FINAL REPORT
IN SUPPORT OF CANDIDATE
ENVIRONMENTAL IMPACT STATEMENT

1

To:

Air Force Special Weapons Center
DEE/Environics
Kirtland Air Force Base
Albuquerque, New Mexico 87117

AD-A956 469

Subject:

An Environmental Assessment of the Fee Acquisition of Dare County Range, North Carolina

Prepared by:

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Project Director:

Mr. David I. Hellstrom

Contract No.:

F29601-73-D-0027
Call Order #0005

October 15, 1974

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Environmental Planning Division
(HQ USAF/CEVP)

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Candidate Environmental Impact Statement

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Arthur D Little, Inc.

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SUMMARY

This report presents an analysis of the environmental impact of the fee acquisition of the Dare County Range by the Air Force. For approximately 10 years about 47,000 acres of land mainly in Dare County, North Carolina has been leased by the Air Force for use as a training range, where pilots could practice ordnance delivery. No live ordnance is used on the Range except for small spotting charges used in practice bombs. The Range is currently used by the U. S. Air Force, Navy, Marines, and Air National Guard.

Approximately 6,000 acres of land on the Range has been cleared to be used for actual ordnance delivery--the rest of the area is wooded. This area is divided into two target areas, one maintained and controlled by the Air Force and one by the Navy.

Dare County is located on the coast of North Carolina, and covers approximately 247,000 acres. The County is divided into three major areas, the outer banks, Roanoke Island, and the mainland. In 1970, the County had a population of about 7,000.

The Range is located on the mainland, which accounts for over 50% of the land area of the County and less than 10% of the population. 202 households on the mainland occupy about .5% of the land area, most of the mainland is vacant. The nearest community to the Base, Stumpy Point, is about 10 miles from the Range, the nearest urban center is Norfolk, Virginia, about 120 miles north.

The direct impact of the fee acquisition of the Dare County Range by the Air Force will be an economic one, because this area will be removed from the tax base. In 1973 Dare County collected about $713,000 in taxes, about $39,000 of this was attributable to the mainland, and about $6,000 to the area occupied by the Range. Also the fee acquisition will have an impact on land use because the Range area will be committed to its current use for an undetermined length of time. Since no changes are planned in range operations as a result of the purchase of the fee acquisition, it can be expected that impacts due to current operations will continue. These current impacts include a small positive impacts on employment and the local economy, and small negative impacts due to increased air pollution, noise, risk of fires, and herbicide application. The Range currently provides over $200,000 in civilian salaries; this will increase when the Air Force Range converts to civilian personnel. About $267,000 in goods and services are purchased in the local community; this will decrease by about $35,000 with conversion to civilian personnel. Air pollution, attributable to Range operations are well below (by factors of at least several hundred) air quality standards. Noise exposure forecasts indicate that in a few narrow corridors entering the Range, NEF values are above 30 dB; however, since

this land is primarily vacant, the impact of this noise is essentially non-existent.

Use of spotting charges in practice bombs increases the risk of fires occurring in the range area. The Air Force has a contract with the North Carolina Forest Service to provide fire prevention and fire fighting. Two major fires have occurred on the Range in the last 10 years, one burned about 3,600 acres and one over 30,000 acres. Both were started by spotting charges. To reduce the amount of burnable material in the area, the target area is burned and herbicides are applied annually. In addition, non-incendiary spotting charges (which can at least partially replace current charges) are being developed.

In summary, adverse impacts of current operations of the Dare County Range are small, partly because of the low density of people in the surrounding area. The fee acquisition of the Range area will not alter substantially these impacts.

1.0 INTRODUCTION - DESCRIPTION OF THE PROPOSED ACTION

1.1 INTRODUCTION

This Draft Environmental Impact Statement (DEIS) has been prepared pursuant to the National Environmental Policy Act (NEPA) of 1969. NEPA directs the responsible federal agencies to develop an Environmental Impact Statement (EIS) on all major actions which may have a significant impact on the quality of the human environment. For this EIS the U. S. Air Force is the responsible federal agency. The proposed action is the fee acquisition of the Dare County Range, North Carolina.

This report is organized in the following manner. First, the proposed action is presented, and the existing environment is described. Then, the existing impact of the Range is described. The impacts of the proposed action are then discussed together with the impacts of other proposed changes in existing operations. Alternatives to the proposed action are outlined next. Finally, adverse impacts which cannot be avoided, irreversible and irretrievable commitments of resources and the relationship between the local short-term use of the environment and the maintenance of long-term productivity are stated.

1.2 DESCRIPTION OF THE PROPOSED ACTION

1.2.1 BACKGROUND

The Dare County Range has been leased for the past 10 years by the U. S. Air Force for use as a training range. (A detailed lease history is given in Appendix A. Currently most of the land is leased from First Colony Farms.) The original lease expired in June 1974 and was extended for 90 days. The Range is currently used by the Air Force, Navy, Marine Corps, and Air National Guard.

1.2.2 THE PROPOSED ACTION

The proposed action is the fee acquisition of the existing leased land by the Air Force for continued use as a training range. This would result in removing the land from the tax base and preventing use of the land for other purposes. Although there are several other changes in range operations that may also occur over the next several years (i.e., changing from military to civilian personnel, use of new practice bomb spotting charges during dry seasons, and an increase in range sorties), none of these is related directly to the proposed action.

2.0 DESCRIPTION OF THE EXISTING USE AND PROPOSED ACTIONS

2.1 BACKGROUND OF THE RANGE AND ITS USE

2.1.1 HISTORY OF THE RANGE

In January 1963, a Congressional committee was appointed by President John F. Kennedy to select a site for a training range on the East Coast for use by the Tactical Air Command (TAC). After considering the requirements for the range, and evaluating advantages and disadvantages of the proposed sites, the impact of the range activity on wildlife and game birds and on commercial interests in the area, the potential fire hazard, and the necessary restrictions on air space in the area, the committee selected the area of the Dare County Range as the best site and recommended that it be leased by the Air Force. Because operations of a range in this area would have interfered with operations of a Navy range at Stumpy Point, it was recommended that a joint range be established to be used by both services. At that time, the site was owned almost exclusively by West Virginia Pulp and Paper Company.

In February 1964, a lease was signed with West Virginia Pulp and Paper Company. In that lease (which remained in effect until June 1974) the Air Force leased about 45,000 acres of land for an initial yearly lease of $135,000. This was raised to $205,000 per year in 1969. The Air Force was responsible for reimbursing the property owner for any timber cleared or accidently burned because of Air Force operations. Two leases for small tracts of land for 1200.31 acres was negotiated with another owner, and an additional 302-acre tract was acquired through lease-hold condemnation. The Range was constructed in 1965 by the U. S. Navy under the supervision of the U. S. Air Force and has been in continuous use since that time. The land owned by WESTVACO (formerly West Virginia Pulp and Paper Company) was sold to M. P. McLean in 1973 and the lease was changed to indicate this.*

The lease expired on June 30, 1974, but was extended to provide an adequate negotiation period.

2.1.2 MILITARY FUNCTION OF THE RANGE

One of the important missions of the Tactical Air Command is to provide close air support (CAS) to forward ground elements and in particular to embattled armored units. Another important mission is to provide the capacity to find and destroy important targets at some distance behind the forward battle line. Forward supply depots, ammunition dumps, critical bridges, etc. are examples of the interdiction type target. In either case when the target area is defended, there is an obvious premium

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*A more detailed lease history is given in Appendix A.

for quickly locating and visually identifying the target and in selecting the optimum tactics for weapons delivery. One method of preparing a pilot to make this vital decision is to practice the various delivery techniques so that he instinctively will select the correct technique. The primary function of the Dare Range then is to provide tactical fighter pilots with the opportunity to repetitively practice ordnance delivery.

A secondary function of the Dare Range is to provide TAC with a tool for measuring unit proficiency. Unit proficiency is measured by the individual scores achieved by each pilot on each event. TAC purposely keeps the minimum qualifying criteria at a level which can be achieved only with a considerable amount of practice. Periodically each unit is subjected to an Operational Readiness Inspection wherein the total performance of the unit is measured by a team of highly qualified personnel from higher headquarters. At such times an inspecting official will be at the Range to observe the conduct and to record the scores posted by the evaluated unit.

One might expect that given the proper incentives to score well, pilots would try by any means whatsoever to better their individual performances. While the incentive is there, it turns out that the best techniques have long since been developed and that the way to improve individual scoring is simply to fly the highly structured patterns (i.e., holding air speeds, altitudes, dive angles, etc. as precisely as possible) better than the next pilot. Thus the flight patterns for any particular event are very repetitive and predictable.

All flights to and from Dare are conducted under Instrument Flight Rules (IFR). Thus the paths of the aircraft over the ground are defined in standard flight plans that specify time and position for transition from Washington Center control to Dare County Range control. Upon completion of its range mission, the flight departs the Range at the exit point at the time and altitude prescribed in the instrument flight plan (DD 175). Should recontact with Washington Center be impossible, the center holds that altitude/route clear of other IFR traffic for the time of flight.

2.1.3 SUMMARY PHYSICAL DESCRIPTION OF THE RANGE

2.1.3.1 Location and Size

The Dare County Range is located in the southern portion of mainland Dare County, in the northeast corner of North Carolina (see Figure 2.1.3-A). The nearest community to the Range is Stumpy Point which is approximately 10 miles away. Adjacent to Dare County in Tyrrell and Hyde Counties, the communities of Gum Neck, Frying Pan Landing, and Englehard are each about 15 miles from the Air Force range targets. A holding zone, used by aircraft entering the Air Force Range complex, is located north of Phelps Lake in eastern Washington County. (A more comprehensive description of the area surrounding the Dare County Range is given in Section 3.2.)

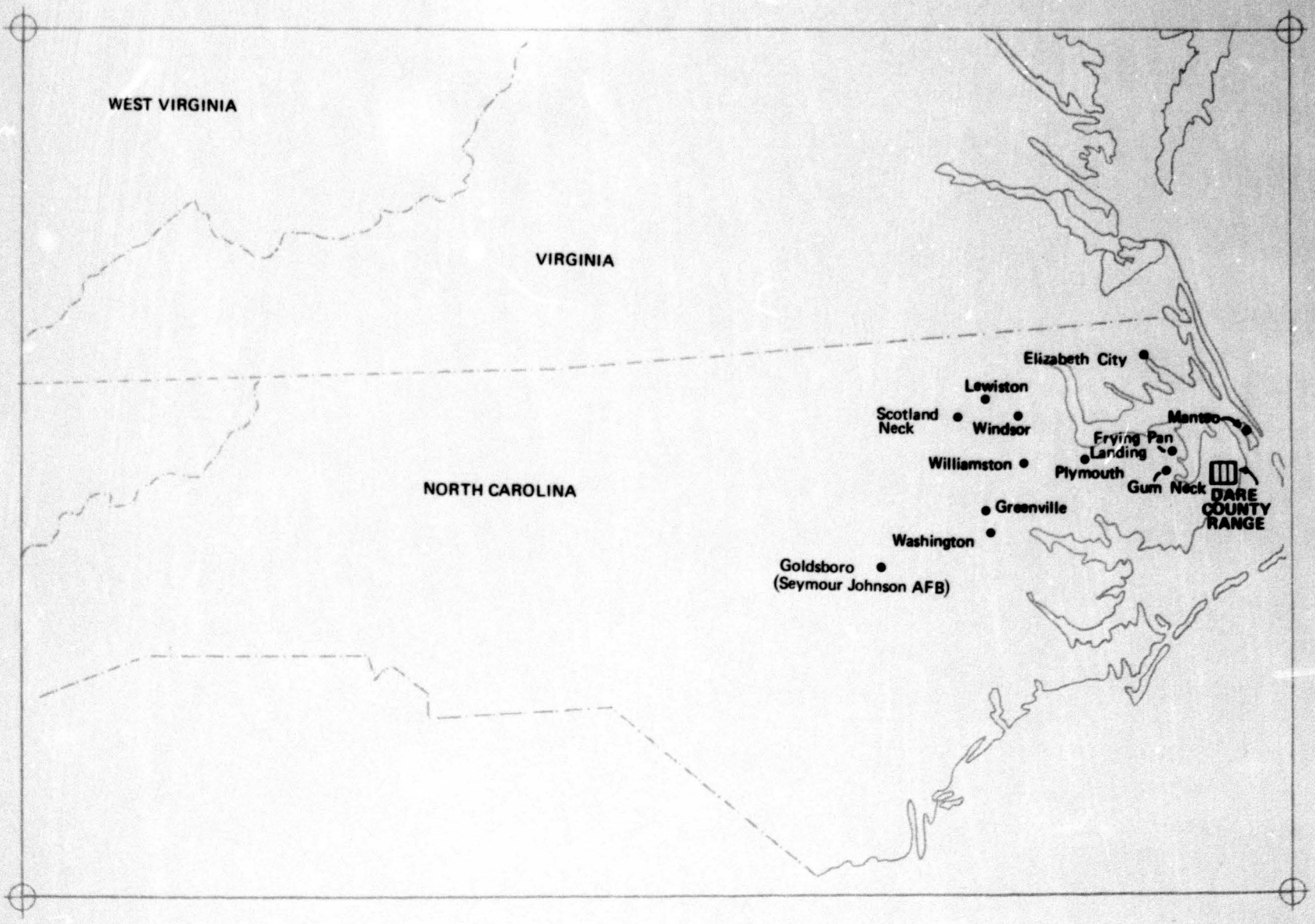


FIG. 2.1.3-A DARE COUNTY RANGE LOCATION

The Dare County Range is located on about 47,000 acres currently leased primarily from First Colony Farms. Figure 2.1.3-B shows the boundaries of the Range. Access to the Range is from Route 264, primarily via Whipping Creek Road or Dead End Road. Helicopter access is also available to the military. The leased property does not directly border on the Alligator River or on Route 264. The area of the Range can be described as open bog in the cleared areas, upland swamps or pocosin areas, and wooded swamps. All areas are underlain by peat of variable depth. The Range site has an elevation of 0 to 10 feet above sea level.

The Range contains two cleared areas, a Navy Dare Range complex and an Air Force (AF) Dare Range complex; the surrounding area is wooded. Approximately 3800 acres are cleared on the Air Force complex and 2300 cleared on the Navy complex. A wooded area remains between the two cleared areas. All active areas, i.e., targets, buildings, decontamination, Range operation, etc., for both the AF Dare and Navy Dare Ranges are within the cleared areas.

2.1.3.2 Roads and Buildings

There are no private homes or buildings or public roads on the leased area. All buildings on the Range (described later) were constructed for Range use. Most of the roads on the Range were constructed by the previous lessor of the property, WESTVACO; others were built during the construction and maintenance of the Range.

Figure 2.1.3-B shows the principal roads on the Range. The roads (approximately 165 miles) are all unpaved and are constructed from material removed during the construction process from ditches or canals which are located along the roads and from other fill. Thus, each road shown on the map has a parallel drainage ditch or canal adjacent to it. The ditches and canals are interconnected, serve to maintain the water level on the Range, and provide drainage as described later.

The following buildings, located on the Range, are shown in Figure 2.1.3-B.

