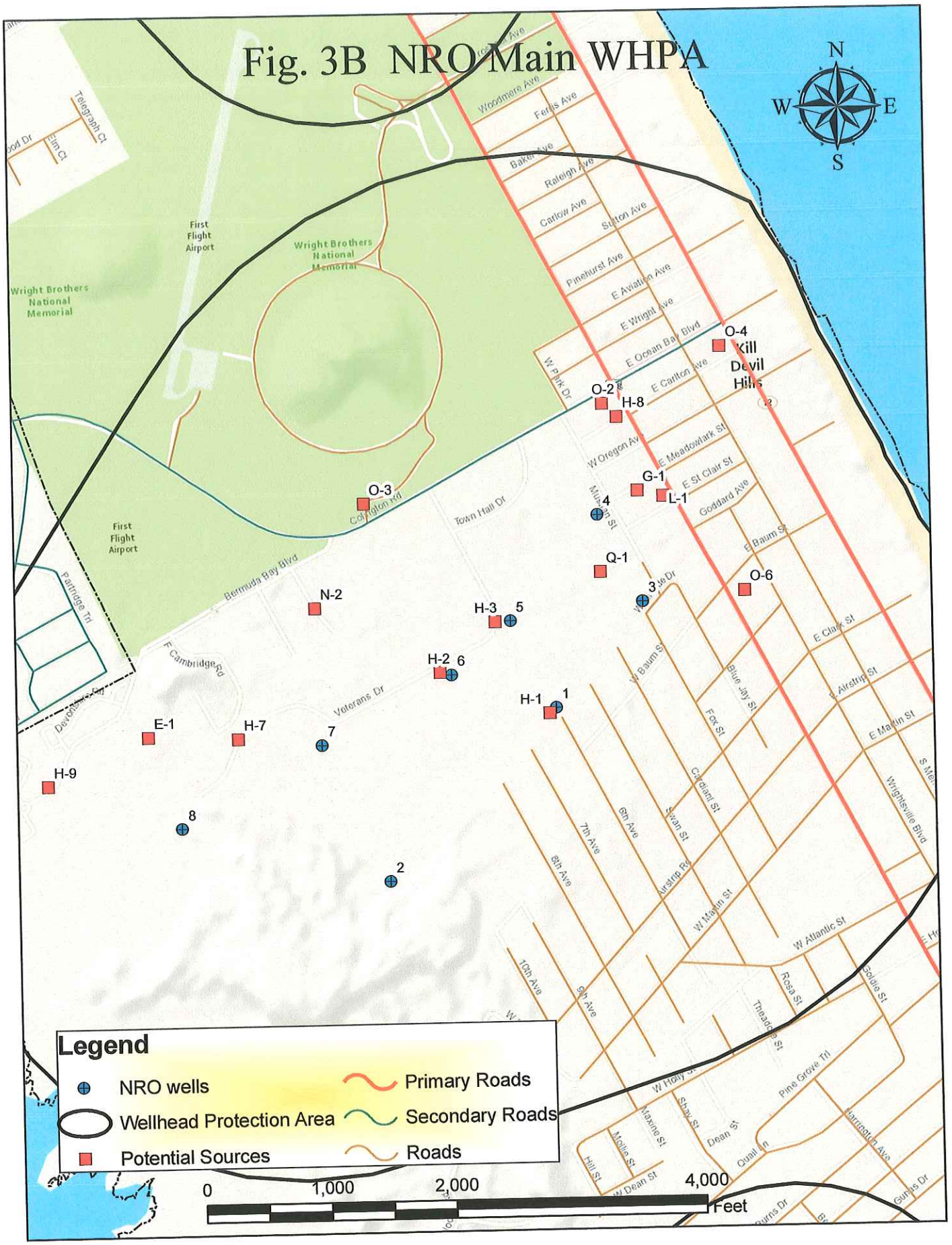


Fig. 3C NRO Kill Devel Hills WHPA

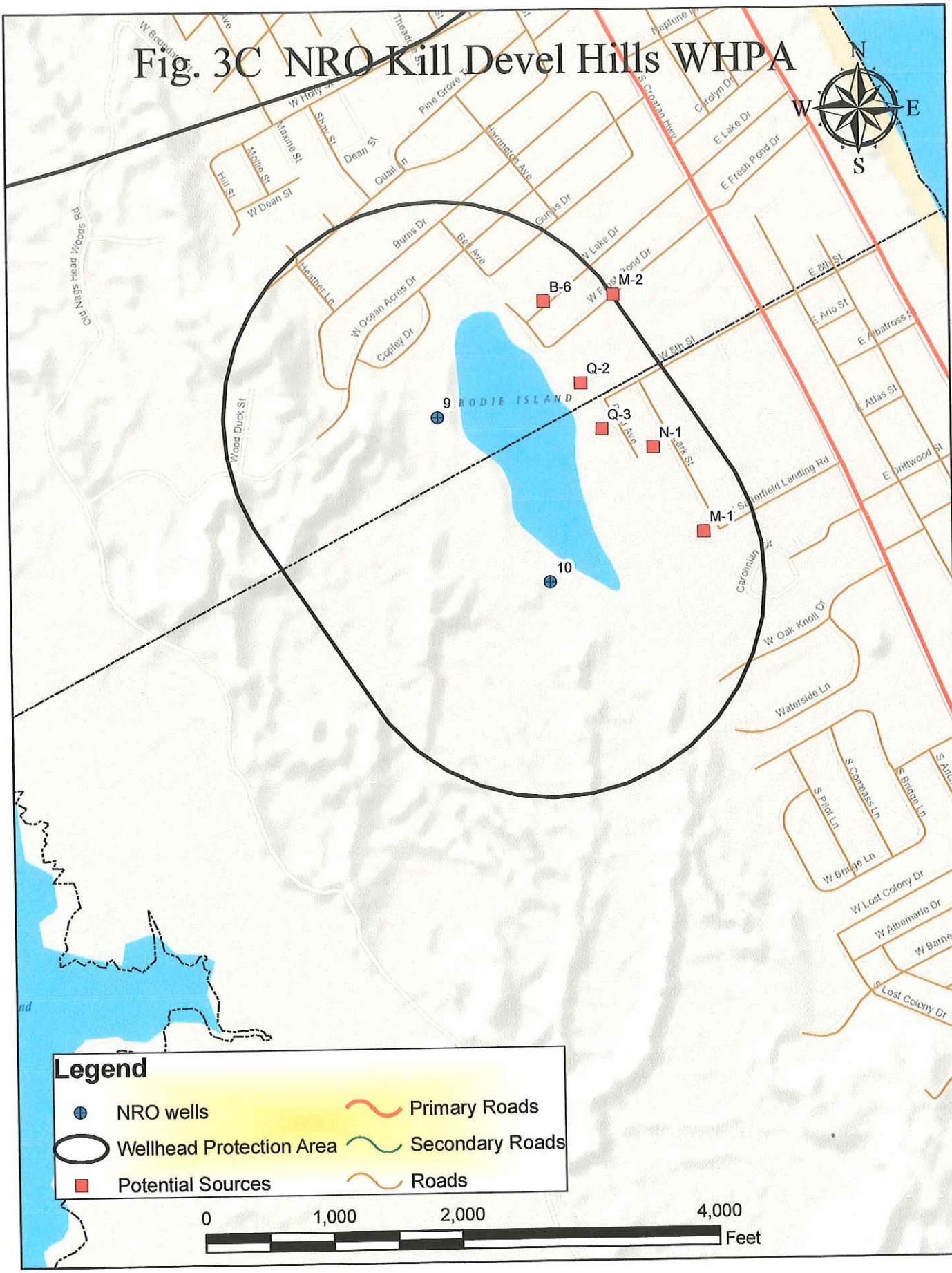


Fig. 3D NRO South WHPAs

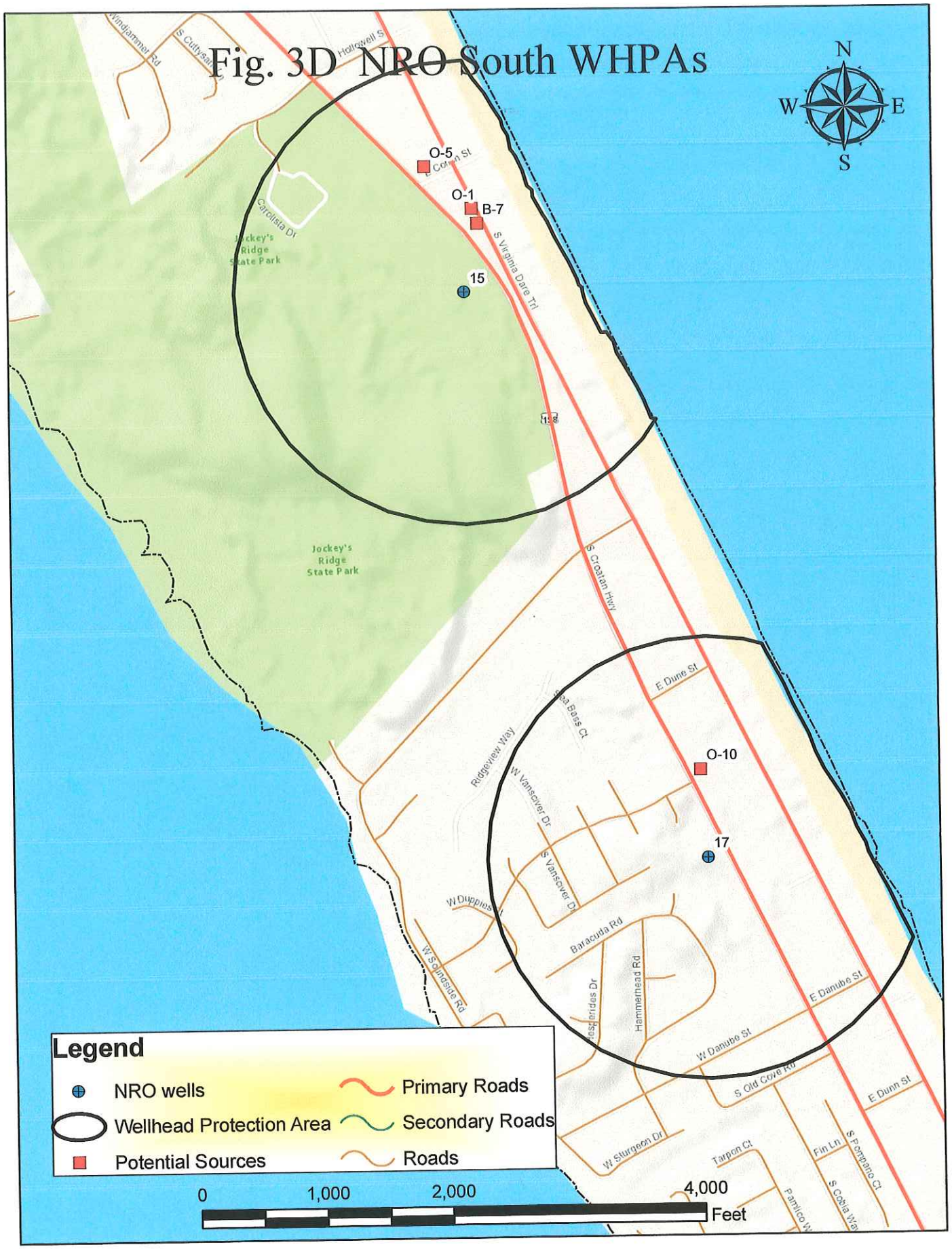
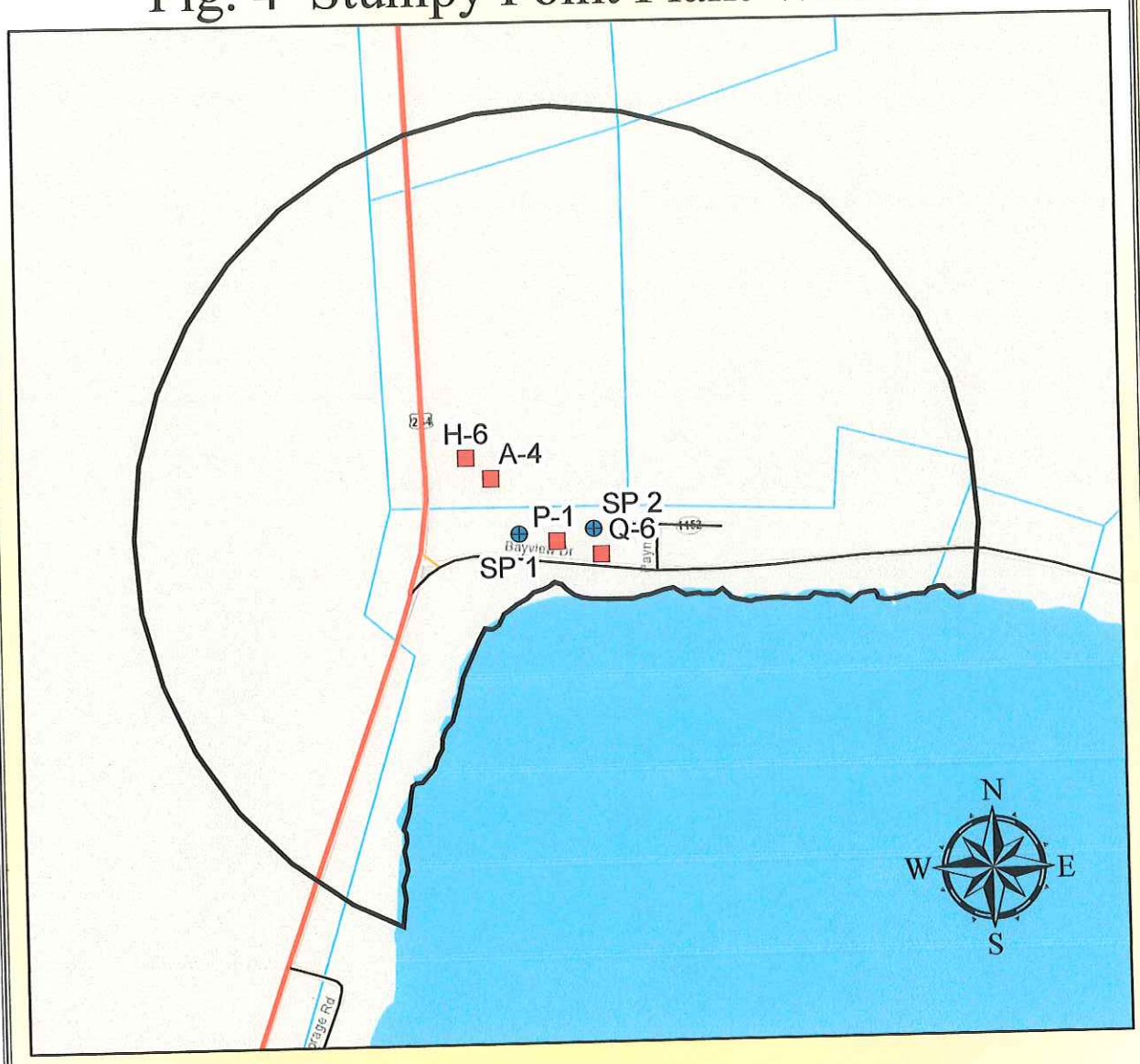