Name		Location
Operations Building (offices, plotting room, storage area, latrine, showers, kitchens, rest area) (50' x 100')		Air Force Dare Range
Operations Buildings Storage Building Kitchens and Rest Area Buildings	adjacent to each other	Navy Dare Range
4 Generator Buildings (20' x 30')		at Flank Towers

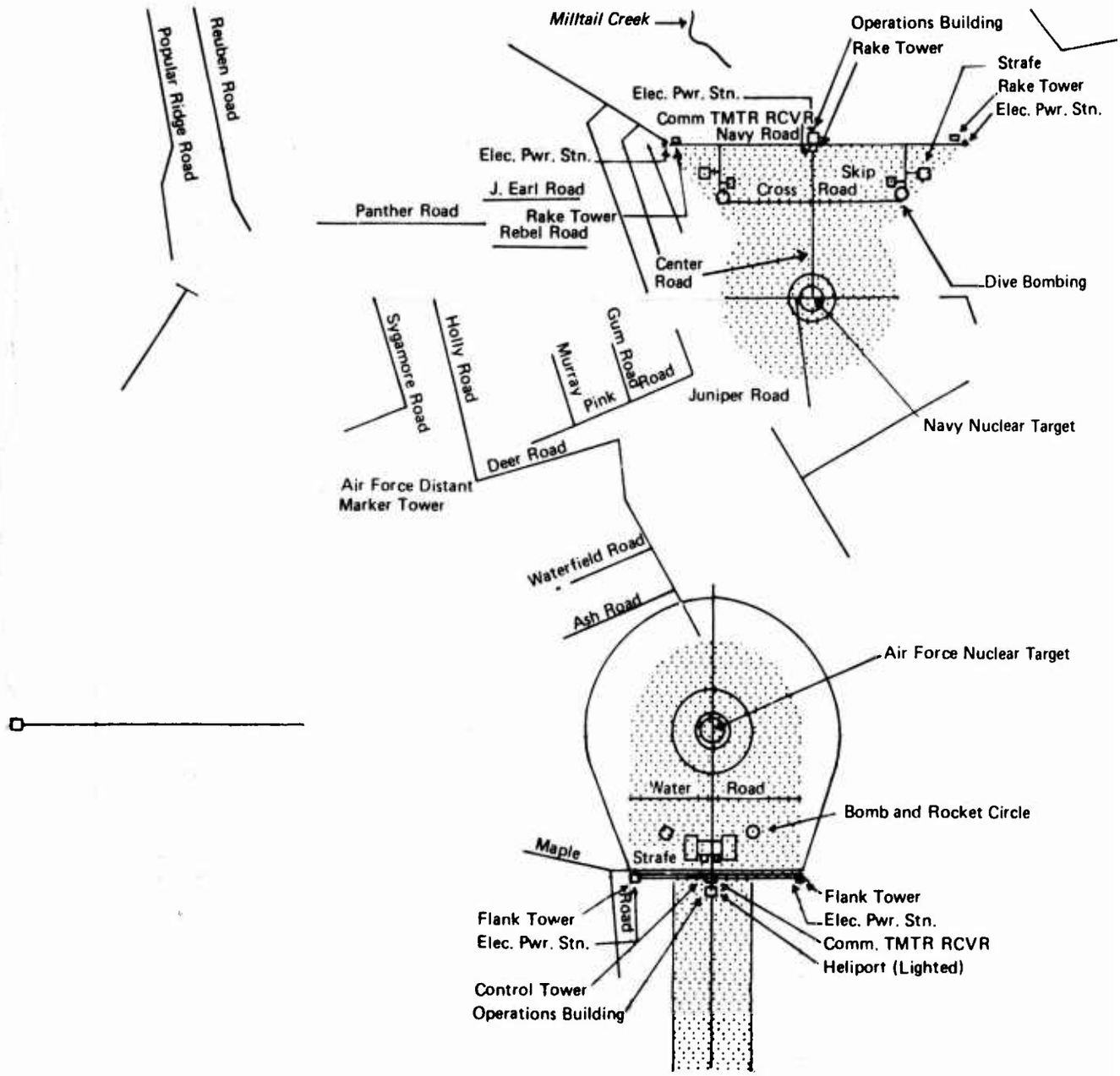


FIGURE 2.1.3-B DARE COUNTY RANGE

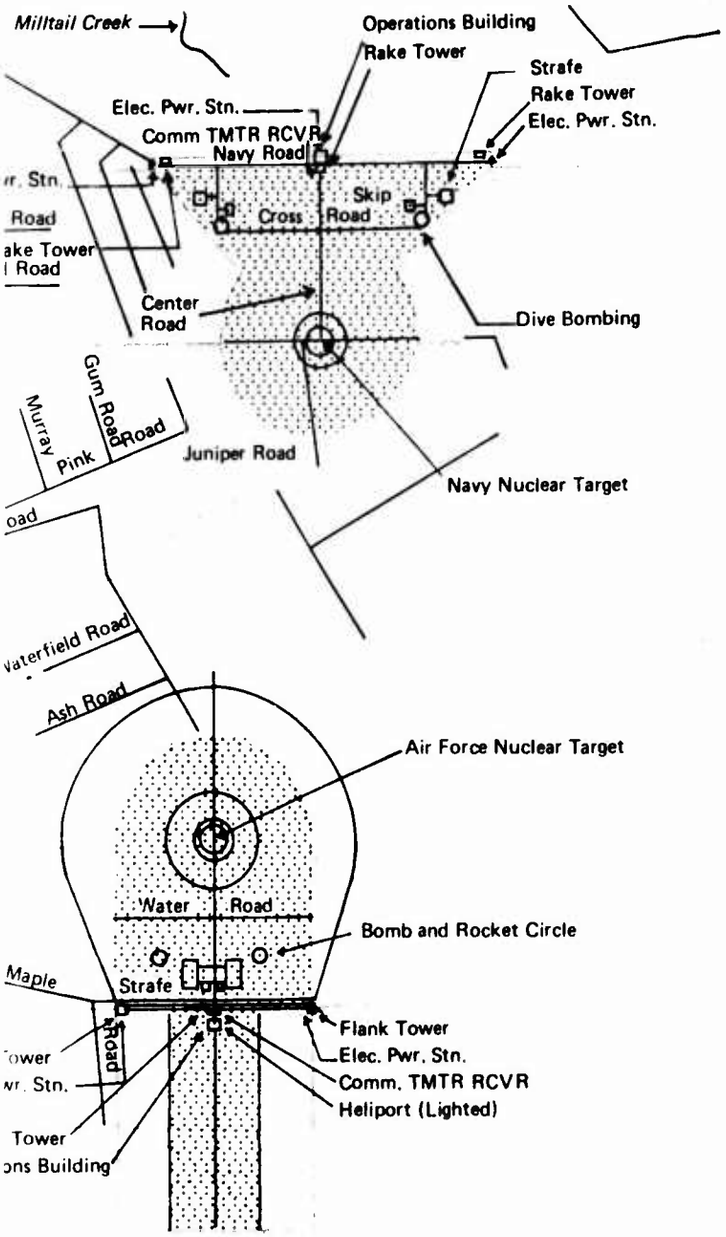


FIGURE 2.1.3-B DARE COUNTY RANGE

Name	Location
2 Generator Buildings (20' x 30')	at Control Towers
Several Small Storage Buildings	Air Force Dare Range
1 Control Tower (50')	Air Force Dare Range
1 Control Tower (30')	Navy Dare Range
2 Flank Towers (50')	Air Force Dare Range
2 Flank Towers (30')	Navy Dare Range

2.1.3.3 Equipment and Vehicles

The principal facilities at the Air Force Dare Range, in addition to the previously mentioned buildings and targets are:

2 100 kw diesel generators--Air Force Control Tower and Operations Building

2 25 kw diesel generators--Navy Control Tower and Operations Building

4 10 kw diesel generators--Air Force Flank Towers (2 at each Flank Tower, 1 operational, 1 spare)

4 10 kw diesel generators--Navy Flank Towers (2 at each Flank Tower, 1 operational, 1 spare)

2 1500-gal. diesel fuel tanks--Navy and Air Force Ranges (Center)

1 2000-gal. gasoline tank--Air Force Range (Center)

1 1000-gal. gasoline tank--Navy Range (Center)

4 600-gal. diesel fuel tanks--Air Force and Navy Flank Towers

1 2000-gal. water tank for fire control use--Air Force Range (Center)

Helicopter Landing Pad--Air Force Range (Center)

Deep Well and Septic Tank--Navy (1000 gal.); Air Force (2200 gal.)

Misc. Heating and Cooling Equipment for Buildings--Air Force Range, Navy Range

Misc. Communications Equipment--Air Force Range, Navy Range

Vehicle Washing Pad--Air Force Range (Center)

The AF Dare Range has the following vehicles:

1 1/2-ton pickup truck
1 6-passenger pickup truck
1 Massey Ferguson industrial tractor
1 20-passenger bus
2 M-Series weapons carriers
1 1 1/2-ton commercial truck
1 magnetic sweeper
1 Thiokol fire truck
1 600-gal fuel trailer for helicopter (anticipated 1974)

The Navy Dare Range has three pickup trucks and one Juggernaut (for working on swampy areas).

Private vehicles on the Range are limited to those of the civilian employees of the Navy and Air Force Ranges and visitors. The Air Force also provides vehicles to the North Carolina Forest Service for maintenance and fire fighting. Some of these are located on the Range; others are located off Range in a Forest Service facility in Stumpy Point. The vehicles available to the Forest Service are listed below:

4 1/2-ton pickup trucks
1 tractor, mower
2 Nodwell
2 Bombardiers
2 5-ton trucks, flat bed
1 road grader
1 front end loader
1 fire truck
1 1 1/2-ton 6-passenger pickup truck
1 5-ton dump truck
1 marsh buggy
2 HD 11 tractors
2 5-ton tractors without trailers
3 10-ton tractors with trailers
1 forklift

2.2 ADMINISTRATION AND PERSONNEL

2.2.1 ADMINISTRATION

Operation and maintenance of the Dare County Range is under the supervision of the Chief, Operations and Training, 4th Combat Support Group (4CSG), Seymour Johnson Air Force Base (SJAFB), N. C. A Range Superintendent (civilian) is directly responsible to the 4CSG of Operations and Training for the proper support and maintenance of the Air Force Dare Range. A Range Control Officer (RCO), who is a qualified pilot, is provided by the 4th Tactical Fighter Wing (4TFW) or other using using units and assumes operational control of the Air Force Dare Range. The primary duties of the RCO are "strict control of the

Range operations in accordance with all applicable directives to include preventing and eliminating unsafe practices or procedures through close supervision of all aircraft in the gunnery pattern." [1] The Range Superintendent is a resident of Dare County and is based on the Range. The RCO, usually based at SJAFB, has a normal one-week tour of duty and is on the Range from 30 minutes prior to the first scheduled mission until after the last scheduled mission is completed. Scheduling at the Air Force Dare Range is accomplished by the 4TFW at SJAFB. The schedule of activity (both AF and Navy) is forwarded to the FAA Washington ARTC Center by the 4TFW. The Navy is a tenant on the Dare County Range, and operation and maintenance of its facilities are under the direction of the Virginia Capes Operating Area Coordinator, Virginia Beach, Virginia. A Navy Range Supervisor (civilian) is in operational charge of the Navy Dare Range. His principal responsibilities are to assure the safe operation and maintenance of the Range and the activities using the Range. Scheduling of the Navy Dare Range is accomplished by the Virginia Capes Operating Area Coordinator (VCOAC), Virginia Beach, Va.

2.2.2 STAFFING

In addition to the AF Range Supervisor and the AF Range Control Officer, the operational staff of the AF Dare Range consists of 13 enlisted personnel, most of whom are on TDY (temporary duty) at the Range for 6 months. The weather specialists and medical specialists have shorter tours.

The Navy Dare Range is operated by the Range Supervisor and eight other civilian employees. All the personnel live in the area surrounding the Range (4 Mann's Harbor, 4 Stumpy Point, 1 Englehard). Weather and medical support is obtained from the AF Dare Range.

The AF Dare Range is usually operated with a full complement of staff; the Navy Dare Range, which usually operates two shifts per day, is staffed by a minimum of four in each shift.

The staff of the AF Dare Range will be civilian rather than military personnel.

2.2.3 CONTRACTS AND SERVICES

A major support contract is awarded to the North Carolina Forest Service by the Air Force to provide for fire suppression and prevention on the entire Dare County Range. This contract and the work performed is described in Section 4.3.1.

The Air Force contracts yearly with the Manteo Motel Corp., Manteo, N.C. to provide billeting for the 13 enlisted personnel and the RCO. Space is provided in 4 trailers on land owned by the Motel and in one motel room. The current value of this contract is approximately $18,000 per year. Diesel oil, gasoline, and miscellaneous supplies, as well as minor maintenance activities are contracted to local suppliers and tradesmen.

2.3 RANGE OPERATION

2.3.1 NORMAL MILITARY OPERATIONS

2.3.1.1 Users of Dare County Range

The Air Force, Navy, Air National Guard, and Marine Corps use the Dare County Range for training of tactical fighter pilots. Table 2.3.1-A summarizes the units, location, and type of aircraft presently using the Range. The Air Force is the principal user, with the Navy, Air National Guard (ANG), and Marine Corps following in that order. Current aircraft using the Range include the F-4, F-105, A-6, A-7, A-4, and A-37. Weekday use of the Range is principally by Air Force and Navy units, except during the summer when the ANG is a frequent user. Weekend use is principally by the ANG. Night operations are more common on the Navy Dare Range. The ANG uses the AF Dare Range; the Marine Corps uses the Navy Dare Range.

2.3.1.2 Uses of Dare County Range

The types of range activities conducted include:

VLD	Visual Lay Down
VLADD	Visual Low Angle Drogue Delivery
RLD	Radar Lay Down
RLADD	Radar Low Angle Drogue Delivery
Offset Bomb	Initial Inbound Heading Offset 0-90°/Dive Angle 0-45°
Low Angle Bomb	Dive Angle 5-25°
Dive Bomb	Dive Angle 30-45°
Dive Toss Bomb	Bomb Release From Positive Climb Angle
Air to Ground Rockets	Dive Angle 30°, Minimum Altitude 1000' AGL
Strafe	Dive Angle 5-15°, Minimum Altitude 75' AGL
EMR	Estimated Manual Release
VTIP	Variable Timer--Initial Point (Variation of Dive Toss)
BTIP	Basic Timer--Initial Point (Variation of Dive Toss)
AGM-65	Air to Ground Missile (Long Straight in Launch)

Table 2.3.1-A

Users of Dare County Range

Air Force	Unit	Location	Aircraft
	4th Tactical Fighter Wing	Seymour Johnson AFB, N.C.	F-4
	354th Tactical Fighter Wing	Myrtle Beach, S.C.	A-7
Navy			
	Fighter Wing One	Oceana	F-4
	(VF-11, 31, 33, 41, 74, 84, 101, 102, 103)		
	Medium Attack Wing One	Oceana	A-6
	(VF-34, 35, 42, 65, 75, 85, 176)		
Air National Guard			
	103 Tactical Fighter Group	Connecticut	F-100
	108 Tactical Fighter Group	New Jersey	F-105
	113 Tactical Fighter Group	District of Columbia	F-105
	175 Tactical Fighter Group	Maryland	A-37
	192 Tactical Fighter Group	Virginia	F-105
Marine Corps			
	Second Marine Air Wing	Cherry Point, N.C.	A-6, F-4
	(VMAT-202, 203, VMA-121, 224, 332)		

These activities are conducted on the AF and Navy Dare nuclear targets and AF and Navy Dare conventional targets.

Some flights to the Dare County Range are low-level flights. A map indicating low-level routes in the vicinity of Dare County Range is shown in Figure 2.3.1-A. The use of low-level routes by AF and ANG units is described in Table 2.3.1-B. The typical altitude of the low-level flights is 1000 feet. The planes fly at 420 knots true air speed.

Use of the AF Dare Range by Air Force and ANG units is shown in Table 2.3.1-C for the period 1 October 1972 through 30 September 1973, and for the following three quarterly periods. In the period 1 October 1972 through 30 September 1973, 42,741 range sorties were conducted of which 76.1 percent were with AF aircraft and 23.9 percent with ANG aircraft. In the next nine-month period, 30,285 range sorties were conducted; percentages for two periods are not comparable because of the high ANG use of the range during the time span 1 July - 30 September of the first period.