Fig. 4 Stumpy Point Plant WHPA



1,000 500 0 1,000 2,000 3,000 Feet

Legend

- Stumpy Point wells
- Wellhead Protection Area
- Potential Sources
- Primary Roads
- Secondary Roads
- Roads

Fig. 5 Mac Midgett Plant WHPA

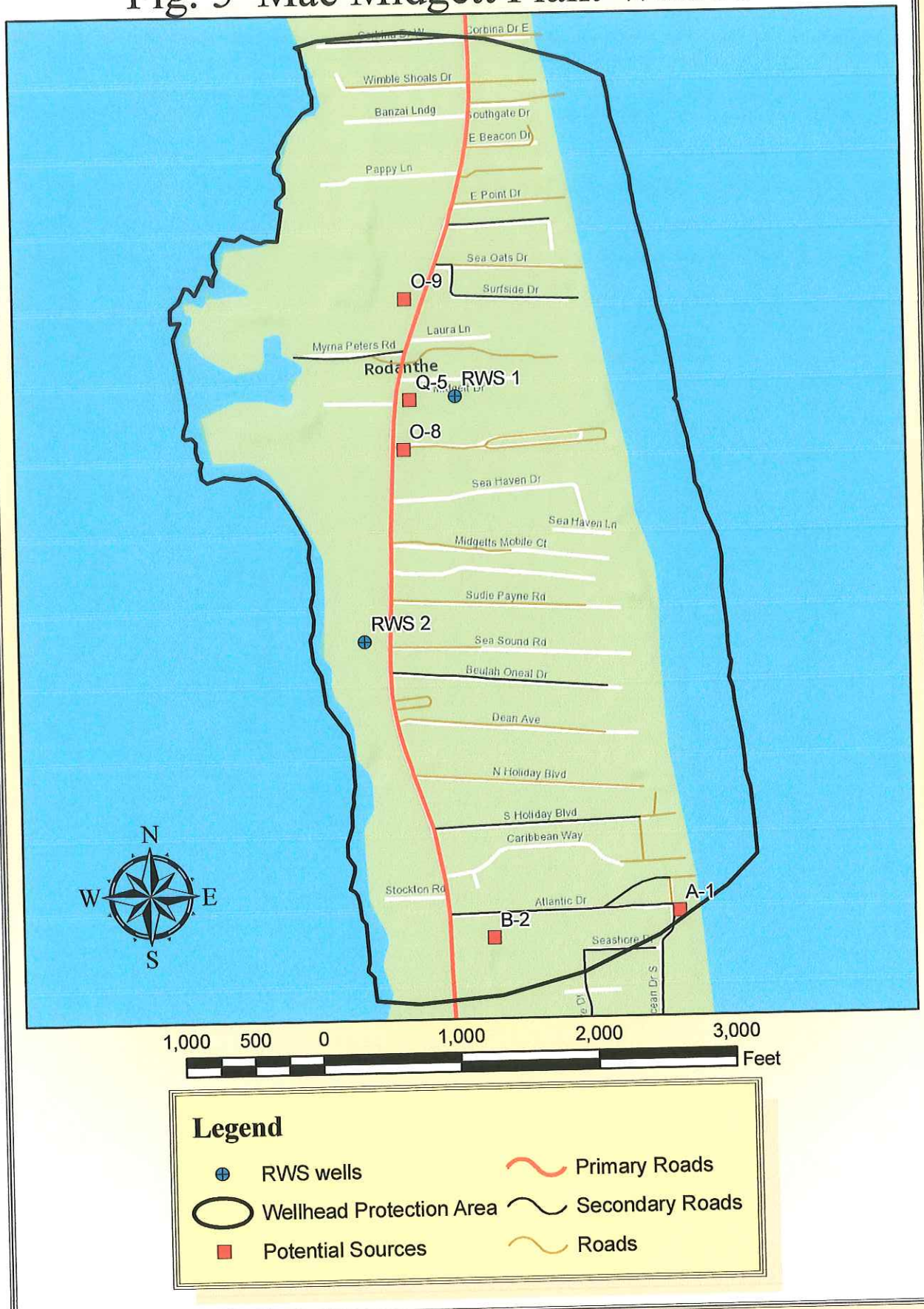


Fig. 6 Hatteras Plant Wellhead Protection Area

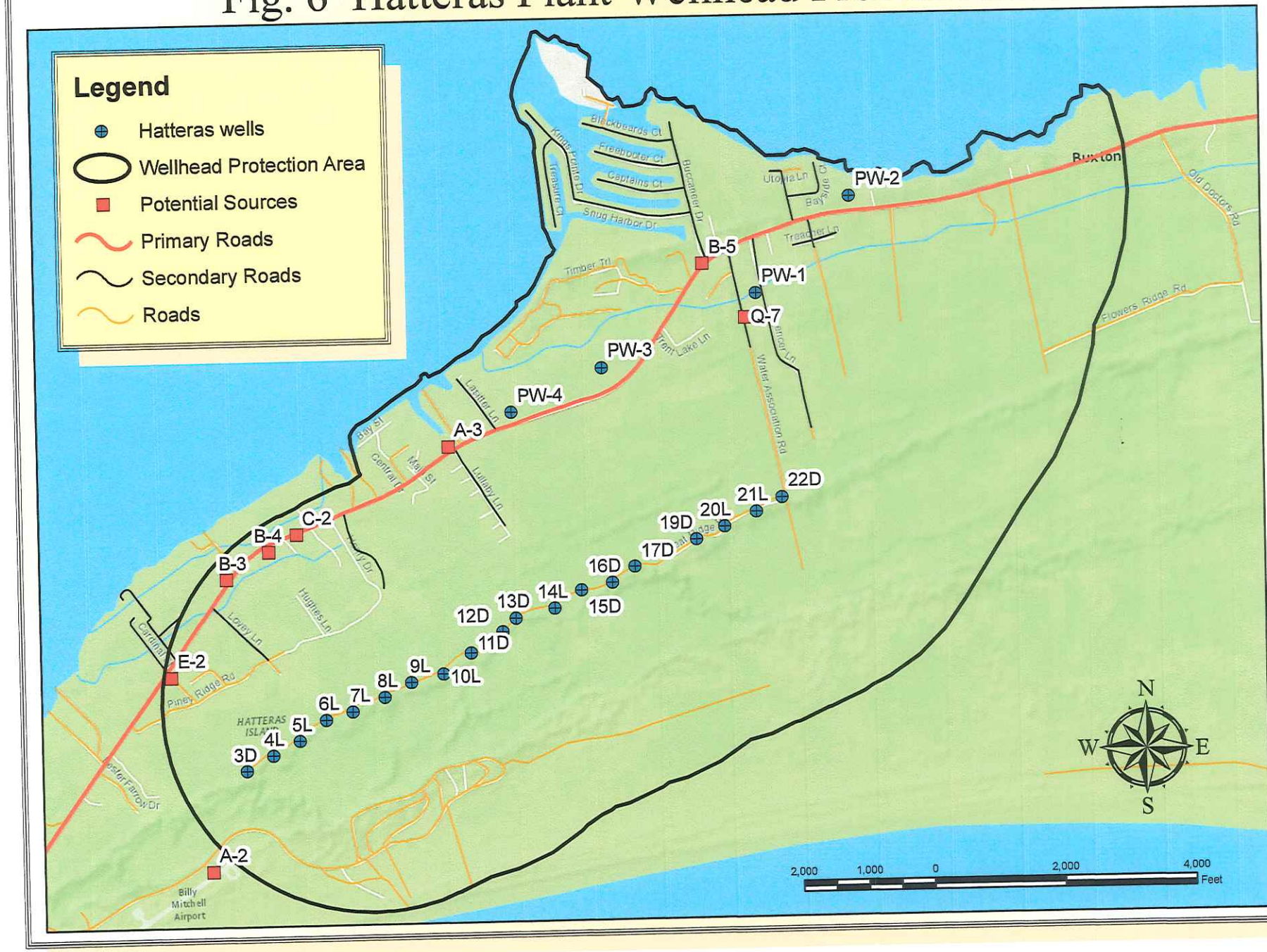


Table 1. Dare County Water Department well data

Well	Depth	Screened interval	Casing dia., in.	Well yield gpm	Date Drilled	Date Tested
Dare County Regional PWSID 04-28-030 North RO WTP						
Well 1	425	320-420	8	500		
Well 2	425	320-420	8	500		
Well 3	425	320-420	8	500		
Well 4	425	320-420	8	500		
Well 5	425	320-420	8	500		
Well 6	425	320-420	8	500		
Well 7	425	320-420	8	500		
Well 8	425	320-420	8	500		
Well 9	410	282-297, 314-405	8	500	8/5/94	
Well 10	402	274-295, 312-396	8	500	8/5/94	
Well 15	395	290-390	8	600		12/20/04
Well 17	430	315-425	8	600		9/9/04
Orville	410	295-405	8	600		10/26/04
Wilbur	435	310-430	8	600		6/25/04
Skyco WTP						
Skyco 2	222	167-217	8	600		5/10/04
Skyco 4	250	170-220	8	500	6/22/78	6/21/78
Skyco 5	235	168-218	8	500	7/26/77	7/27/77
Skyco 6	225	150-220	10	605	12/23/04	
Skyco 7	250	165-215	8	703	3/1/78	2/28/78
Skyco 8	250	162-212	8	503	5/1/78	5/2/78
Skyco 10	250	142-192	8	620	3/30/78	3/30/78
Skyco 11	223	196-218	8	500	3/28/83	4/11/83
Skyco 13	225	176-216	8	500	3/21/83	3/28/83
Skyco 14	200	150-200	10	495	2/15/07	4/12/07

Table 1. Dare County Water Department well data

Well	Depth	Screened interval	Casing dia., in.	Well yield gpm	Date Drilled	Date Tested
Mac Midgett WTP PWSID 04-28-035						
RWS 1	410	305-395	12	700	1986	3/2/95
RWS 2	365	293-363	8	850	2/95	3/7/95
Stumpy Point WSD PWSID 60-28-002						
Stumpy Pt 1	197	172-192	6	125	5/1/02	5/6/02
Stumpy Pt 2	230	170-190	4	97	11/14/00	11/17/00
Cape Hatteras WTP PWSID 04-28-025						
3D	80	60-80	6	75	2/26/98	2/27/98
4L	75	62-72	6	100	12/14/98	12/15/98
5L	75	60-70	6	100	12/13/65	12/14/98
6L	75	63-73	6	100	12/1/95	12/2/95
7L	75	62-72	6	100	12/11/95	12/12/95
8L	72	62-72	6	100	12/7/95	12/8/95
9L	75	60-70	6	100	4/24/96	4/25/96
10L	75	60-70	6	100	4/26/96	4/27/96
11D	95	75-95	6	75	3/3/98	3/4/98
12D	95	75-95	6	75	5/13/98	5/14/98
13D	95	75-95	6	75	3/5/98	3/6/98
14L	70	60-70	6	100	5/3/96	5/4/96
15D	95	75-95	6	75	3/4/98	3/5/98
16D	95	75-95	6	75	5/12/98	5/13/98
17D	95	75-95	6	75	3/11/98	3/12/98
19D	95	75-95	6	75	5/14/98	5/15/98
20L	74	62-72	6	100	11/20/95	11/21/95
21L	74	63-73	6	100	9/24/95	3/17/98
22D	90	70-90	6	75	3/16/98	3/17/98
PW-1	260	243-260	10	820	11/1/98	11/18/98
PW-2	276	248-276	10	900	8/1/95	8/4/95