The principal missions were:

	1 Oct 72-30 Sept 73	1 Oct 73-30 Jun 74
Strafe	30.3%	29.0%
Dive and Dive Toss Bomb	29.9%	30.0%
Low Angle Bomb	25.1%	27.9%
Visual Lay Down	8.8%	3.2%
All Others	5.9%	9.9%

Based on an estimated average 12 range sorties (individual passes made on the Range during one flight) per aircraft, 3562 AF and ANG individual aircraft flights used the Range during 1 October 72 through 30 September 73, and 2525 AF and ANG individual aircraft flights used the Range during 1 October 73 through 30 June 74. Considering the fact that ANG use of the Range is heaviest in the three months between July and September, the AF Dare Range use from 1 October 73 through 30 September 74 is expected to be similar to that of the previous 12-month period.

Based on an estimated average 12 flights (range sorties) per aircraft, 3562 AF and ANG aircraft used the Range during 1 October 72 through 30 September 73 and 2525 AF and ANG aircraft used the Range during 1 October 73 through 30 June 74. Considering the fact that ANG use of the Range is heaviest in the three months between July and September, the AF Dare Range use from 1 October 73 through 30 September 74 is expected to be similar to that of the previous 12 month period.

The use of the Navy Dare Range by Navy aircraft is shown in Table 2.3.1-D. Note that the first column represents the calendar year 1973. The second column covers the same time period, 1 October 73 through 30 June 74, as shown in Table 2.3.1-C. Although it appears that Navy Range utilization was lower in this nine-month period, the summer months are also high activity months for the Navy Dare Range.

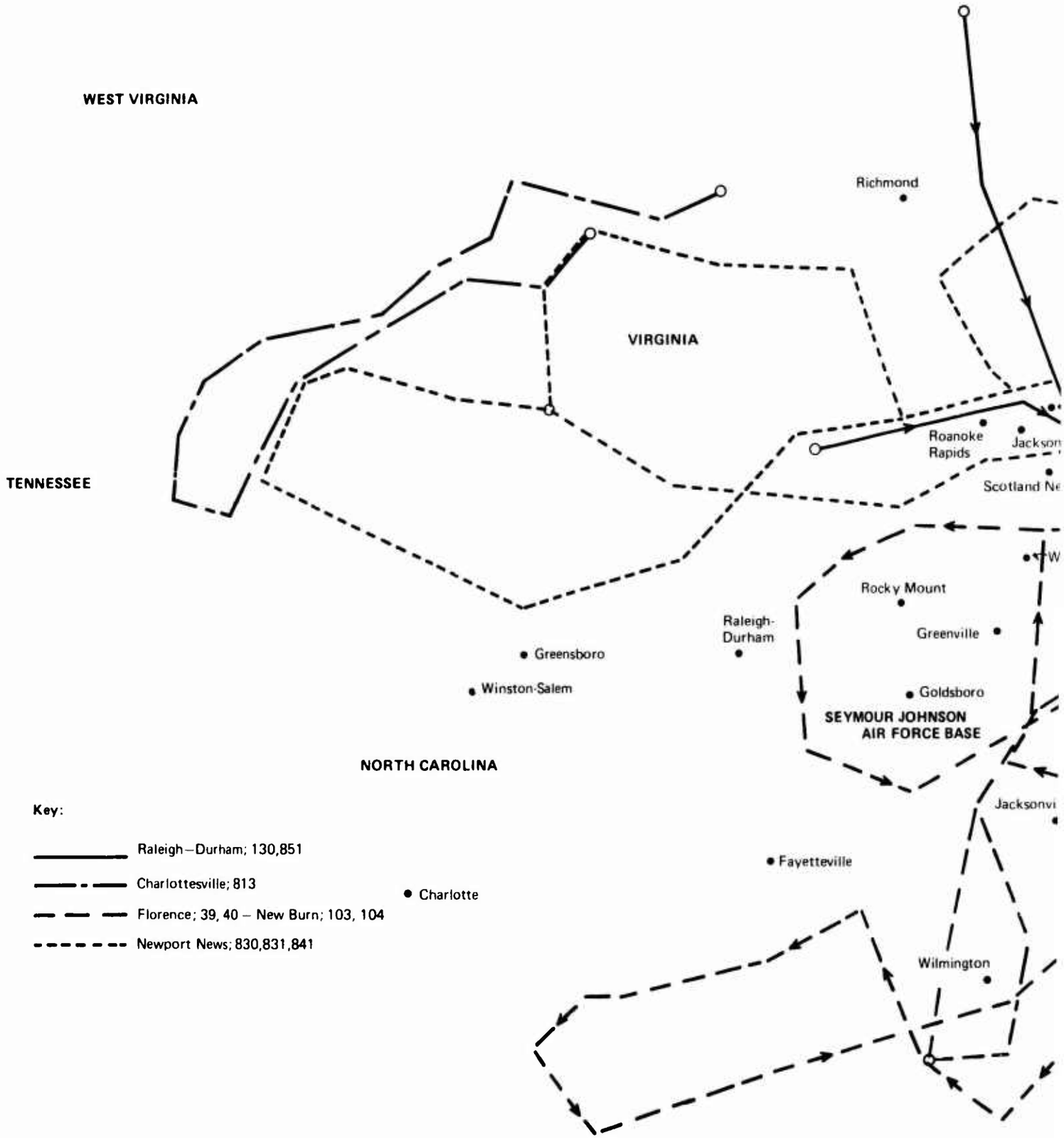


FIGURE 2.3.1–A LOW LEVEL ROUTES

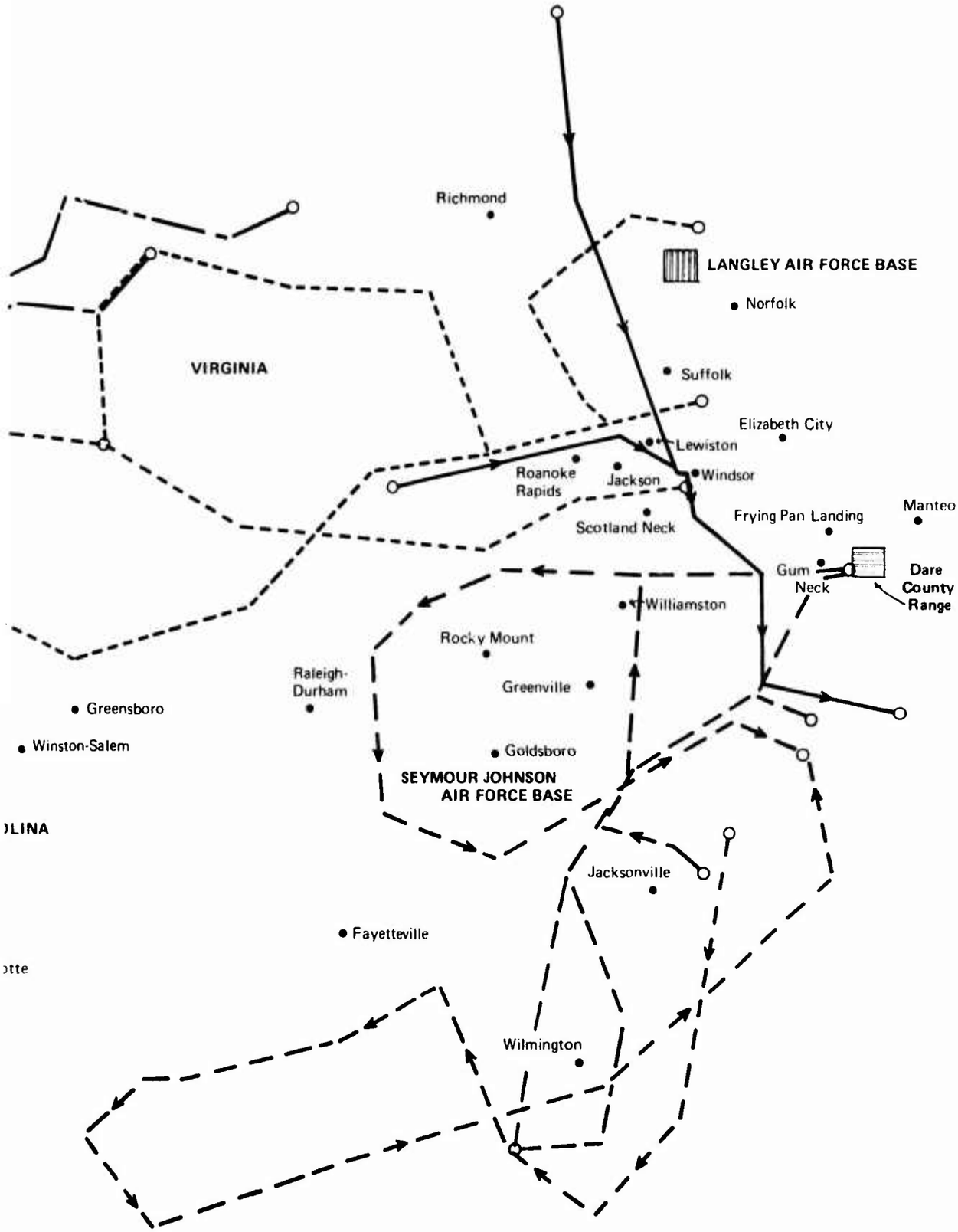


FIGURE 2.3.1–A LOW LEVEL ROUTES

Table 2.3.1-B

Use of Low-Level Routes by AF and ANG Units in the Vicinity of Dare County Range

Tactical Fgt Unit	State	Low-Level Route LLR	Use
103 TFG (F-100)	Connecticut ANG	Florence #39	Only on deployments (12 sorties[1]/year)
108th TFG (F-105)	New Jersey ANG		Use high altitude only
113 TFG (F-105)	District of Columbia ANG	Washington 851	4 sorties/week
175 TFG (A-37)	Maryland ANG		none
192 TFG (F-105)	Virginia ANG	Richmond 849	20 sorties/week
4th TFW (F-4)	Seymour Johnson AFB	Raleigh Dur 130 (mostly) Florence 39 (occasionally)	60 sorties/week
354th TFW (A-7)	Myrtle Beach AFB	Florence 39	60 sorties/week[2]

1. 1 sortie equals 1 aircraft

2. estimated

Table 2.3.1-C

Use of Air Force Dare Range by AF and ANG

	Range Sorties[a]			
	1 Oct 72-30 Sept 73		1 Oct 73-30 June 74	
	Hot[b]	Dry[b]	Hot[b]	Dry[b]
VLADD	553*	51	591	39
VLD	2931	851	923	39
RLADD	591	127	600	68
RLD	596	145	788	112
Dive and Dive Toss	6514 (3857)**	1854 (566)	6560 (1309)	1082 (148)
Low Angle Bomb	6256 (2768)	1563 (143)	6152 (1410)	740 (137)
Strafe	8443 (2239)	1971 (278)	5824 (1565)	1098 (289)
EMR	56	7	45	4
Offset	29	9	84	15
Air to Ground Rockets	(323)	(20)	532	131
Total AF	25969	6578	22099	3328
Total ANG	(9187)	(1007)	(4284)	(574)
Total	35156	7585	26383	3902
	42741		30285	

*Numbers are AF Range Sorties

**Numbers in parentheses are ANG Range Sorties

(a) Range Sortie defined as one pass over the appropriate target

(b) Hot and dry refer to dropping or firing training munitions and no munitions, respectively.

Table 2.3.1-D

Use of Navy Dare Range

	Range Sorties	
	1 Jan 73-31 Dec 73	1 Oct 73-June 74
Bomb	19,471	12,126
Rocket	2,875	1,285
Strafe	127	141
Dry Run	2,352	2,248
	24,825	15,800
	Aircraft	
F-4	791	364
A-6	1,786	1,600
Other	22	18
	2,599	1,982
Sorties/Aircraft	9.6	8.0

Approximately 55% of the total flights from NAS Oceana to the Navy Dare Range use low-level routes. All of the low-level flights are by A-6 aircraft; therefore, approximately 80% of the A-6 flights to Navy Dare Range are low level. The low-level routes used by the Navy units have been shown in Figure 2.3.1-A. The major low-level routes include:

Charlottesville	813
Florence	39
Florence	40
New Burn	103
New Burn	104
Newport News	830
Newport News	831
Raleigh Durham	130
Washington	851

Routes Florence 39 and Raleigh Durham 130 lead directly to the Dare Range. The minimum altitude for Navy low-level flights is 200 ft.

The use of the Navy Dare Range by Marine Corps aircraft was estimated at about 2 percent of the Navy use; details were not obtained on the types of activities or number of aircraft.

2.3.1.3 Range Utilization

The use of AF Dare Range is normally scheduled in half-hour periods, 8 hours each day, 5 days per week. Night and weekend scheduling is on an as-required basis and is not counted in the hours/year range availability. Table 2.3.1-E shows the hours of AF Dare Range availability and actual use, indicating reasons for lost time. Changes in reporting systems, i.e., different methods for classifying lost time, have occurred.

Night use of the AF Dare Range, based on 1 October 73 through 30 June 74 data, is about 12 percent of the total use. ANG weekend use, based upon 1 October 72 through 30 September 73 data is about 17 percent of the total.

The use of Navy Dare Range is normally scheduled in 15-minute periods, with an availability of 15 1/2 hours per day Monday-Thursday and 8 hours on Friday. Thus, the typical availability for a 20-operating-day month is 280 hours. Scheduled and actual use of the Navy Dare Range for the calendar year 1972 and the period 1 October 73 through 30 June 74 are given below.

	1 Jan 73-31 Dec 73	1 Oct 73-30 June 74
Scheduled Use (hours)	2675.5	1758.5
Actual Use (hours)	1266	943.75
% of Schedule	47.3%	53.7%

Range closure details and reasons for lost time were not obtained. Approximately 36 percent of the Navy Dare Range use occurs at night.

Table 2.3.1-E

Utilization of Air Force Dare Range

	1 Oct 72-30 Sept 73	1 Oct 73-30 June 74
Number Hours Available:	1992[a]	1560
Hours Lost:		
Weather	307	211.5
Range Maintenance	254.5	58.5[c]
Decontamination	26.5	--
Fire or Fire Hazard	9	69
Operations and Higher Headquarters Cancellations	193	120.5[d]
	790	459.5
Usable Hours	1202	1100.5
Estimated Hours of Actual Use	745[b]	717.5[e]+97[f]
% Usable Hours	62%	65%

(a) Based on 8 hours/day; 5 days/week less holidays

(b) Does not include ANG use of 157 hours on weekends

(c) Because of a change in reporting procedure, controlled burning may be reported as fire or fire hazard

(d) Includes holidays

(e) Includes ANG use

(f) Hours of night use

2.3.1.4 Ordnance Used

No live ordnance is used on the Dare County Range. None of the practice weapons used on the Range (AF or Navy) contain explosives except for the spotting charge used in practice bombs. The spotting charge (MK-4) is a mixture of phosphorous and smokeless powder designed to produce a small flash and smoke cloud upon impact and thus to provide an indication of bomb impact location for scoring purposes. The spot charge is approximately equal to the contents of a 8-gauge shotgun shell. It has the potential for causing fires.