PW-3	308	270-308	12	500	11/1/98	11/11/98
PW-4	308	245-308	12	700	11/1/98	11/16/98

Table 2. Confined aquifer WHPA calculations

Well	Q Gal/day	well screen length, (b)	radius, feet
Dare County Regional PWSID 04-28-030			
North RO plant			
Well 1	360,000	100	1,673
Well 2	360,000	100	1,673
Well 3	360,000	100	1,673
Well 4	360,000	100	1,673
Well 5	360,000	100	1,673
Well 6	360,000	100	1,673
Well 7	360,000	100	1,673
Well 8	360,000	100	1,673
Well 9	360,000	100	1,673
Well 10	360,000	100	1,673
Well 15	432,000	100	1,832
Well 17	432,000	110	1,747
Orville	432,000	110	1,747
Wilbur	432,000	120	1,673
Skyco plant			
Skyco 2	432,000	50	2,591
Skyco 4	360,000	50	2,365
Skyco 5	360,000	50	2,365
Skyco 6	435,600	70	2,199
Skyco 7	506,160	50	2,805
Skyco 8	362,160	50	2,373
Skyco 10	446,400	50	2,634
Skyco 11	360,000	22	3,566
Skyco 13	360,000	40	2,645
Skyco 14	356,400	50	2,354
Cape Hatteras PWSID 04-28-025			
PW-1	590,400	17	5,195
PW-2	648,000	28	4,241
PW-3	360,000	38	2,713
PW-4	504,000	63	2,493

Table 2. Confined aquifer WHPA calculations

Well	Q Gal/day	well screen length, (b)	radius, feet
Mac Midgett PWSID 04-28-035			
RWS 1	504,000	90	
RWS 2	612,000	70	
Combined =	1,116,000	70	3,520
Stumpy Point PWSID 60-28-002			
Stumpy Pt 1	90,000	20	
Stumpy Pt 2	69,840	20	
Combined =	159,840	20	2,492

Table 3. Surficial aquifer WHPA calculations

Well	Q Gal/day	Contributing Area, sq. mi.	radius, feet
Cape Hatteras PWSID 04-28-025			
3D	54,000	0.09	4,223
4L	72,000	0.12	4,223
5L	72,000	0.12	4,223
6L	72,000	0.12	4,223
7L	72,000	0.12	4,223
8L	72,000	0.12	4,223
9L	72,000	0.12	4,223
10L	72,000	0.12	4,223
11D	54,000	0.09	4,223
12D	54,000	0.09	4,223
13D	54,000	0.09	4,223
14L	72,000	0.12	4,223
15D	54,000	0.09	4,223
16D	54,000	0.09	4,223
17D	54,000	0.09	4,223
19D	54,000	0.09	4,223
20L	72,000	0.12	4,223
21L	72,000	0.12	4,223
22D	54,000	0.09	4,223
Total:	1,206,000	2.01	

Table 4. Land Use Activities

Land Use	Skyco	NRO	Stumpy Pt.	RWS	Hatteras
Residential	2%	45%	3%	65%	3%
Nat'l/State parks, Reserves	20%	45%	92%	15%	87%
Swamps, wetlands	68%	-	3%	15%	7%
Business, industry	9%	7%	1%	3%	1%
Rights of Way	1%	3%	1%	2%	2%

Table 5. Types of Potential Sources

Type of Potential Source	Map Symbol	Risk Category
AST/Generators	A	Mod
Auto Repair/fleet vehicles	B	High
Cemetery	C	Low
Chemical Storage	D	High
Electrical Substation	E	Mod
Pollution Incident	F	High
Laundromat	G	High
Lift Station/WWTP	H	Mod
Injection well	I	High
Landfill	J	High
Primary Road	K	Mod
Printer	L	High
Self-Storage	M	Low
Solid Waste	N	Mod
UST/Gas Station	O	High
Pesticide/herbicide application	P	Low
Water Treatment Plant	Q	Mod

Table 6. Inventory of potential contaminant sources

Potential Contaminant Source Description	Type of Source	Map Symbol
NRO Plant		
Luke's Auto repair	Auto Repair	B-6
Nags Head Ocean Rescue	Auto Repair/fleet vehicles	B-7
Lowe's	Chemical Storage	D-3
Dominion Electrical Substation	Electrical Substation	E-1
Coin Op Laundry	Laundromat	G-1
Stormwater Sewer	Lift Station/WWTP	H-1
Stormwater Sewer	Lift Station/WWTP	H-2
Stormwater Sewer	Lift Station/WWTP	H-3
Stormwater Sewer	Lift Station/WWTP	H-7
Stormwater Sewer	Lift Station/WWTP	H-8
Stormwater Sewer	Lift Station/WWTP	H-9
US 158	Primary Road	K-3
NC 12	Primary Road	K-4
Master Graphics Printers	Printer	L-1
Nag's Head Self Storage	Self-Storage	M-1
Beach Warehouses Mini Storage	Self-Storage	M-2
Nag's Head Public Works	Solid Waste	N-1
KDH Recycle Center	Solid Waste	N-2
Austin Fish Co.	UST/Gas Station	O-1
Kangaroo (RAM 53)	UST/Gas Station	O-2
Wright Memorial Maintenance	UST/Gas Station	O-3
Stop n Shop Convenience & Deli	UST/Gas Station	O-4
Nag's Head Shell	UST/Gas Station	O-5
Quality Plus Oil	UST/Gas Station	O-6
Duck Thru 24	UST/Gas Station	O-10
NRO Water Treatment Plant	Water Treatment Plant	Q-1
KDH RO Water Treatment Plant	Water Treatment Plant	Q-2
Nag's Head Water Treatment Plant	Water Treatment Plant	Q-3

Table 6. Inventory of potential contaminant sources

Potential Contaminant Source Description	Type of Source	Map Symbol
Skyco Plant		
Midway Automotive	Auto Repair	B-1
Cudworth Cemetary	Cemetery	C-1
Outer Banks Pest Control	Chemical Storage	D-1
Marine NAPA (Murray Auto)	Chemical Storage	D-2
Dominion Electrical Substation	Electrical Substation	E-3
Eastern Service Center (former)	Pollution Incident	F-1
Decatur Partnership FTF Site	Pollution Incident	F-2
Lift Station	Lift Station/WWTP	H-4
Lift Station	Lift Station/WWTP	H-5
Coastal Studies Institute	Injection well	I-1
Baumtown Road Dump	Landfill	J-1
Walker Recreation Park	Landfill	J-2
US 64	Primary Road	K-1
NC 345	Primary Road	K-5
Dare Storage	Self-Storage	M-3
Mann's Red & White	UST/Gas Station	O-7
Skyco WTP	Water Treatment Plant	Q-4
Mac Midgett Plant		
Rodanthe Pier	AST/Generators	A-1
Chicamacomico Fire Department	Auto Repair/fleet vehicles	B-2
NC 12	Primary Road	K-4
N. Beach Campground	UST/Gas Station	O-8
Liberty Island Convenience	UST/Gas Station	O-9
RWS WTP	Water Treatment Plant	Q-5
Stumpy Point Plant		
Sprint cell tower emer. Gen.	AST/Generators	A-4
US 264	Primary Road	K-2
Pointer's Field	Pesticide/herbicide application	P-1
Stumpy Point WWTP	Lift Station/WWTP	H-6
Stumpy Point Water Treatment Plant	Water Treatment Plant	Q-6

Table 6. Inventory of potential contaminant sources

Potential Contaminant Source Description	Type of Source	Map Symbol
Hatteras Plant		
Billy Mitchell Airstrip	AST/Generators	A-2
Scotch Bonnet Marina	AST/Generators	A-3
Frisco Volunteer Fire Department	Auto Repair/fleet vehicles	B-3
Hatteras Body Shop	Auto Repair	B-4
Auto Banks Car Repair	Auto Repair	B-5
Fulcher Cemetary	Cemetery	C-2
Hatteras Elec. Coop. Substation	Electrical Substation	E-2
NC 12	Primary Roads	K-4
Hatteras WTP	Water Treatment Plant	Q-7

Table 7. Dare County Wells Risk Analysis

Site Description	Map Symbol	Closest Well	Protection radius, ft	Distance from well	Proximity Score	Risk Category	Overall Risk
NRO Potential Sources							
Luke's Auto repair	B-6	9	1,673	1,200	0.28	3	0.85
Nags Head Ocean Rescue	B-7	15	1,832	550	0.70	3	2.10
Lowe's	D-3	Orville	1,747	950	0.46	3	1.37
Dominion Electrical Substation	E-1	8	1,673	800	0.52	2	1.04
Coin Op Laundry	G-1	4	1,673	400	0.76	3	2.28
Stormwater Sewer	H-1	1	1,673	100	0.94	2	1.88
Stormwater Sewer	H-2	6	1,673	100	0.94	2	1.88
Stormwater Sewer	H-3	5	1,673	125	0.93	2	1.85
Stormwater Sewer	H-7	7	1,673	650	0.61	2	1.22
Stormwater Sewer	H-8	4	1,673	800	0.52	2	1.04
Stormwater Sewer	H-9	8	1,673	1,100	0.34	2	0.68
US 158	K-3	Multiple	1,747	200	0.89	2	1.77
NC 12	K-4	Multiple	1,747	200	0.89	2	1.77
Master Graphics Printers	L-1	4	1,673	600	0.64	3	1.92
Nag's Head Self Storage	M-1	10	1,673	1,300	0.22	1	0.22
Beach Warehouses Mini Storage	M-2	9	1,673	1,500	0.10	1	0.10
Nag's Head Public Works	N-1	10	1,673	1,300	0.22	2	0.45
KDH Recycle Center	N-2	7	1,673	1,100	0.34	2	0.68
Austin Fish Co.	O-1	15	1,832	650	0.65	3	1.94
Kangaroo (RAM 53)	O-2	4	1,673	900	0.46	3	1.39
Wright Memorial Maintenance	O-3	5	1,673	1,500	0.10	3	0.31
Stop n Shop Convenience & Deli	O-4	4	1,673	1,650	0.01	3	0.04
Nag's Head Shell	O-5	15	1,832	1,000	0.45	3	1.36
Quality Plus Oil	O-6	3	1,673	800	0.52	3	1.57
Duck Thru 24	O-10	17	1,747	700	0.60	3	1.80
NRO Water Treatment Plant	Q-1	3	1,673	400	0.76	2	1.52
KDH RO Water Treatment Plant	Q-2	9	1,673	1,150	0.31	2	0.63
Nag's Head Water Treatment Plant	Q-3	10	1,673	1,250	0.25	2	0.51
						Total:	**29.86**