The weapons and associated delivery methods for both the AF and Navy Dare Ranges are as follows:

Delivery Method	Ordnance	Spot Charge
Nuclear	MK 106	MK-4
Conventional	BDU-33	MK-4
Rocket	2.74 FFAR (solid head)	None
Skip Bomb	BDU-33	MK-4
Strafe	20 mm (solid head)	None
Dive/Skip	BDU-33	MK-4
Skip	M 106 (5 lb)	MK-4
Dive	M 82 (500 lb)	Sand Filled

2.3.1.5 Decontamination

Decontamination of the AF Dare Range is conducted in several stages. The area in front of the strafing targets is cleaned of spent munitions (manually and using a magnetic sweeper) once or twice each day, depending on range utilization. Practice bombs and other ordnance are removed from the target areas once per month (weekend operation). An annual range cleanup is conducted over about a one-week period at an optional scheduling point. In the period 1 October 72 through 30 September 73, approximately 1228 manhours were expended on decontamination, and 7.5 tons of spent ordnance sent to salvage.

Decontamination of the Navy Dare Range is less frequent because of the low number of strafing missions, the type of terrain, and the difficulty in locating and collecting spent ordnance. Spent ordnance is removed from roads during normal range maintenance.

2.3.1.6 Range Targets

2.3.1.6.1 Air Force Dare Range [1]

Nuclear Weapons Target (see Figure 2.1.3-B)

The nuclear target is a 25 by 25 foot billboard centered within three concentric circles having radii of 500, 800, and 2000 feet, located 6928 feet to the north of the control tower. The radius of the cleared area surrounding the target is 4000 feet.

There are two visual Initial Points (IP's) on the run-in line located at 7000 and 13,000 feet from the center of the target. The 13,000-foot IP consists of three 25-by-25 foot billboards equally spaced, 200 feet apart, aligned perpendicular to the run-in heading. The 7000 foot IP consists of two 25-by-25 foot billboards bracketing a radar reflector, aligned perpendicular to the run-in heading. The billboards and reflector

are equally spaced, 200 feet apart. There are two radar reflectors abeam the target, each positioned 1500 feet from the "Bull" aligned perpendicular to the run-in line. The run-in line is easily identified as a clearing cut through the wooded area to the target, 500 feet in width. Orientation of the run-in line is 109° magnetic.

Conventional Range (Dual Targets, see Figure 2.1.3-B)

The conventional ranges are located east and west of the control tower. Both sides are identically constructed. The final attack heading is 019° magnetic. Range traffic is normally right-hand for the west (left) and left-hand for the east (right) range; all forward firing ordnance is delivered from left range/right traffic or right range/left traffic.

Low Level Bomb Target

The target panel is 10 feet high and 25-feet wide. The scoring area is a water-filled entrenchment (50-by-200 feet) extending in front of the target.

Cluster Bomb Unit (CBU) Target

There are two water-filled entrenchments (50-by-200 feet) placed end to end with the desired impact area located in the center.

Dive/Rocket Circle

The circle has a radius of 140 feet and is constructed of interspaced, white 55-gallon drums. A center aim point is built from automobile bodies. A run-in line leading to the dive circle is formed by two parallel rows of interspaced, white-painted ammunition crates.

Strafe Targets

There are five strafe targets on each range. They are numbered one through five starting at the control tower outward. The panels are 25-by-25 feet; 20-by-20 foot panels may be requested in advance by units authorized to use the 1600-foot foul line.

Strafe Targets (Acoustical)

There are two acoustical scoring targets on each range located between upright supports for strafe panels 1/2 and 4/5. The normal target is a 10-by-10 foot panel centered in the scoring area; on occasions, a 25-by 25 foot strafe panel will be superimposed over the acoustical scoring area to check system calibration. The acoustical scoring area is normally 625 square feet based on the 2000-foot foul line, but can be reduced to 400 square feet for the 1600-foot foul line request.

2.3.1.6.2 Navy Dare Range [2] (see Figure 2.1.3-B)

Navy East Target

The Navy East Target complex has a rocket-glide bombing target consisting of one 20-foot circle of painted international orange tires and one circle of tires (also painted) 40 feet in diameter. Two scoring circles surround the target at 100 and 200 feet radius each. A strafing area is located 1500 feet northeast of the circular target and consists of tires painted international orange in the shape of a boat. A white strafing banner will be erected at the aim point of the strafing target if requested at least one day prior to the date desired. A battery-operated acoustiscore system is installed at the strafing target. The run-in heading is 199° magnetic with a left-hand pattern.

Navy Loft Target

The Navy Loft Target (nuclear) is a large circular special weapons target located 7000 feet south of the center tower. The target consists of steel cans painted international orange in a 50-foot diameter circle with a height of 20 feet. The firebreak, which surrounds the Navy complex and which circles the southern half of this target, has a radius of 4000 feet from the target center and provides an additional aerial spotting aid. Billboard-type distance markers are installed 6000 feet, 12,000 feet, 18,000 feet, 24,000 feet, and 30,000 feet from the center of the point of aim. These markers are aligned to the run-in heading of 109° magnetic and have the numbers 30, 24, 18, 12, and 6 painted to indicate the distance to the target in thousands of feet.

Bomb Dummy Unit (BDU) Target

The Navy BDU Target consists of a cylinder 14 feet in length and 8 feet in diameter. Painted with orange and silver stripes, the target is oriented broadside to the run-in heading of 109° magnetic. The target is located between the center tower and the loft target and is offset slightly to the east of an imaginary line between those points.

Minimum Altitude Lay-Down Target

The Minimum Altitude Lay-Down Target is 500 feet south of the center tower and consists of metal lockers and tires painted international orange in the shape of a horseshoe. It is 60 feet long and 15 feet wide. The run-in heading is 109° magnetic, left-hand pattern.

2.3.1.7 Typical Flight Operations

SJAFB Manual 55-1 (31 Oct 73) establishes procedures for the use of the AF Dare Range. COMNAVAIRLANT Instruction 13150.2 (15 May 73) establishes procedures for the use of the Navy Dare Range. Additional operational data relevant to operation of AF weapons ranges and training of pilots on weapons ranges are found in AF Manual 50-46 Training-Weapons Range,

30 June 1972, TAC Supplement 1, 13 Nov 1973, in the pertinent TAC/PACAFM 55-XXX relating to specific aircraft, and similar Navy manuals. The details of these operations will not be described here. Instead, a short summary of important procedures which have a bearing on the environmental impact of the Dare County Range and its use will be given, followed by a description of restricted air space, holding areas, entry and exit procedures, and flight paths for the air space surrounding and on the Dare County Range.

Procedures for the use of the AF Dare Range are as follows [1]:

- No live ordnance will be used on the range. Marking charges for practice bombs may be used for spotting purposes. Rockets will have a plastic (inert) head. Machine gun and cannon ammunition will be solid ball.
- There will be no supersonic flight on the Range or in maneuvering to enter/exit the Range.
- Inadvertent, gross error, or off-range releases will be reported immediately to range control.
- There will be no uncontrolled flight within the restricted area during range operation. All flights will be under control of a Range Control Officer. When the range is closed, the airspace will be under the control of Washington Center.
- The restricted airspace will be controlled by the Range Control Officer. Radio Contact must be made with Range Control before any aircraft enters the Range restricted area. Necessary overflights by agencies having reason to send planes over the range area while patrolling for fires after an electric storm or conducting waterfowl census, and similar reasons, must be cleared by the Range Control Officer. Call sign will be Air Force Dare County Range.
- Flares will not be dropped by aircraft on the Range or in support of range operations.
- The shorelines of Pungo Lake and Lake Mattamuskeet will be avoided by five nautical miles.

Procedures for the use of the Navy Dare Range are as follows [2]:

- Pilots are cautioned to avoid the City of Manteo, North Carolina. In particular, the amphitheater, located two miles northwest of the city, must be avoided by at least five miles as indicated below. The Lost Colony Pageant is annually being shown nightly except Sundays in this amphitheater from 15 June through Labor Day commencing at 2015 local time and lasting for two hours. During the above time, Navy East Target will not be utilized and the aircraft will avoid passing within ten miles of the presentation.

- High explosives will not be used on Navy Dare Range targets. The following items are authorized:

    a. Bombs - Any size practice bomb or training shape may be used providing it is inert and utilizes only a marking charge for spotting purposes.

    b. Rockets - Sub-caliber practice rockets through 2.75 inch with inert head may be used. Five-inch rockets may be authorized when requested.

    c. Strafing Ammunition - Only solid ball ammunition will be used.

- Aircraft will cross outer banks at 500 feet above ground level (AGL) or higher at a point north of Oregon Inlet and south of Wanchese, N. C.

    a. Airspace being utilized is not incorporated in the Dare County Range (R-5314); therefore FAA Regulations must be observed.

    b. Pea Island National Wildlife Refuge is located south of Oregon Inlet and the minimum altitude crossing this area is 3000 feet AGL.

2.3.1.8 Restricted Air Space

Figure 2.3.1-B and Table 2.3.1-F show the restricted air space associated with and near the Dare County Range. The controlling agency for this restricted space is the FAA, Washington ARTC Center. These areas are restricted on a continuous basis.

2.3.1.9 Holding Areas

The west entry holding point for the AF Dare Range is 35°38'N 76°28'W. Aircraft awaiting clearance to the Range hold on the north shore of Phelps Lake at or above 1500 feet utilizing turns remaining north of the center of the lake. Weather permitting, flights hold at odd thousands plus 500 feet above 3000 feet (i.e., 3500 ft, 5500 ft, etc.). The east entry holding point for the AF Dare Range (less frequently used) is 35°41'N 75°44'E (Figure 2.3.1-C). This area is over Pamlico Sound. Aircraft hold at even thousands plus 500 feet above 2000 feet, utilizing turns and avoiding area R-5313. Area R-5313 is a Navy Target area not associated with the Dare County Range. (See Figure 2.3.1-C for holding areas and entry routes.)

The holding area for the East Target at the Navy Dare Range is located

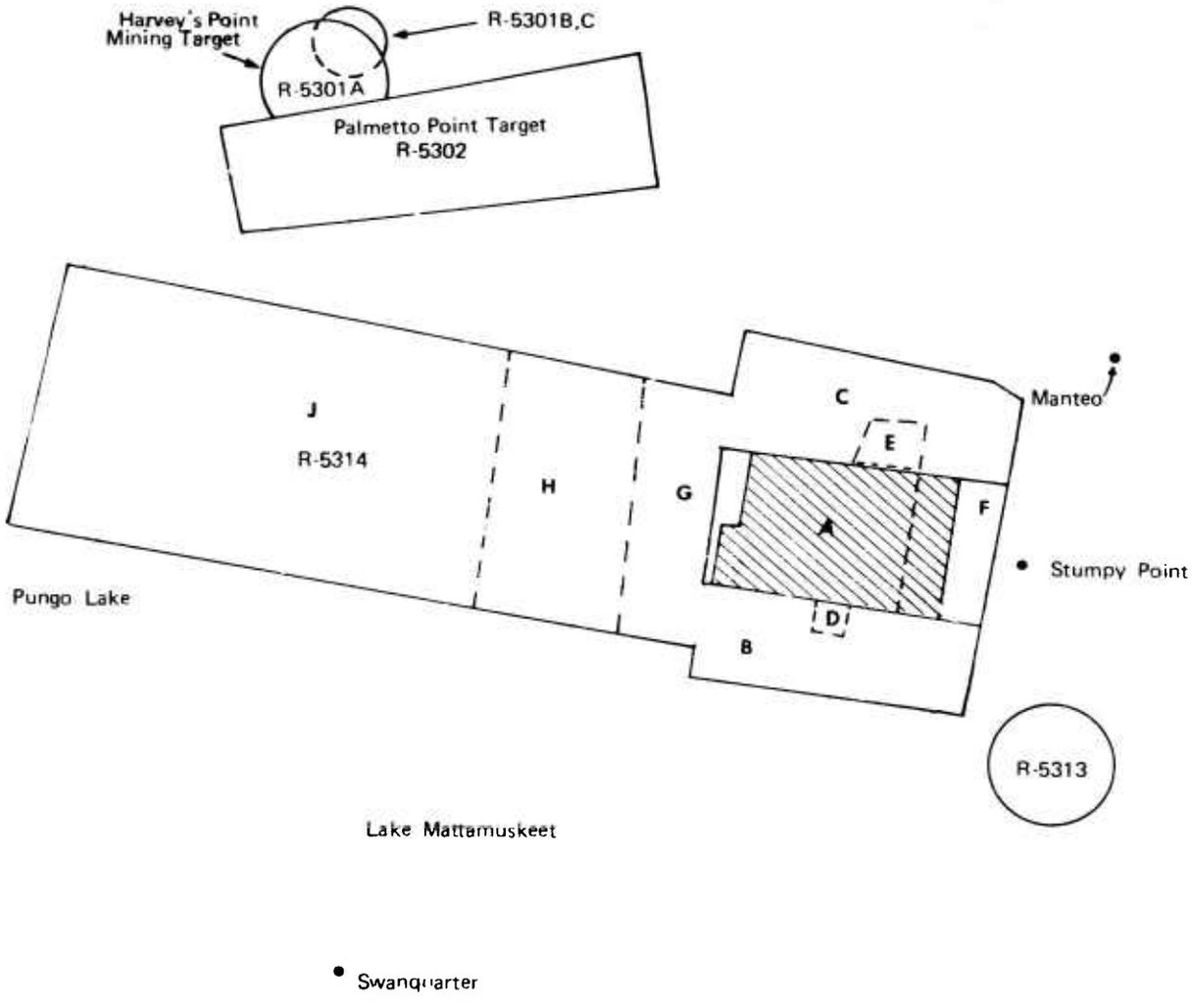


FIGURE 2.3.1-B RESTRICTED AIR SPACE

Table 2.3.1-F

Restricted Air Space

Area	Altitudes	Location
R5314 A	0 to 20,500'	35°45'40"N, 75°49'20"W to 35°40'10"N, 75°50'15"W to 35°41'30"N, 76°00'20"W to 35°47'00"N, 75°59'00"W to point of beginning
B	500 to 20,500'	35°39'30"N, 75°45'45"W to 35°34'40"N, 75°46'50"W to 35°36'45"N, 76°01'20"W to 35°41'30"N, 76°00'20"W to point of beginning
C	500 to 20,500'	35°48'30"N, 75°43'40"W to 35°45'00"N, 75°44'35"W to 35°47'00"N, 75°59'00"W to 35°51'35"N, 75°57'55"W to 35°49'30"N, 75°45'00"W to point of beginning
D	0 to 20,500'	35°40'30"N, 75°52'05"W to 35°38'40"N, 75°52'35"W to 35°39'00"N, 75°54'35"W to 35°40'40"N, 75°54'10"W to point of beginning
E	0 to 20,500'	35°47'50"N, 75°48'50"W to 35°45'40"N, 75°49'20"W to 35°46'10"N, 75°52'35"W to 35°48'00"N, 75°52'00"W to point of beginning
F	500 to 20,500'	35°45'00"N, 75°44'35"W to 35°39'30"N, 75°45'45"W to 35°40'10"N, 75°50'15"W to 35°45'40"N, 75°49'20"W to point of beginning
G	200 to 15,000	35°49'40"N, 75°58'20"W to 35°38'55"N, 76°01'00"W to 35°39'20"N, 75°05'00"W to 35°50'20"N, 76°02'20"W to

Table 2.3.1-F (Cont'd)

Area	Altitude	Location
R5314 H	500 to 10,000'	35°50'20"N, 76°02'30"W to 35°39'20"N, 76°05'00"W to 35°40'25"N, 76°12'25"W to 35°51'25"N, 76°10'05"W to point of beginning
J	1,000 to 6,000'	35°51'25"N, 76°10'05"W to 35°40'25"N, 76°12'25"W to 35°43'50"N, 76°35'30"W to 35°54'50"N, 76°33'11"W to point of beginning
R5301 A	0 to 5,000'	3-statute-mile radius 36°04'N, 76°20'W
B	0 to 5,000'	1 1/2-nautical-mile radius 36°05'25"N, 76°18'30"W
R5302	0 to 14,000'	36°04'N, 35°58'N, 76°03'W, 76°02'W, 35°56'N, 36°01'N, 76°24'W, 76°25'W
R5313	0 to 18,000	3-statute-mile radius 35°33'N, 75°41'W

at 36°05'N 75°47'W over Albemarle Sound west of Pt. Harbor. Flights hold at 8000 feet or higher in this area. The holding area for the Navy Loft and BDU Targets (nuclear) is located east of Columbia, N.C., at approximately 35"55'N 76°12'W, at or about 8000 feet (see Figure 2.3.1-C).