Table 7. Dare County Wells Risk Analysis

Site Description	Map Symbol	Closest Well	Protection radius, ft	Distance from well	Proximity Score	Risk Category	Overall Risk
Skyco Potential Sources							
Midway Automotive	B-1	Skyco 11	3,566	1,400	0.61	3	1.82
Cudworth Cemetary	C-1	Skyco 2	2,591	2,000	0.23	1	0.23
Outer Banks Pest Control	D-1	Skyco 11	3,566	2,675	0.25	3	0.75
Marine NAPA (Murray Auto)	D-2	Skyco 11	3,566	2,700	0.24	3	0.73
Dominion Electrical Substation	E-3	Skyco 11	3,566	2,250	0.37	2	0.74
Eastern Service Center (former)	F-1	Skyco 11	3,566	2,450	0.31	3	0.94
Decatur Partnership FTF Site	F-2	Skyco 11	3,566	2,600	0.27	3	0.81
Lift Station	H-4	Skyco 6	2,199	1,150	0.48	2	0.95
Lift Station	H-5	Skyco 2	2,591	400	0.85	2	1.69
Coastal Studies Institute	I-1	Skyco 6	2,199	1,800	0.18	2	0.36
Baumtown Road Dump	J-1	Skyco 2	2,591	2,100	0.19	3	0.57
Walker Recreation Park	J-2	Skyco 2	2,591	2,450	0.05	3	0.16
US 64	K-1	Skyco 14	2,354	500	0.79	2	1.58
NC 345	K-5	Multiple	2,199	150	0.93	2	1.86
Dare Storage	M-3	Skyco 6	2,199	600	0.73	1	0.73
Mann's Red & White	O-7	Skyco 2	2,591	550	0.79	3	2.36
Skyco WTP	Q-4	Skyco 11	3,566	1,400	0.61	2	1.21
						Total:	**17.50**
Mac Midgett Potential Sources							
Rodanthe Pier	A-1	RWS-2	3,520	3,000	0.15	2	0.30
Chicamacomico Fire Department	B-2	RWS-2	3,520	2,350	0.33	3	1.00
NC 12	K-4	Multiple	3,520	175	0.95	2	1.90
North Beach Campground	O-8	RWS-1	3,520	550	0.84	3	2.53
Liberty Island Convenience	O-9	RWS-1	3,520	800	0.77	3	2.32
RWS WTP	Q-5	RWS-1	3,520	350	0.90	3	2.70
						Total:	**10.74**

Table 7. Dare County Wells Risk Analysis

Site Description	Map Symbol	Closest Well	Protection radius, ft	Distance from well	Proximity Score	Risk Category	Overall Risk
Stumpy Point Potential Sources							
Sprint cell tower emer. Gen.	A-4	Stumpy Pt 1	2,492	375	0.85	2	1.70
US 264	K-2	Stumpy Pt 1	2,492	550	0.78	2	1.56
Pointer's Field	P-1	Stumpy Pt 1	2,492	200	0.92	1	0.92
Stumpy Point WWTP	H-6	Stumpy Pt 1	2,492	580	0.77	2	1.53
Stumpy Point Water Treatment Plant	Q-6	Stumpy Pt 2	2,492	100	0.96	2	1.92
						Total:	**7.63**
Hatteras Potential Sources							
Billy Mitchell Airstrip	A-2	3D	3,137	1250	0.60	2	1.20
Scotch Bonnet Marina	A-3	PW-2	4,241	1060	0.75	2	1.50
Frisco Volunteer Fire Department	B-3	6L	3,137	2650	0.16	3	0.47
Hatteras Body Shop	B-4	6L	3,137	2700	0.14	3	0.42
Auto Banks Car Repair	B-5	8L	3,137	2750	0.12	3	0.37
Fulcher Cemetary	C-2	8L	3,137	2820	0.10	1	0.10
Hatteras Elec. Coop. Substation	E-2	3D	3,137	1730	0.45	2	0.90
NC 12	K-4	Multiple	4,241	200	0.95	2	1.91
Hatteras WTP	Q-7	PW-1	5,195	375	0.93	2	1.86
						Total:	**8.72**

Table 8. Dare County Water System Contacts

Water System Management	
Utilities Director	(252) 480-2296
Assistant Utilities Director	(252) 441-4726
Water Treatment Plants	
NRO WTP	(252) 475-5990
Skyco WTP	(252) 475-5790
RWS WTP	(252) 475-5780
Hatteras WTP	(252) 475-5760
Stumpy Point WTP	(252) 473-6609
Radio	
WVOD 99.1 Manteo	(252) 475-1888
WCXL 104.1 Nags Head	(252) 441-1024
WOBR 95.3 Manteo	(252) 473-2444
Television	
Channel 3 WTKR	(757) 460-1000
Channel 4 WSKY	(757) 382-0004
Channel 7 WITN	(252) 473-4705
Channel 10 WAVY	(757) 393-1010
Channel 20 Gov't Access	(252) 475-5900
Newspapers	
Outer Banks Sentinel	(252) 480-2234
Virginian Pilot	(757) 446-2155
Coastland Times	(252) 473-2105
Law Enforcement	
NRO, Kill Devil Hills PD	(252) 449-5337
Dare Co Sheriff	(252) 475-5980

WELLHEAD PROTECTION PLAN

for

The County of Dare,

North Carolina

APPENDIX

- Dare County Wellhead Protection Ordinance
- Coastal Studies Institute injection wells site map and construction specifications
- Dare County Water Department educational brochure
- Potential Contaminant Sources Risk Categories
- Potential Contamination Source Inventory, 2013
- Dare County Well Construction Records

WEBSITE AND DATABASE SEARCH:

1. 2011 Water Supply System Report:
http://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/search.php

2. EPA's Envirofacts data warehouse (including Enviromapper) for information on air, community water sources, water dischargers, toxic releases, hazardous waste and superfund sites: http://www.epa.gov/enviro/index.html

3. Sourcewater Protection and Assessment in NC for information on Animal Operations, CERCLIS, NPL, NPDES, PCS, RCRA, septage disposal, soil remediation, and Tier II sites, non-discharge permits, landfills, pollution incidents, and UIC and UST permits:
http://204.211.89.20/Swap/

COUNTY OF DARE
KILL DEVIL HILLS, NORTH CAROLINA 27948

GROUNDWATER PROTECTION RESOLUTION
IN SUPPORT OF THE DARE COUNTY WELLHEAD PROTECTION PLAN

600 MUSTIAN ST.
PHONE (919) 441-7788

WHEREAS, the Dare County Water System derives their public water supply from ground wells, and

WHEREAS, the groundwater needs to be protected from contamination by activities of mankind, and

WHEREAS, the Dare County Water System desires to assume and maintain a leadership role in the protection of its drinking water resources through its own efforts and in cooperation with other local governments and state and federal agencies,

NOW THEREFORE BE IT RESOLVED by the Dare County Board of Commissioners that the Dare County Water System, NC does hereby adopt the following resolution titled "Groundwater Protection Resolution".

This resolution shall be known as the "Groundwater Protection Resolution".

It is the purpose of this resolution to promote public health, safety, and general welfare, and to minimize public and private losses due to contamination for the public water supply, to maximize groundwater protection/pollution abatement control procedures, and protect our groundwater resources:

1) Protect human life and health;
2) Minimize expenditure of public money for costly pollution projects;
3) Minimize business interruption;
4) Insure that the public is provided with a safe potable water supply now and for future generations;
5) Protect the natural groundwater resources of the state.

In order to accomplish its purpose, this resolution shall employ the following methods:

1) Establish a groundwater protection area.
2) Inventory and plot on a map all potential sources of contamination within the designated groundwater protection area.
3) Frequent monitoring of existing and future activities within the groundwater protection areas that have been identified as potential sources of contamination.
4) Develop contingency plans for alternative drinking water supplies to help mitigate contamination of the current public water supply.
5) Educate the public on groundwater, where it comes from, how it becomes contaminated, and the ways to protect it.
6) Use all local, state, and federal resources and regulations to protect groundwater.
7) Submit a copy of this program to the NC Department of Environment and Natural Resources, Public Water Supply Section for consent and approval.