Both the Air Force and Navy pilots take a great deal of pride in arriving at the range entry point at the exact moment of scheduled range time. During ORI (Operational Readiness Inspection) evaluations, in particular, it is not unusual for each flight to arrive at the range entry point within a few seconds of the scheduled time. Clearance to enter range is always a requirement. If for any reason the flight using the range in the preceding block time is still on the range, the incoming flight will have precedence when its block time starts. Under these circumstances there is relatively little use of the holding pattern. Each turn around the holding pattern requires a minimum of four minutes; thus any holding delays will be in four-minute increments.

2.3.1.10 Range Entry and Exit Routes

Figure 2.3.1-C shows the principal entry and exit routes to Dare County Range. All flights must contact the Range Control Officer (AF or Navy) prior to departing the range entry holding points.

On west entry to the AF nuclear target, aircraft depart the northern edge of Phelps Lake heading 109°. On west entry to the AF conventional targets, flights depart the northern edge of Phelps Lake heading 116° and may descend to a minimum of 500 feet when the range complex is in sight. West exit from the AF Dare Range is direct to the west entry holding point; flights exiting under VFR will be at even thousands plus 500 feet, above 6000 feet if weather permits.

East entry to the AF conventional range is from the holding area southwest toward the range complex remaining south of Highway 264. A right run is made around Long Shoal Point for a spacer pass (obtaining necessary spacing between aircraft) descending to 500 feet when the range complex is in sight. On east exit from the AF Dare Range, aircraft climb to at least 1000 feet above flights holding at the east entry point before exiting R-5314 directly to the entry point. Flights exiting under VFR are at odd thousands plus 500 feet, if weather permits, and exit above 5000 feet.

Aircraft using the Navy East Target leave the entry point (off Pt. Harbor) and are cleared on target using a left hand pattern with a run in heading of 199° magnetic. Aircraft departing the Range clear eastbound above 3000 feet passing north of Oregon Inlet.

Aircraft using the Navy Loft Target using a left-hand pattern with a run-in heading of 109° magnetic. Maximum altitude of the downwind (westbound) leg will be 5000 feet. Aircraft departing the Range clear eastbound above 3000 feet passing north of Oregon Inlet.

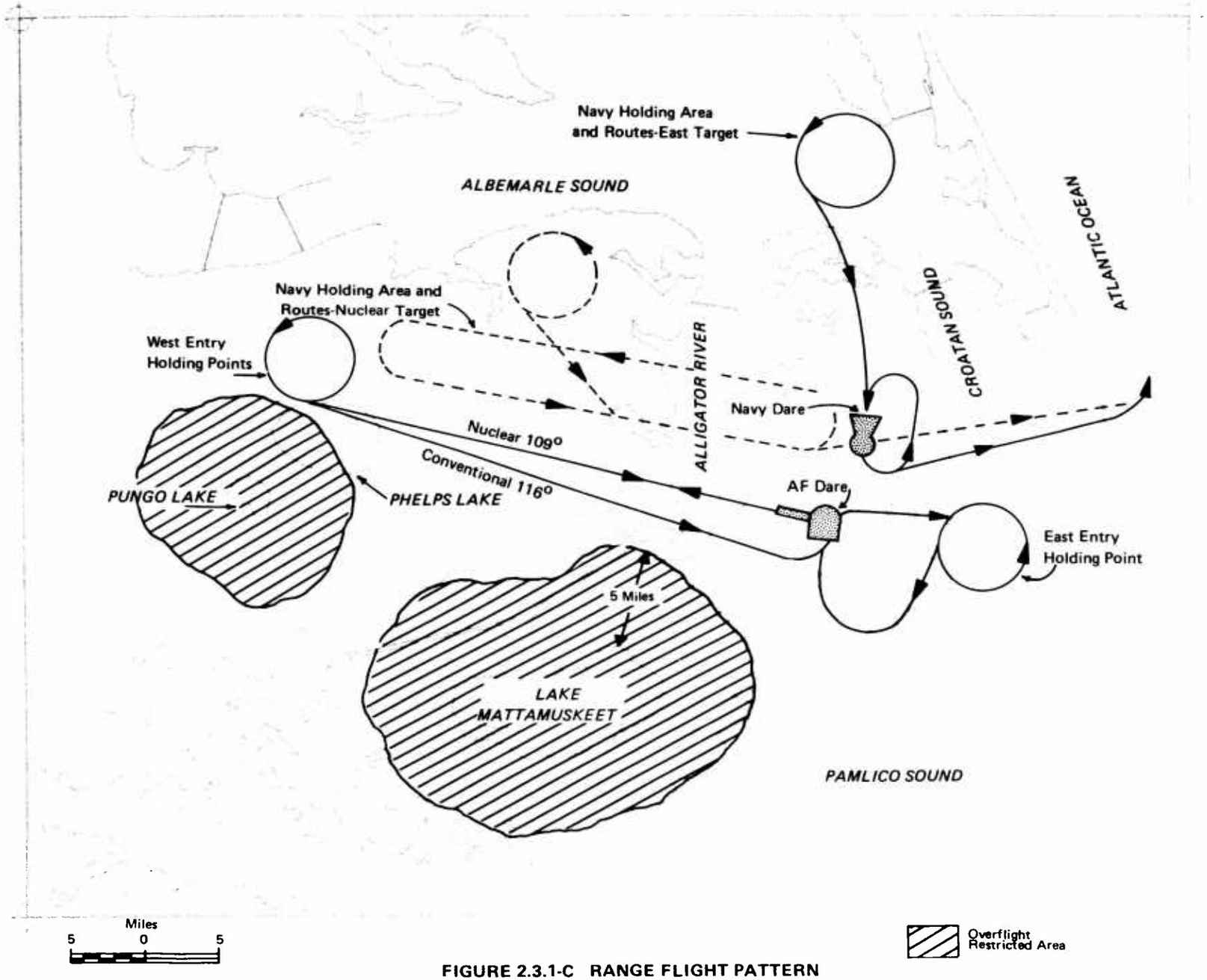


FIGURE 2.3.1-C RANGE FLIGHT PATTERN

2.3.1.11 Range Flight Patterns

The specific flight patterns to and over the Range vary with the aircraft, the type of training mission, weather, pilots, etc. The information presented in this section is intended to provide representative flight paths thus showing the portions of the Range and surrounding area flown over and representative aircraft altitudes, etc.

A typical AF training mission will begin with a dry pass on the nuclear range for spacing, followed by 2 to 4 hot sorties. Aircraft use the Range in groups of 2 to 4 spaced in accordance with training directions. Following the use of the nuclear targets, the AF training flights typically proceed to the conventional range for bomb and strafe missions.

2.3.1.11.1 Air Force Nuclear Targets

From the holding point over Phelps Lake, flights depart heading 109°. Minimum departure altitude is 2500 feet. The Alligator River is crossed at an altitude of approximately 300 feet for visual delivery or at approximately 1000 feet for radar delivery. The following table gives minimum altitudes for delivery and "pull up" altitude after delivery.

		Min. Alt.	Pull Out Alt.
Level Delivery	Visual	300'	3,500'
	Radar	1,000'	4,500'
Low Angle Drogue Delivery	Visual	300'	3,500'
	Radar	1,000'	4,000'

Aircraft speed from holding area to target is approximately 500 knots True Air Speed. After release and pull out, aircraft head for the intercoastal waterway at the base of the Alligator River at approximately 350 knots to make the return to the holding area or for a second pass over the target. The nuclear target is used for 10-15% of the range sorties.

2.3.1.11.2 Air Force Conventional Targets

The AF conventional range is approached from the Phelps Lake or Stumpy Point holding area as indicated previously. After a dry pass over the Range for spacing, aircraft make 2 to 4 passes for strafing, dive bombing, rocket firing, etc. As mentioned earlier, a typical training flight will include some 9 to 12 passes over the Range, including both nuclear and conventional events. Figures 2.3.1-D, 2.3.1-E, 2.3.1-F, and 2.3.1-G show typical training patterns for strafing, dive bombing, low angle level bombing, and skip bombing. The strafing, low angle, and level bombing patterns shown are for F-4 aircraft, the skip bombing is for F-105. Patterns for other aircraft are quite similar, differences usually being in the air speed, altitude of the downwind leg, length of base leg, etc. In terms of impact of the flights on the areas surrounding

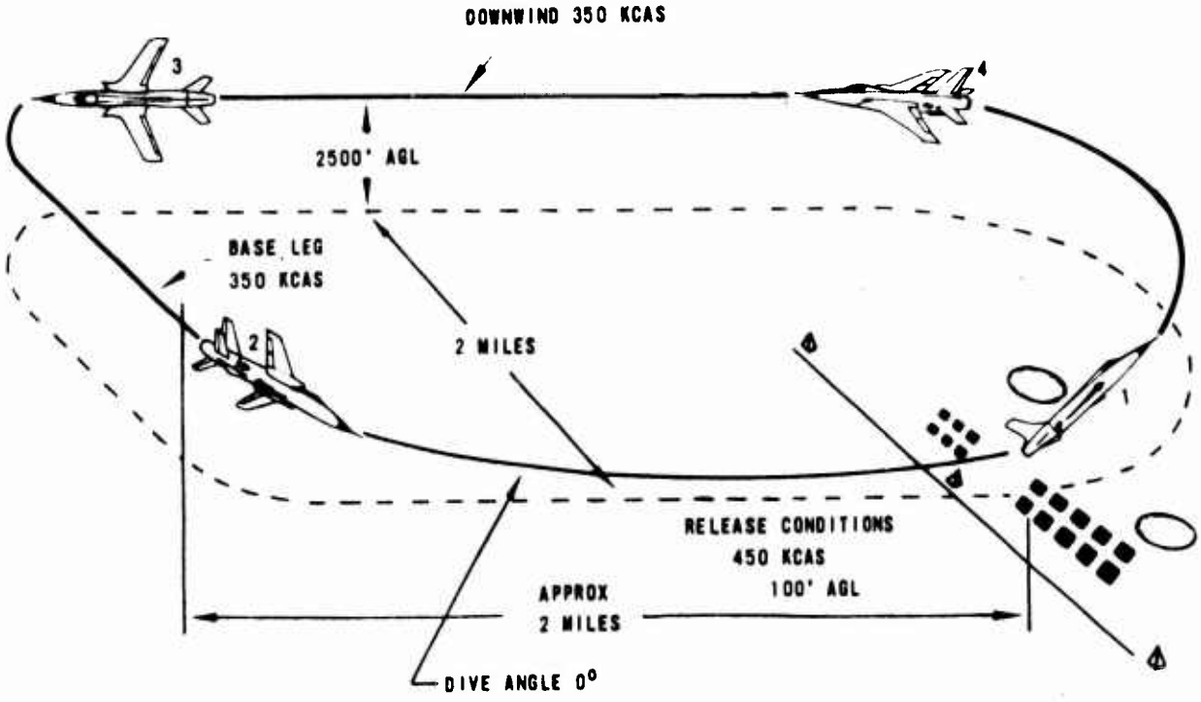


FIGURE 2.3.1-D TYPICAL SKIP BOMB TRAINING PATTERN

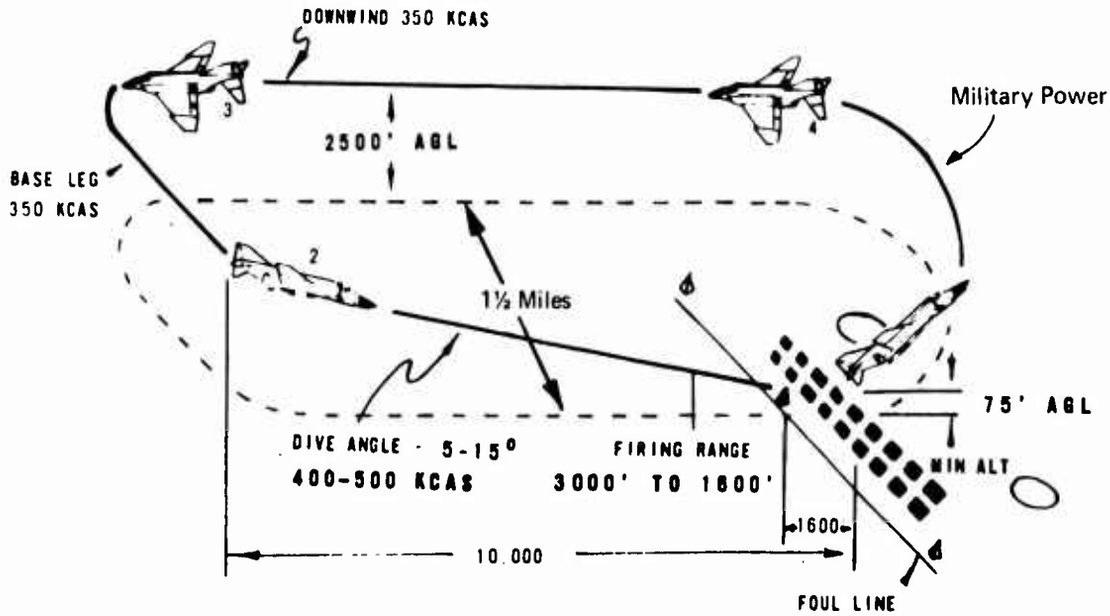
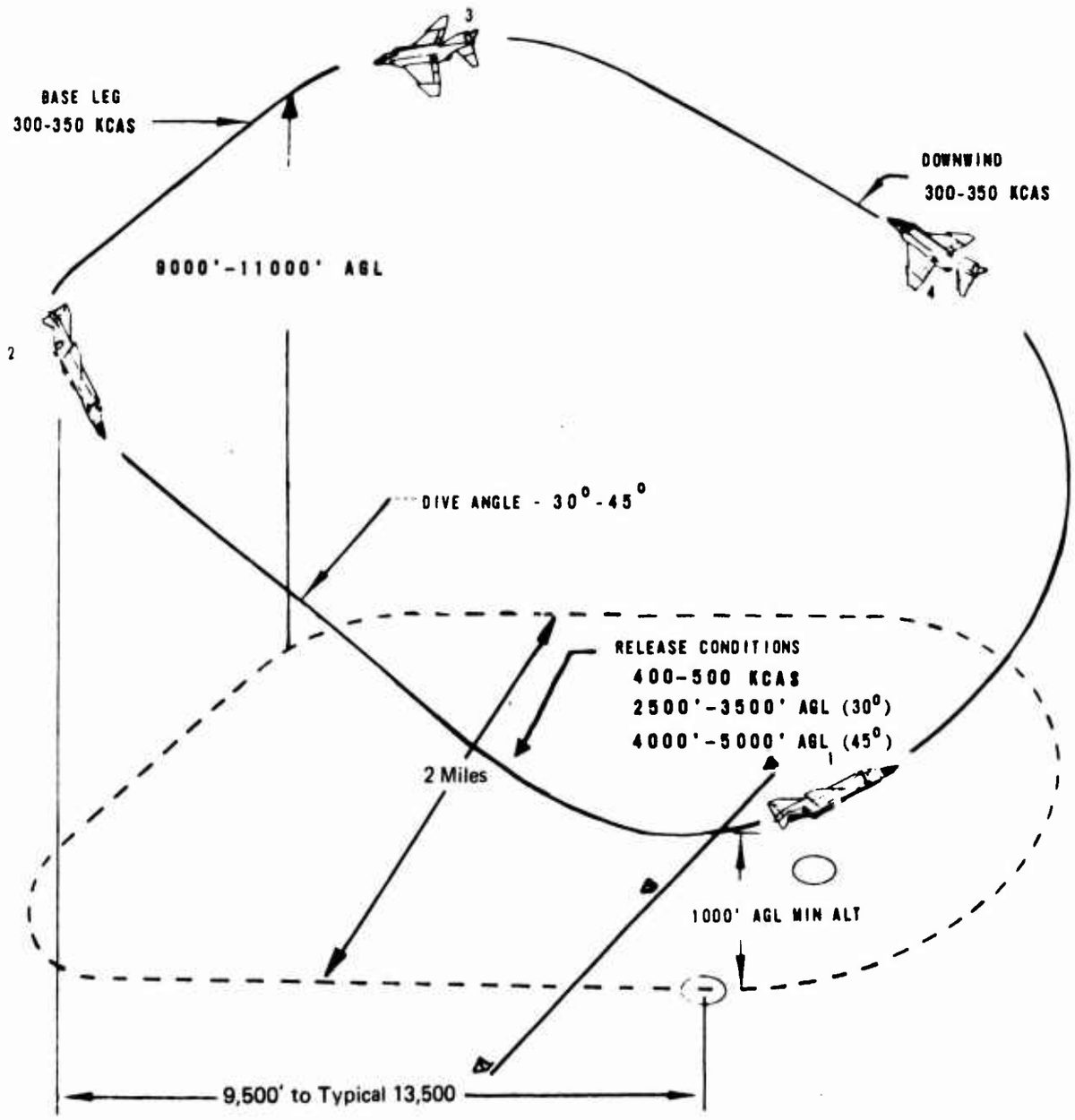


FIGURE 2.3.1-E TYPICAL STRAFE TRAINING PATTERN



ALTERNATE HIGH ALTITUDE RELEASE PATTERN

BASE LEG ALTITUDE - 13,000
RELEASE ALTITUDE - 7000'
MINIMUM ALTITUDE - 4000'

FIGURE 2.3.1-F TYPICAL 45° TRAINING PATTERN

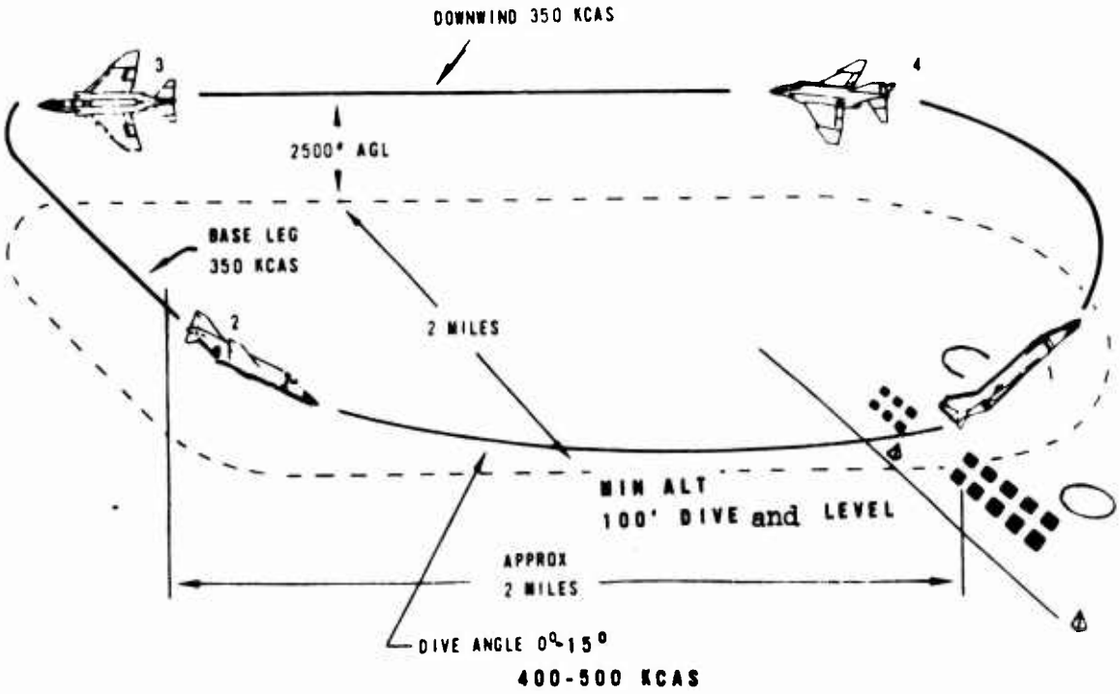


FIGURE 2.3.1-G TYPICAL LOW ANGLE/LEVEL BOMB TRAINING PATTERN

the Range, the differences in flight patterns for the aircraft presently using the Range is not significant.

2.3.1.11.3 Navy Range

Operations on the Navy Dare Range consist primarily of straight path nuclear deliveries, high loft nuclear deliveries, dive bombing, and rocket firing; very little strafing is done. The nuclear bull and the short bull targets are the most frequently used (over 90%). The conventional target (east target) has less use; thus most of the flights for the Navy Range approach from the west rather than from the north. A-6 aircraft use the Range in groups of 2 to 5 aircraft; a maximum of 4 aircraft with weapons and one dry observer on VFR, maximum of 3 aircraft on IFR. Other type aircraft use the range in groups of 1 to 4. On most of the nuclear deliveries,aircraft are at an altitude of 500 to 1000 feet as they cross the range boundary, and pull up to 3500-4500 feet as they leave on the return leg. All aircraft stay south of Route 64 in their maneuvers on the Range.

2.3.1.12 Fire Suppression and Control

2.3.1.12.1 Fire History

It was recognized early in the planning for the Dare County Range that fires could have a major impact on Range operations and the environment. Although practice munitions containing explosives are not used on the Range, the MK-4 spotting charge used for scoring purposes on both the AF and Navy Dare Ranges contains phosphorous and smokeless powder and has the potential for igniting fires. Further, although a large portion of the Range is very wet (bog) even in the dry seasons, there is considerable fuel for fires once they are initiated. Because of the considerable thickness of peat, and its high organic content, peat fires which are frequently long-lived and difficult to extinguish can be a problem.

Table 2.3.1-G shows the number and area of fires on the Range since its development. Many of the fires are small and localized. They are rapidly extinguished by available personnel and equipment. Only two fires reached the "project status," where personnel and equipment other than that available to the Air Force or under contract to the North Carolina Forest Service had to be requested. A project fire on 11 April 1966 started by a spotting charge on the AF Dare Range consumed almost 4000 acres before it was extinguished. After that fire, several improvements were made to prevent recurrence of a large fire: additional roads and canals were built; fuel modification (reduction in the amount of ignitable material in the area) through controlled burning and herbicide application was initiated (see later discussion), and a helicopter was stationed at the Range during the fire season. Despite these preventative measures, another project fire was initiated (by an MK-4 smoke charge) on 22 March 1971. Critical fire weather, low fuel moisture conditions, apparent unawareness of the critical conditions, and inadequate equipment readiness all contributed to the intensity and

Table 2.3.1-G

Fires on Dare County Range

Air Force Range			Navy Range		
Year	Number of Fires	Acres	Year	Number of Fires	Acres
1965	2	<1	1965	3	<1
1966	9	3,605	1966	4	184
1967	45	36	1967	15	32
1968	28	<1	1968	16	8
1969	25	<1	1969	10	<1
1970	29	32	1970	10	91
1971	18	30,207	1971	4	9
1972	5	5	1972	7	17
1973	17	3	1973	22	36
	178	33,890		91	377

spread of this fire. Over 200 people were involved in fighting the fire at its peak, drawn from private, public, local, state, and federal sources. Over 30,000 acres were burned, both on and off the Range. Fires in other parts of Dare County occur much less frequently than on the Range. They are caused by debris burning, human carelessness (smoking and camp fires), and nature (lightning).

2.3.1.12.2 Contract with North Carolina Forest Service

The Air Force has contracted with the North Carolina Forest Service since 1965 to provide for fire suppression and control on the Dare County Range. The annual value of this contract has varied from $115,000 in FY 1966 to $243,000 in FY 1971. The estimated contract value for FY 1975 is $297,095, including salaries and expenses such as contract helicopters, tanker and herbicide operations.

The contract provides for "supplemental forces" to make a fast initial attack on any fires threatening the area. Twelve certified employees and a secretary are supported by the contract. During the peak fire season, supplemental forces are available on the Range when flying operations are in progress, in order to respond immediately to threats of fire. At other times the supplemental forces are in the area to allow quick reaction.

The fire protection responsibilities of the supplemental forces include fire prevention and pre-suppression activities such as manipulation of water control structures, prescribed burning for hazard reduction and fuel conversion, road shoulder and canal bank clearing for break improvement, maintenance of fire access roads and related work, as well as fire suppression.

The supplemental forces are under the direction of the Dare County Forest Ranger, who coordinates his team's activities with the Range Control Officer, the Range Supervisor, and the Operations and Training Officer of the 4TFW, SJAFB. The government provides vehicles for use by the supplemental forces (described earlier), tools and equipment, and several buildings at the North Carolina Forest Service site at Stumpy Point. A fire suppression (action plan) and a manning guide are prepared to specify activities and procedures used by the supplemental forces.

The activities of the supplemental team vary with the season. The principal fire hazard season is in March through May with a secondary hazard season of October and November. The percent of the supplemental team on the range varies with the Readiness Plan (see below). The Forest Service stresses the importance of early detection, reporting, and response to the fires on the Range; ideally within the first five minutes of the fire's existence.

Much of the activity of the supplemental team is maintenance of the range roads and canals, controlled burning, control of water level in the cleared areas by flood gates, culverts and pumping, at as high a level as practical to prevent fires. In the peak fire season, both equipment and personnel are stationed on the Range for immediate action.

The supplemental forces operate jointly with the North Carolina Forest Service in District 13 (Washington, Tyrrell, Dare, and Hyde Counties) to prevent and control fires. A Fire Readiness Plan which describes actions to be taken by Forest Service personnel is in force. The plan has seven stages:

Readiness Plan One--No appreciable fire activity

Readiness Plan Two--Occasional fire activity

Readiness Plan Three--Moderate fire season activity

Readiness Plan Four--Normal fire season activity

Readiness Plan Five--Severe fire conditions

Readiness Plan Six--Critical fire conditions

Readiness Plan Seven--Extreme fire conditions

Under Readiness Plans Five and Six, the Air Force (and Navy) may be asked to restrict some of their operations (portions of the nuclear range and conventional range may be closed, night operations curtailed); under Readiness Plan Seven, the North Carolina Forest Service will request that operations be closed. A B-17 aircraft for fire fighting is available from Edmunton, North Carolina, to assist fire fighting in the district surrounding the Range.

2.3.1.12.3 Controlled Burning

Controlled or prescribed burning of brush and other vegetation on the cleared areas of the Air Force and Navy Dare Range is conducted by the North Carolina Forest Service as a means of eliminating hazardous fuels and therefore preventing wild fires. Prescribed burning is a step in fuel conversion, in which the higher order growth on the cleared area (brush and cane) is converted ultimately to grasses and weeds, reducing the volume and hazard of the available fuel. A secondary objective of the burning is to improve the trafficability of the cleared area. Prescribed burning is usually conducted in late fall or winter, after a heavy frost has occurred, and when appropriate weather and fire hazard conditions exist. The controlled burning is supervised by the North Carolina Forest Service, and conducted in accordance with the Smoke and Burning Guidelines developed by the U.S. Forest Service. After the areas are burned, the subsequent intensity from fires in the revegetated grasses and weeds is less and of shorter duration than from brush.

Therefore, there is less danger of spotting from grass burning and less hazard of spread of fires caused by range activities.

2.3.1.12.4 Herbicide Application

Application of herbicides on the Dare County Range has been conducted for six years. The purpose is to arrest the natural succession of cane, gallberry and other higher vegetation, allow for the natural succession of grasses and broomsedge, and permit controlled burning. The application is conducted by a contractor (helicopter spraying) under the direction of Forest Service personnel. A number of herbicides have been used:

Tordon 101 Mixture Brush Killer (Picloram)

Kuron Low Volatile Weed and Brush Killer (2,4,5-TP, Silvex)

Weedone - 2,4,5-TP (Silvex)

Dowpon Grass Killer (Dalapon)

Esteron 245 (2,4,5T)

The application and results have been reviewed by the North Carolina Forest Service at all levels, to promote the environmental safety of the application. Consultation with manufacturers and specialists at North Carolina State University has resulted in changes in formulations and application procedures.

In 1974, approximately 95 acres of brush on the Navy Dare Range, 90 acres of brush on the AF Dare Range, and 85 acres of switch cane on the AF Dare Range are to be treated with herbicides. The areas covered are near the nuclear bull and on the perimeter road of the Navy Range, a semi-circular area 2000 feet from the nuclear bull on the AF Range, and an area about 2000 feet from the Air Force control tower. Similar acreage was treated in previous years (e.g., 305 acres total in 1971).

Pertinent practices regarding the use of herbicide in 1974 are given below:

"Mix 185 gallons of TORDON 101 MIXTURE BRUSH KILLER (U.S.D.A. Registration No. 464-306), 185 gallons of KURON LOW-VOLATILE WEED AND BRUSH KILLER (U.S.D.A. Registration No. 464-162) (silvex) OR 185 gallons WEEDONE 2,4,5-TP (Silvex) and 2,405 gallons of water; and apply this mixture uniformly at the rate of 15 gallons per acre to the 185 acres of brush.

Mix 1,875 pounds of DOWPON GRASS KILLER (U.S.D.A. Registration No. 464-164), 1,875 gallons of water, and 8 gallons of X-77 SURFACTANT (colloidial) or an equivalent non-ionic wetting agent; and apply this mixture uniformly to the rate of 20 gallons per acre to the switch cane areas.

Mix 960 pounds of DOWPON GRASS KILLER, 600 gallons of water, 16 gallons of ESTERON 245 OR 16 gallons of WEEDONE 2,4,5-TP, and 4 gallons of X-77 Surfactant (colloidial) or an equivalent non-ionic wetting agent; and apply this mixture uniformly at the rate of 20 gallons per acre to the 60 acres of switch cane with brush areas.

Conditions for Application of Chemical Mixture:

(1) Mixture will be applied by helicopter between June 1 and June 15, 1974. The Forest Service will designate the actual time of application and will give seven (7) days notification to the Contractor. The Forest Service will have right to suspend spraying because of weather conditions or conflict with use of the Range.

(2) Mixture will not be applied when vegetation is wet or on a day that rain is forecasted or when the wind velocity exceeds 6 miles per hour.

(3) Mixture will not be applied within 50-feet of the canals surrounding the areas.

(4) Contractor will perform such tests as necessary to assure the Forest Service that the proper rate and distribution of spray mixture is applied. For uniform coverage, swaths will overlap on 30 to 40 foot centers and should be flagged.

(5) The Forest Service will provide necessary flagging for the contractor on both areas." [3]

These practices are designed to minimize the drift of runoff of the herbicide into the canals and to prevent penetration into the peat.

2.3.2 ABNORMAL OPERATIONS

The principal abnormal operations on the Dare County Range include fires, aircraft accidents, inadvertent release of ordnance, dropping of ordnance outside the cleared area, and accidents on the Range.

Fires on the Range, their prevention, occurrence, and reporting were discussed in the previous section.