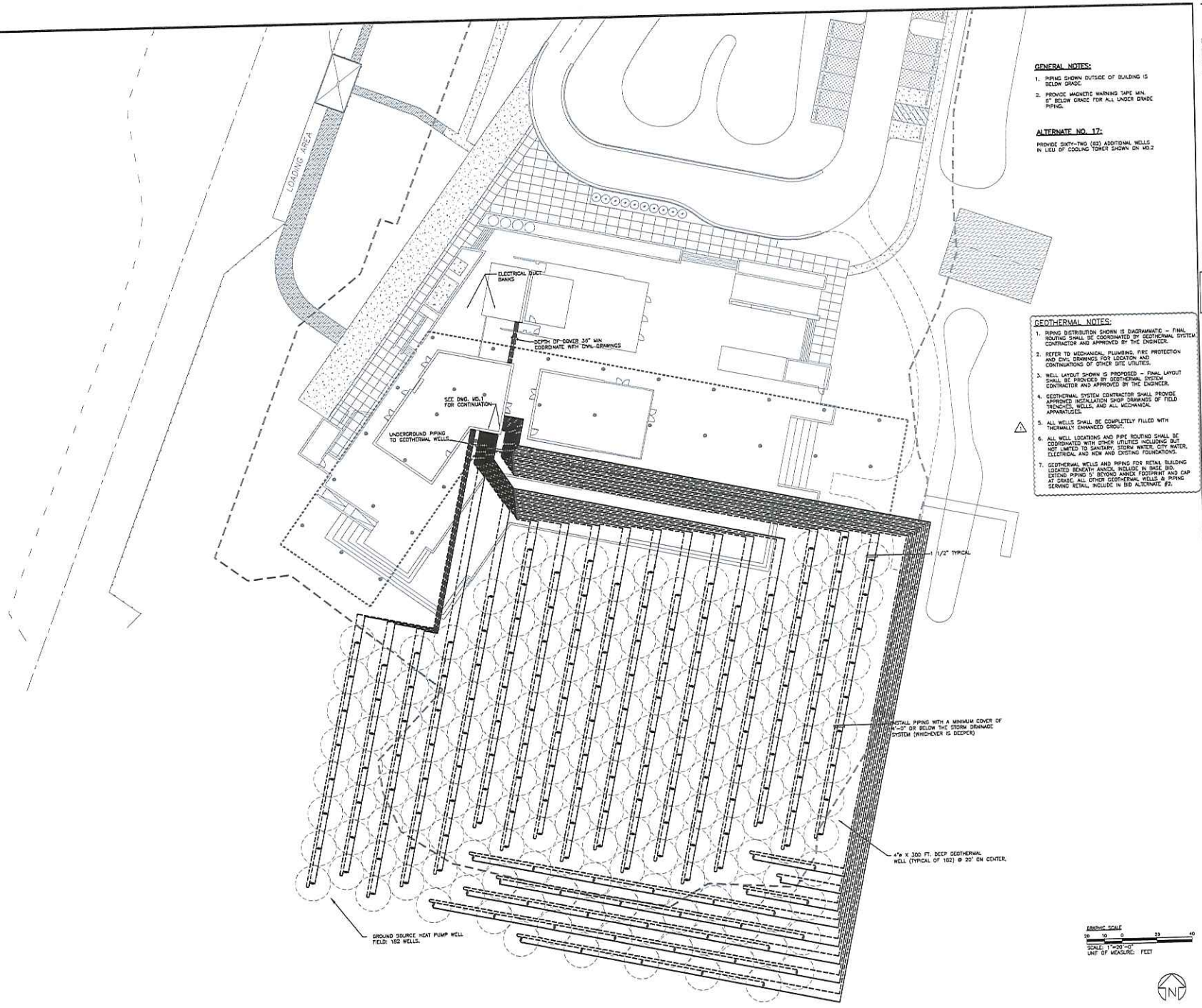
This the 7th day of September, 1999

DARE COUNTY BOARD OF COMMISSIONERS

By: Renee W. Perry
Chair

ATTEST:

Frances W. Harris
Clerk



GENERAL NOTES:

1. PIPING SHOWN OUTSIDE OF BUILDING IS BELOW GRADE.
2. PROVIDE MAGNETIC WARNING TAPE MIN. 6" BELOW GRADE FOR ALL UNDER GRADE PIPING.

ALTERNATE NO. 17:

PROVIDE SIXTY-TWO (62) ADDITIONAL WELLS IN LIEU OF COOLING TOWER SHOWN ON M0.2

GEOTHERMAL NOTES:

1. PIPING DISTRIBUTION SHOWN IS DIAGRAMMATIC – FINAL ROUTING SHALL BE COORDINATED BY GEOTHERMAL SYSTEM CONTRACTOR AND APPROVED BY THE ENGINEER.
2. REFER TO MECHANICAL, PLUMBING, FIRE PROTECTION AND CIVIL DRAWINGS FOR LOCATION AND CONTINUATIONS OF OTHER SITE UTILITIES.
3. WELL LAYOUT SHOWN IS PROPOSED – FINAL LAYOUT SHALL BE PROVIDED BY GEOTHERMAL SYSTEM CONTRACTOR AND APPROVED BY THE ENGINEER.
4. GEOTHERMAL SYSTEM CONTRACTOR SHALL PROVIDE APPROVED INSTALLATION SHOP DRAWINGS OF FIELD TRENCHES, WELLS, AND ALL MECHANICAL APPARATUSES.
5. ALL WELLS SHALL BE COMPLETELY FILLED WITH THERMALLY ENHANCED GROUT.
6. ALL WELL LOCATIONS AND PIPE ROUTING SHALL BE COORDINATED WITH OTHER UTILITIES INCLUDING BUT NOT LIMITED TO SANITARY, STORM WATER, CITY WATER, ELECTRICAL AND NEW AND EXISTING FOUNDATIONS.
7. GEOTHERMAL WELLS AND PIPING FOR RETAIL BUILDING LOCATED BENEATH AWNER, INCLUDE IN BASE BID. EXTEND PIPING 5' BEYOND AWNER FOOTPRINT AND CAP AT GRADE. ALL OTHER GEOTHERMAL WELLS & PIPING SERVING RETAIL INCLUDE IN BID ALTERNATE #2.

EAST CAROLINA UNIVERSITY

UNC COASTAL STUDIES INSTITUTE

SKYCO SITE - MANTEO, NORTH CAROLINA

OWNER PROJECT IDENTIFICATION
SCO ID#: 04B632502A
CODE: 45438
ITEM: 307

ARCHITECT
PBC+L ARCHITECTS
Pearce Brinkley Cease + Lee
333 Fayetteville St. Suite 1000
Raleigh, North Carolina 27601
p.(919)836.9751 f.(919)836.1751

SEALS
NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT SEAL
JEFFERY L. MONROE
11.15.10

CONSULTANT
RMF ENGINEERING, INC.
4309 EMPEROR BOULEVARD
SUITE 325
DURHAM, NORTH CAROLINA 27703
PHONE: 919-941-5575
FAX: 919-941-9551
NC LICENSE NO.: C-1125

SUBMITTAL
APPROVED BID DOCUMENTS
15 NOVEMBER 2010

11.15.10	BID FINAL COMMENTS

KEY PLAN

SHEET
MECHANICAL SITE PLAN (ALTERNATE NO. 17)

M0.3

PROJECT NUMBER
PBC+L 1398 VOLUME 1
RESEARCH BUILDING

Coastal Studies Institute
University of North Carolina
Manteo, North Carolina
SCO #040632502A

SECTION 232113.33 - GROUND-LOOP HEAT-PUMP PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping for vertical, direct-buried, ground-loop, heat-pump systems that operate between 23 and 104 deg F.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
   1. Ground-Loop, Heat-Pump Piping: 160 psig.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Pipe and fittings.
   2. Joining method and equipment.

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. PE Pipe: ASTM D 2239, SIDR Numbers 5.3, 7, 9, or 11.5; with PE compound number required to achieve required system working pressure.
   1. Molded PE Fittings: ASTM D 2683 or ASTM D 3261, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. U-Bend Assembly: Factory fabricated with embossed depth stamp every 24 inches from U-bend.

2.2 BOREHOLE BACKFILL

A. Surface Seal: Cement with thermal conductivity greater than 1.2 Btu/h x sq. ft. x deg F.

B. Backfill below Surface Seal: Natural or manufactured sand specified in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, warning tape, and backfilling are specified in Division 31 Section "Earth Moving."

WHAT IS GROUNDWATER?

Groundwater is rain or snow that soaks down into the ground and is stored in pores between the soil or in cracks in the bedrock. Dare County uses groundwater as its water supply, using wells to pump water from the Yorktown aquifer to provide high-quality drinking water to the citizens of the county.

THE WELLHEAD PROTECTION PROGRAM

Dare County has developed a Wellhead Protection Program to protect its water supply from contamination. As a part of the program, it has identified vulnerable areas around its wells called a "Wellhead Protection Area". Chemicals and other pollutants spilled or dumped in this area can be drawn into the well, possibly contaminating our community's drinking water supply. Residents and businesses in these areas must be very careful with chemicals and other potential pollutants.

POLLUTION SOURCES!

Many things we do in our daily lives can pollute our surface water and groundwater. Sources of groundwater pollution include:

- Used oil, paint thinner, gasoline and other chemicals poured on the ground
- Leaking storage tanks (aboveground and underground)
- Overuse of pesticides and fertilizers on lawns, golf courses and agricultural fields
- Chemical spills at businesses, farms and along highways
- Illegal dumps and poorly managed landfills
- Failing septic tanks
- Leaking sewer lines
- Improperly abandoned wells
- Unlined waste pits, ponds and lagoons

NEED MORE INFORMATION?

The County of Dare
Public Utilities Department
(252) 475-5606
NC Rural Water Association
(336) 731-6963

HOW CAN YOU HELP?

Water is our most valuable natural resource – we must protect it! You can help by doing your part to protect our supply and by supporting this program.
Here are some tips:

- Never pour used oil, paint thinner or other hazardous chemicals on the ground or down the drain. Take them to a recycling center or to a Household Hazardous Waste Collection Day
- Check for and fix leaks in storage tanks (i.e. home heating oil/kerosene) at your home or business
- Inspect and pump your septic tank as needed
- Have any unused wells on your property properly abandoned
- Minimize your use of pesticides and fertilizers and store them properly
- Clean up junk and debris on your property
- Report all chemical spills immediately
- Encourage community leaders and businesses to do everything possible to protect our drinking water supply

Potential Contamination Sources by Risk Category

Higher Risk Potential Contamination Sources for Ground Water PWS Systems

COMMERCIAL/INDUSTRIAL

- Automobile Body shops
  Gas stations
  Repair shops
- Chemical /petroleum processing/storage
- *Sewer lines
- Utility right-of-way/pesticide use
- Chemical/petroleum pipelines
- Wood/pulp/paper processing and mills
- Dry cleaners
- Electrical/electronic manufacturing
- Fleet/trucking/bus terminals
- Furniture repair/manufacturing
- Home manufacturing
- Junk/scrap/salvage yards
- Machine shops
- Metal plating/finishing/fabricating
- Mines/sand or gravel excavations
- Parking lots/malls (>50 spaces)
- Photo processing/printing
- Plastics/synthetics producers
- Research laboratories

OTHER

- Road salt storage areas
- Military installations
  (for classified risks not otherwise listed)

AGRICULTURAL/RURAL

- Farm machinery repair
- Rural machine shops
- *Intensive livestock operations; Lagoons, spray fields
- Fertilizer, pesticide, and petroleum storage, distribution, handling, mixing, and cleaning areas
- *Sewage sludge (biosolids) storage, handling, mixing and cleaning areas
- *Sewage sludge (biosolids) land application
- Unauthorized/illegal disposal of wastes/chemicals

RESIDENTIAL/MUNICIPAL

- Airports - maintenance/fueling areas
- Railroad yards/maintenance/fueling areas
- Landfills/dumps
- Utility stations - maintenance areas
- *Septic systems - high density (>1/acre)
- *Sewer lines
- *Stormwater drains/discharges
- Fertilizer, pesticide, sewage sludge

Notes: *1. This is a list of potential sources of contamination not a list of known databases of contaminants.*
2. Higher risk potential contaminant sources are considered to have a higher potential for drinking water contamination than those designated moderate risk or lower risk Facility-specific management practices are not taken into account in estimating risks and assigning these categories.
3. An asterisk [*] indicates activities that may be associated with microbiological contamination.

Potential Contamination Sources by Risk Category (Con't)

Moderate Risk PCSs

COMMERCIAL/INDUSTRIAL
- Car washes
- Cement/concrete plants
- Food processing
- Hardware/lumber/parts stores

AGRICULTURAL/RURAL
- *Auction lots
- *Boarding stables
- Crops, irrigated (berries, Christmas trees, hops, mint, orchards, vineyards, nurseries, greenhouses, vegetables, sod)
  NOTE: Drip-irrigated crops are considered lower risks.
- Drinking water treatment plant residuals/sludge application

RESIDENTIAL/MUNICIPAL
- Drinking water treatment plants
- Golf courses
- Housing - high density (>1 house/.5 acres)
- Motor pools
- Parks
- Waste transfer/recycling stations
  Wastewater treatment plants
  collection stations

OTHER
- Above ground storage tanks
- Construction/demolition areas
- Hospitals
- Transportation corridors
  Freeways/state highways
  Railroads
  Right-of-way maintenance (herbicide use areas)
- Irrigation, water supply, or monitoring wells

Lower Risk PCSs

COMMERCIAL/INDUSTRIAL
- Office buildings/complexes
- RV/mini storage

AGRICULTURAL/RURAL
- Crops, non-irrigated (grains, grass seeds, hay)
- *Rangeland
- Managed forests/silviculture

RESIDENTIAL/MUNICIPAL
- Apartments and condominiums
- Campgrounds/RV parks
- Fire stations
- Schools
- Housing – low density (< 1 house/.5 acres)

OTHER
- Medical/dental offices/clinics
- Veterinary offices/clinics

SOURCE: Adapted from EPA (1993), and from the Oregon Wellhead Protection Program

INVENTORY OF POTENTIAL CONTAMINATION SOURCES

Source Code A-1

Closest Well _____

FACILITY NAME: RODANTHE PIER

ADDRESS:
24138 HOLIDAY BLVD S.
RODANTHE, NC 27968

PHONE #: (252) 989-2345

OWNER/RP:
HATTERAS PARTNERS
PO BOX 9
RODANTHE, NC 27968

PHONE #: _____

MUNICIPALITY: MAC MIDGETT

POTENTIAL CONTAMINATION SOURCES:	QUANTITY:
CHEM STORAGE (SWIMMING POOL)	
RECREATION VEHICLE DUMPING STATION	± 2,000-gal
KEROSENE AST	500-gal

ADDITIONAL INFORMATION:

2013 ✓

INVENTORY OF POTENTIAL CONTAMINATION SOURCES

Source Code A2

Closest Well _____

FACILITY NAME: BILLY MITCHELL AIRSTRIP

ADDRESS:
NC 12
FRISCO, NC

PHONE #: (252) 995-3735

OWNER/RP:
DARE COUNTY REGIONAL AIRPORT
410 AIRPORT RD
MANTEO, NC 27954

PHONE #: (252) 473-2600

MUNICIPALITY: HATTERAS

POTENTIAL CONTAMINATION SOURCES:	QUANTITY:
TEMPORARY STORAGE OF AVGAS FOR EMER. REFUELING	± 5,000 GAL

ADDITIONAL INFORMATION:
TANKER TRUCK ONLY; NO PERMANENT AST
2013 ✓

INVENTORY OF POTENTIAL CONTAMINATION SOURCES

Source Code A-3

Closest Well _____

FACILITY NAME: SCOTCH BONNET MARINA

ADDRESS:
NC HWY 12, PO BOX 70
FRISCO, NC 27936

PHONE #: (252) 995-4242

OWNER/RP:

PHONE #: _____

MUNICIPALITY: HATTERAS

POTENTIAL CONTAMINATION SOURCES:	QUANTITY:
AST - DIESEL	2,500-GAL

ADDITIONAL INFORMATION:

2013 ✓