Safety and emergency procedures are defined in the Range Operation Manuals [1,] and aircraft training manuals to prevent aircraft accidents to establish emergency communications, to jettison ordnance, and to provide for emergency landings, controlled bailout, and crashes on the Range. The primary duty of the RCO is strict control of range operations in accordance with all applicable directions to include preventing and/or eliminating unsafe practices or procedures through close supervision of all aircraft on the Range. Specifically pertaining to safety, he:

- Notifies the pilot concerned of any observed procedural errors that should be corrected.

- Notifies the flight leader of any repeated procedural errors that could lead to a compromise of mission effectiveness or safety.

- Directs the pilot concerned to leave the pattern when the measures above have failed to produce corrective action. The RCO may direct any pilot to leave the pattern whenever he feels the pilot has committed a dangerous act affecting the safety of the pilot or range personnel. Specifically, an attack on the wrong range or use of the wrong pattern will constitute a dangerous act.

- Directs a pilot who has committed two fouls to leave the ordnance delivery pattern. A foul is committed and will be logged anytime a pilot violated range minimums as prescribed by applicable directives, whether ordnance is delivered or not.

- When calling fouls, states the violation committed and receives acknowledgement from the pilot concerned.

- Monitors the aircraft in the delivery pattern for any unsafe practice from base roll-in, through to the appropriate crosswind.

- Notifies Seymour Johnson Command Post, ext. 6601, of all off range releases.

- Insures that the North Carolina Forest Service representative is notified immediately of any on or off-range smoke/fire other than spotting charges. Suspends range operations until cleared to resume by the Forest Service. In addition, keep an accurate log of the events as they occur.

Since the initiation of Dare County Range activities there have been five aircraft accidents as described below:

Year	Aircraft	Location	Remarks
1967	F-100	On leased area	Aircraft fatality
1968	--	Near Frying Pan Landing, Gum Neck	Aircraft on route to leased land; no fatality
1969	F-8	On Navy Range, east side	Aircraft failure; 2 fatalities
1970	F-4	Phelps Lake	Accident while in holding pattern, fatality
1972	A-6	Alligator River	On route to range, no fatality

Inadvertent release of ordnance occurs rarely on the Dare County Range. For example, Seymour-Johnson-based aircraft using the Range, 1 release of a practice bomb (MK-106), 7000 feet short of the target but within the leased property occurred last year. Occasional releases outside the cleared area--one every three or four months--occur on the Navy Dare Range. An empty centerline fuel tank was inadvertently released on the Range in July 1974.

The RCO is responsible for reporting off-range drops or inadvertent releases of any ordnance or other object. Jettisoning of ordnance may be accomplished on the AF nuclear target heading 109° or on an AF conventional target heading 019° at a minimum altitude of 1000 feet as directed by the RCO.

There have been no incidents of runaway guns on the Range. Procedures in the event of runaway guns [1] call for the pilot to point the aircraft toward an uninhabited area and safe the guns as soon as possible.

The Navy and AF Range Superintendents indicate that occupational accidents on the Range have been infrequent.

2.3.3 RANGE USE FOR NON-MILITARY ACTIVITIES

Present policy allows hunting and fishing in the non-cleared portion of the Navy and AF Ranges during non-operational hours. The majority of the hunters are from the SJAFB with the remainder from Dare County. Fishing is not extensive since many other areas of Dare County are more accessible and have a greater abundance of fish. Hunting is primarily for deer, muskrat, mink, weasel, quail, rabbit, and duck.

3.0 DESCRIPTION OF EXISTING ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT

3.1.1 ATMOSPHERIC REGIME

3.1.1.1 Climatology

Dare County is in the North Coastal Plain area of North Carolina. This tidewater portion is generally flat and swampy with most of the land no more than a few feet above sea level. The close proximity of the Atlantic Ocean tends to limit maximum and minimum seasonal temperatures as compared with areas in the interior.

The average path of the Gulf Stream passes offshore at a distance of about 50 miles from the area, and in the winter the southern portion of the cold Labrador Current passes between the Gulf Stream and the coast. The flow of cold water from the north lessens the warming effects of the stream on coastal temperatures. The meeting of the two opposing currents provides a perfect environment for storms. Frequently, storms have their origin east of Cape Hatteras generating rain on the coast and in states to the north.

During the winter, northerly winds are dominant, and frequently storms and flows of cold polar air will occur. During the summer the prevailing wind direction is from the south and southwest bringing in tropical air from the Atlantic and Gulf of Mexico. In late summer and early fall, storms develop east of Cape Hatteras and move northward along the coast causing damage from high tides, northeast winds, and heavy rains.

There are no distinct wet and dry seasons in Dare County, although there is some seasonal variation in average precipitation. Summer rainfall is generally the greatest with July having maximum precipitation.

Winter precipitation in the form of sleet or snow does not usually occur on the coast. On the average, one or two snow storms pass through the area each year.

Tropical hurricanes come close enough to influence the weather on the coast about twice a year with occasional damage from high tides.

The moderating effects of the ocean provide for milder winters on the coastal area with as many as 290 days without freezing temperatures. As a result a great variety of vegetation occurs in the area.

The nearest weather station to the Dare County Range is at Cape Hatteras which is approximately 35 miles south-southeast. Other weather stations in the general vicinity are at Wilmington and Raleigh. Since both of these stations are approximately 160 miles west or southwest of the Range they do not adequately represent meteorological conditions of Dare County. Average meteorological data for Hatteras are given in Table 3.1.1-A.

Table 3.1.1-A

Meteorological Norms for Cape Hatters

	-------- Temperature °F --------				-------- Wind ---------	
Month	Daily max.	Daily min	Average Monthly	Precipitation Inches/Month	Prevailing Direction	Mean Speed MPH
Jan.	52.3	38.2	45.3	4.26	NNE	13.0
Feb.	53.1	38.5	45.8	4.15	NNE	13.4
Mar	57.9	43.2	50.6	3.84	SW	12.6
Apr	66.3	51.5	58.9	3.07	SW	12.5
May	73.8	60.2	67.0	3.28	SW	12.5
Jun	80.5	68.1	74.3	4.83	SW	11.1
Jul	83.8	72.1	78.0	5.90	SSW	10.5
Aug	83.4	71.5	77.5	6.75	SW	10.0
Sep	79.5	67.8	73.7	5.76	SW	10.9
Oct	71.3	59.1	65.2	4.79	NE	11.8
Nov	63.1	48.8	56.0	4.45	NNE	11.8
Dec	54.8	40.5	47.7	4.54	NNE	12.1
Yr	68.3	55.0	61.7	55.62	SW	11.8

Source: "Climatology of the United States No. 81-4, Decennial Census of U. S. Climate."

3.1.1.2 Air

The air pollution potential for the area is dependent on two principal factors, one being the pollutant emissions from all sources and the second being the meteorological parameters that affect the diffusion rates of these pollutants. Since the area has no heavy industry, is sparsely populated, and has few roads and little traffic flow, the total emissions are very low.

There are no air monitor data available for the mainland of Dare County. An air monitoring station at Cape Hatteras is run by the National Ambient Surveillance Network (NASN). The data at this site have been considered unreliable and not really representative of Cape Hatteras. Suspended particulate levels have been the only readings that are high, but this has been attributed to the location of the monitor with respect to the windswept sandy beaches on the Cape.

Because Cape Hatteras is separated from the mainland by Pamlico Sound, which is about 30 miles wide, no direct relationship can be made between air quality at the monitor station and that near the Dare County Range. It can be concluded that the air pollution level is low in the vicinity of the Range because of no strong emission sources.

3.1.2 AMBIENT NOISE

The ambient noise levels within the Dare County Range area, assuming that no military operations or activities were taking place, would be characterized primarily by natural sources such as wind-generated rustling of vegetation and wildlife noises. In addition, the ambient levels would include on occasion the effects of distant traffic, primarily due to Route 264 activities south and east of the Range, and marine engine noise from Pamlico Sound, the Long Shoal River, and occasional lake use.

There are no available data on ambient noise levels in the Dare County region. Based on measurements in similar regions, however, it would be expected that the average ambient noise levels would be in the 35 to 50 dBA range which would be judged as very quiet on a subjective basis. (See Section 4.1.2.1.1 for a description of noise measures.) This conclusion is consistent with ambient noise levels obtained at several remote locations in the Florida Everglades, a prolific wildlife region, where median noise levels were about 43 dBA, the L_{10} noise level (value exceeded 10 percent of the time) was about 47 dBA, and the L_{90} noise level (value exceeded 90 percent of the time) was about 40 dBA. [4]

For comparative purposes, the equivalent (energy average) noise level identified by the Environmental Protection Agency as "suitable for the protection of public health and safety with an adequate margin of safety" for outdoor areas where people spend time in a variety of activities is 55 dBA. [5]

3.1.3 HYDROLOGIC REGIME

The average annual precipitation for three stations in the vicinity of Dare County Range is as follows:

New Holland	53.4 inches	(25 mi SW)
Manteo	44.3 inches	(16 mi NE)
Cape Hatteras	54.5 inches	(38 mi SE)

These data are based on normals for the period 1931-1960. [63] Distance and bearing indicate the location of the station relative to the center of the Range. Monthly distributions of temperature and precipitation for the Cape Hatteras station are shown in Table 3.1.1-A. In general, the precipitation is fairly evenly distributed throughout the year.

Other pertinent hydrologic data applicable to Dare County area are: [64]

Average annual snowfall	1 - 2 inches
Average annual evaporation from open water surface	40 inches
Average annual evapotranspiration	34 - 35 inches
Average annual surface water runoff	11 - 12 inches

The area is also shown to be in a major aquifer region of the United States.

The entire Range is low and swampy, with elevations ranging from 0 to 10 feet above sea level. Peat ground cover thickness varies from 2 to 18 feet with about an 8 foot average. There are no major drainage canals or water bodies on the Range, although drainage canals have been constructed adjacent to roadways running through the property. These canals were designed as V-shaped with widths of 33 to 48 feet and depths from 12 to 19 feet. Their design depth does not appear to have been based on hydraulic criteria, but rather on the need to excavate to a sufficient depth that the underlying sand could be used to build a three foot deep base for the adjoining roadways. The sand layer was placed on logs which were placed on top of the peat surface. Overlying peat was spoiled on the far side of the canal. In a few locations, smaller ditches have been dug between the canals to provide additional drainage. As a result of the construction of the drainage system, the ground water table has been lowered about one to two feet, principally in the vicinity of the target areas.

The water in the drainage canals flows slowly to three surrounding water bodies: the Alligator River to the west, Albemarle Sound to the north, and Pamlico Sound to the east and south. The periodic tidal range in these bodies is less than one-half foot.

The ground water in the unconfined aquifer near the surface of the ground will be acidic and colored due to the thick peat deposit. No data are available concerning deeper aquifers which may lie beneath the Range property. However, a study was made in 1972 of the potential ground water supplies for Roanoke Island and the Dare County Beaches by Peek, Register and Nelson of the Ground Water Division of the North Carolina Department of Natural and Economic Resources. Although this area is about 16 miles away, it may provide some indication of the geohydrology at the Range property. The findings, as a result of eight site explorations to depths of about 500 feet, showed there to be three significant water-bearing sand units beneath the area: (1) an unconfined aquifer to depths of about 35 to 100 feet that has been the principal source of supply in the area; (2) an upper confined aquifer that offers an excellent potential water supply; and (3) a lower confined aquifer containing enough salt content to preclude its general use. The recharge of the confined aquifers may be from local rainfall and from seepage from mainland areas.

The Air Force Range has a chlorinated water supply for drinking water. Wells are used for other purposes, such as the washing of vehicles. Sanitary wastes are discharged to septic tanks. The Bioenvironmental Engineer from SJAFB made a limited number of tests of the canal waters to determine whether any wash rack effluents were reaching the drainage system. The results were negative.

3.1.4 TERRESTRIAL REGIME

3.1.4.1 Topography

The Dare County Range is situated within the Atlantic Coastal Plain which occupies the eastern two-fifths of North Carolina. The area is characterized by little relief and is gently sloping from the fall line, marking the transition from the Piedmont Region,,to the Coastal Plain, to the coast. Elevations within Dare County vary from just above sea level to 20 feet at Cape Hatteras with elevations of from sea level to about 5 feet occurring at the project site.

The County is unique in North Carolina in that it is composed of three distinct and separate landforms: the mainland, Roanoke Island, and the Outer Banks. Mainland Dare County is a peninsula bounded on the west by the Alligator River, on the north by Albemarle Sound, on the east by Croatan Sound, and on the south by Pamlico Sound and the Pamlico River. The area is poorly drained with many swamps and bogs. Located to the east is Roanoke Island which is surrounded by the Croatan, Roanoke, and Pamlico Sounds.

Both the mainland and Roanoke Island are protected by the Outer Banks which stretch from Currituck County in the north for almost 100 miles to Ocracoke Island in the south. The Outer Banks are bounded on the east by the Atlantic Ocean, on the south by Hyde County, and on the west by Currituck, Roanoke, and Pamlico Sounds. The Outer Banks are characterized by low marshlands on the sound side and dunes and sandy beaches along the Atlantic Ocean. Between the offshore islands and the mainland are sounds or lagoons some of which extend 50 miles inland as estuaries giving rise to an extremely irregular coastline. Indications are that the entire Outer Banks chain is shifting slowly westward as a result of wind and water action from the Atlantic Ocean. [6]

3.1.4.2 Geology

The Dare County Range is located in the Atlantic Coastal Plains physiographical Flatwoods region. The Coastal Plain consists of a series of marine and non-marine terrace deposits that step up in elevation, from east to west, from sea level to about 400 feet at the western extremity of the Province. Dare County is situated on an emerged marine terrace of the Pleistocene Age.

3.1.4.3 Soil Conditions

Soil conditions vary within the three land form areas of Dare County; the mainland, Roanoke Island, and the Outer Banks. The soils on the mainland are generally organic in nature, while Roanoke Island soil conditions vary from deep, well-drained sandy soils supporting maritime forests to fertile marshes. Soils on the Outer Banks vary from marshes to large, shifting sand dunes. Figure 3.1.4-A is a general soil map of Dare County.

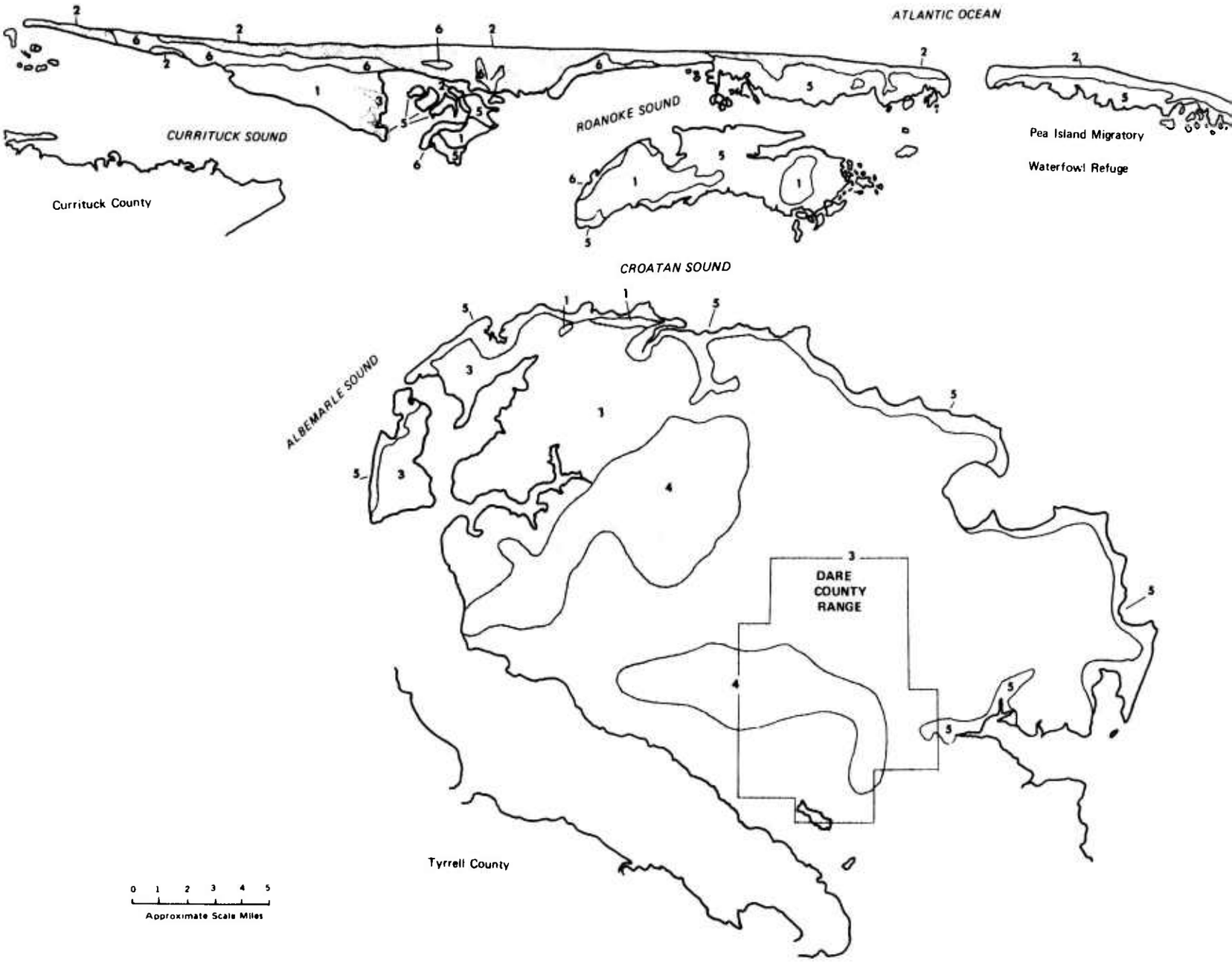
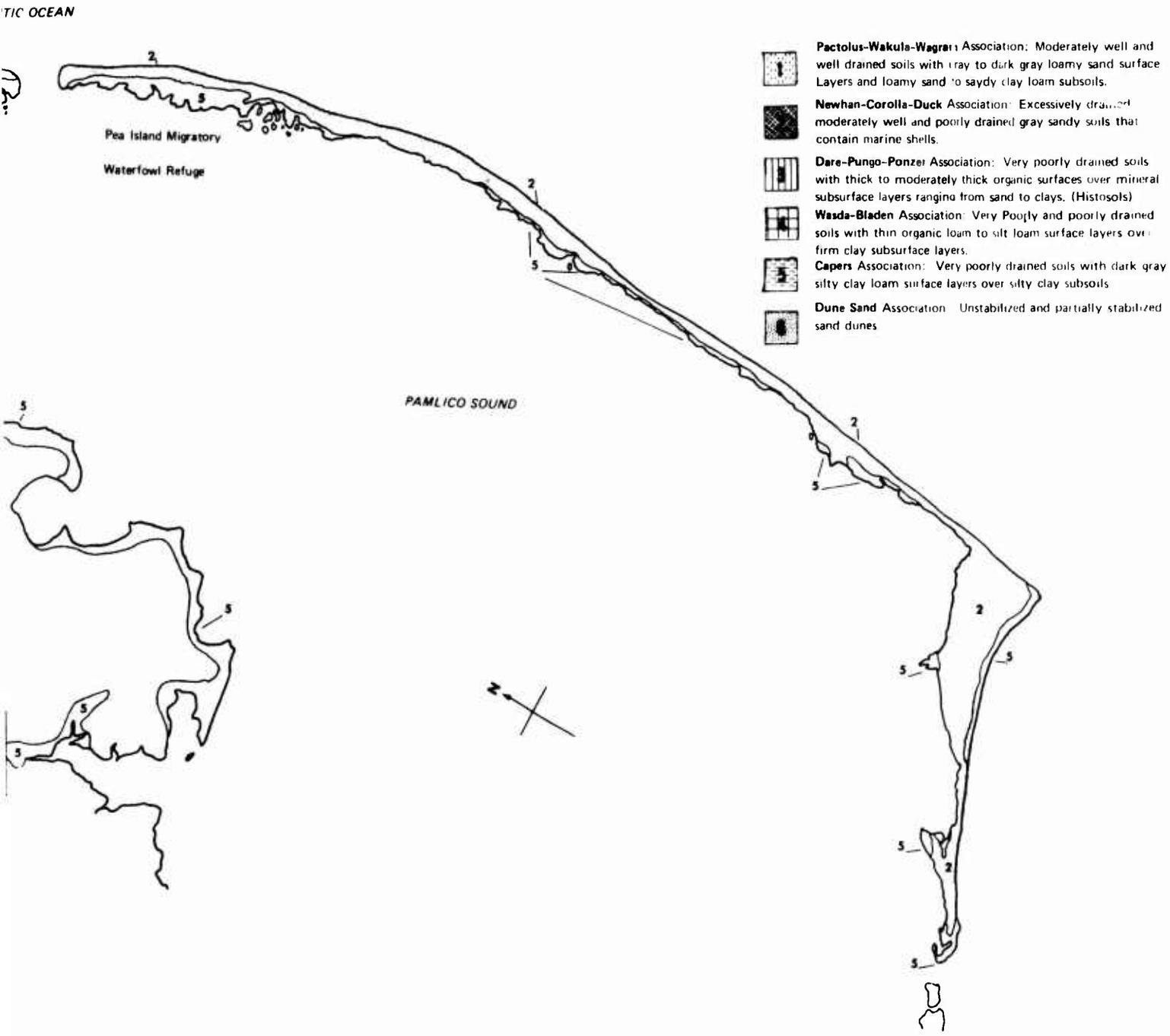


FIGURE 3.1.4-A GENERAL SOIL MAP - DARE COUNTY, NOR



L SOIL MAP - DARE COUNTY, NORTH CAROLINA

Within the Dare County Range, two soil associations predominate:

- Dare-Pungo-Ponzer Association. Very poorly drained soils with thick to moderately thick organic surfaces over mineral subsurface layers ranging from sand to clays. This soil is classified as histosol, and

- Wasda-Bladen Association. Very poorly and poorly drained soils with thin organic loam to silt loam surface layers over firm clay loam or clay subsurface layers.

3.1.4.3.1 Dare-Pungo-Ponzer Association

Soils of this association, along with other closely related organic and mineral soils, comprise about 70% of the County's total area and represent an even larger percentage of mainland Dare County. Organic soils are those in which 16 inches or more of the surface layer is composed of mostly organic materials.

Dare type soils in the Dare-Pungo-Ponzer Association comprise about 40% of this association. Depth of organic matter for these soils ranges from 50 inches up to 8 feet before reaching the underlying sandy textured mineral substrata. The surface layers are generally black and in some areas contain large amounts of charcoal reflecting a past history of severe fires in the County. Also contained in Dare soils are large roots, stumps, and logs persisting from vegetation existing in the area thousands of years ago; this woody material occupies up to 35% of the surface and subsurface soil volume. Unrubbed fiber content of Dare soils may be as great as 30 percent of the soil volume. Upon rubbing, visible fibers disintegrate to less than 2 percent.

Characteristically, these soils contain a subsurface layer of highly decomposed organic material that is at least ten inches thick and is dark red-brown in color and has a greasy or paste-like texture when wet. This "colloidal" material may irreversibly disintegrate when exposed to air and dried.

Pungo soils comprise 25 percent of this association and are similar to Dare soils, however, these soils are underlain by clay, mineral substrata, and generally contain a greater percentage of unrubbed fibers, up to 35 percent of the soil volume before rubbing. The thick "colloidal" layer in both Pungo and Dare soils indicate development probably occurred under extremely saturated conditions.

Ponzer soils comprise 20 percent of this association with depth or organic matter ranging between 16 to 50 inches in thickness. The substrata is a loamy textured mineral substrata varying from dark gray to light yellow-brown in color. Ponzer soils also contain charcoal along with stumps and logs persisting from previous vegetation.

The remaining 15 percent is composed of small acreages of closely related Dorovan, Mattamuskeet, Pamlico, and Belhaven soils as well as isolated areas of mineral soils containing large amounts of organic matter in the surface layers.

The soils of this association are extremely wet year round and are extremely acid unless limed. Large amounts of wood are found throughout the profile along with a high percentage of unstable organic materials. This material is highly susceptible to fire when dry. These characteristics for organic soils limit its potential for agriculture and forestry and indicate no potential for industrial development. Indications are that these areas would be best suited for pasture or forage crop production. [6]

3.1.4.3.2 Wasda-Bladen Association

This association comprises about 10 percent of the County's total acreage occurring in two fairly large homogeneous areas on mainland Dare County. This association is characterized by very poorly and poorly drained soils; surface layers are thin organic loam to silt loam with a subsurface of firm clay loam or clay.

Wasda soils comprise about 65 percent of this association. These soils are intergraded between organic and mineral soils. With the exception of the thickness of the organic layers, 8 to 16 inches, Wasda soils are quite similar to Ponzer soils. They are very poorly drained, are moderately permeable, and have a slow surface runoff. As with Ponzer soils, when drained, developed and maintained properly, they may be used for pasture, corn, soybeans, and other cultivated crops. These soils are not suited to uses other than agriculture or forestry.

Bladen soils comprise 20 percent of the association. Surface layers include loam, fine sandy loam, and sandy loam with surface colors from gray to light brownish gray. Subsoils range from clay loam and sandy clay to clay with matrix colors of gray, dark gray to light brown-gray.

Bladen soils occur at somewhat higher elevations than do Wasda soils. These soils are also poorly drained; surface runoff is slow and the water table may be at or near the surface during the rainy season.

The remaining 15 percent of this association includes minor acreages of related organic soils including Ponzer, Dare, and Pungo and mineral soils such as Hyde, Bayboro, and Portsmouth. Potential uses of this association are limited to agriculture and forestry. [6]

3.1.4.4 Minerals

There are no known commercially valuable mineral deposits in Dare, Hyde, Tyrrell, or Washington Counties. [7]

Until recently, Cities Service Oil Company of Oklahoma owned oil rights in Albemarle Peninsula area, partially on mainland Dare County. Some exploratory drilling was conducted in Dare County over the past few years, but there were no wells established. When the rights expired in 1973, they were not renewed.

3.2 BIOTIC ENVIRONMENT

3.2.1 FLORA ON THE RANGE

3.2.1.1 Description of the Area

The Dare County Range lies within the deciduous forest biome which is a major plant formation occupying most of the eastern United States. This biome is characterized by diverse, well-developed herb and scrub layers and soil biota. This biome has several subdivisions which differ in forest types from the predominant deciduous forest. One of these is the pine edaphic forest of the Southeastern Coastal Plain. The Dare County Range is included in this subdivision which is characterized by a variety of pines (longleaf, loblolly, pond) as the predominant vegetation. Within the deciduous biome, pine is usually considered a transition forest type, or 'subclimax,' to the deciduous hardwoods. The pine in the subdivision of the Southeastern Coastal Plain has never been displaced by deciduous trees because of soil limitations and the action of fires. [8] The soil (predominantly peat) in this subdivision is often termed "immature" since it is similar to the partially decomposed plant material which comprises the first soil in the transition from an aquatic to a terrestrial community. It is this 'immaturity' which has been a major factor in limiting the transition of pine to deciduous forest types.

The counties of Dare, Tyrrell, Hyde, and Washington differ from most of the other counties of the North Carolina Coastal Plain. While most other counties are dominated by loblolly pine (Pinus taeda) with sporadic pond pine (Pinus serotina), these counties are dominated by pond pine.* This is due in part to the fact that these four counties are the only counties in the state which are predominantly underlain with peat. Mineral soils, which generally underlie the peat layers, occasionally protrude to the surface. [9] In some parts of these counties these peat soils have been drained and used for agriculture.

This four-county area also differs in its wetland forest type. While most of the fresh water wetlands in other counties of the Coastal Plain are inundated for only a brief part of the year, most of the wetlands in these four counties have standing water for much or all of the year. Because of this, the tree association in these swamps is limited to gum-cypress and does not include oak [9] which requires a drier habitat. Predominant gum species are tupelo, Nyssa aquatica and blac (Nyssa sylratica); the cypress is bald cypress (Taxodium distichum). Gum-cypress forests are recognized as the most productive wildlife habitat in the South. [10]

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*Scientific names will be given the first time a plant is mentioned. Thereafter, only the common name will be used.

3.2.1.2 Dare County

Dare County is divided into two distinct ecological areas (Figure 3.3.1-A The Outer Banks, separated from the mainland by Pamlico Sound, Croatan Sound, and Albemarle Sound, consist of sand dunes with numerous salt and fresh water wetlands. Large blocks of salt marsh occupy Roanoke Island and the Outer Banks from Bodie Island to Hatteras. Fresh water marsh lies in the vicinity of Kitty Hawk Bay and the southeastern end of Currituck Sound. The Pea Island National Wildlife Refuge and the Cape Hatteras National Seashore include two of the largest ponds in Dare County (about 200 to 400 acres each). These two areas also include most of the wetlands, both salt and fresh, of the Outer Banks. [11] A particularly important area on the Outer Banks from the standpoint of waterfowl is the open fresh pond at the Pea Island Wildlife Refuge.

The Outer Banks are separated from the mainland by shallow brackish sounds with sandy bottoms. Most of the nutrients which form the basis of the food chain within these sounds are supplied by the surrounding salt and fresh marshes. Blue crabs, oysters, and many species of fish are found in these waters.

The mainland is predominantly a peat bog which will be described in more detail below. Although true bogs are formed from deep glacial lakes or potholes, the term bog is often used to describe low areas with water-logged peaty soils supporting vegetation typical of true bogs, e.g., sphagnum moss. Dare County bogs are typical of this latter definition. Swamps in Dare County, as described below, refer to wooded areas flooded seasonally or year round. On the eastern shore of the mainland, there is an irregularly flooded salt marsh. This type of marsh is also found in Stumpy Point and the southern shores extending into Pamlico Sound. These irregularly flooded salt marshes contain needlerush (Juncus roemerianus), salt-meadow cordgrass (Spartina patens), sawgrass (Cladium jamaicence), and threesquare (Scirpus olney). On the northern shore and along some of the inland open fresh waters there are shallow fresh marshes vegetated by needlerush, threesquare, cattail (Typha), and big cordgrass (Spartina cynosuroides). Wildlife found in these marshes includes muskrat, raccoon, otter, mink, and birds such as king and Virginia rails. Wooded swamps exist in the eastern portions of the county. These swamps are the cypress-gum associations discussed earlier. Loblolly stands, representing areas of mineral soil, are present in the lower central and northeastern portions of the mainland. [11]

Dare County is bordered on the west by the Alligator River which is also part of the Intercoastal Waterway System. This river is highly acidic with little vegetation. Small segments of fresh water marsh, however, have resident duck populations. Active osprey nests have also been seen on the banks of the river. [12]

Much of Dare County (and the Range) is occupied by a peat bog community. Bogs are usually formed in lakes with poor drainage where floating plants extend out to form a mat contiguous with plants near shore.

Proliferation of this floating vegetation suppresses both photosynthesis by aquatic vegetation and surface mixing leading to the depletion of dissolved oxygen (DO). As the floating plants die and sink to the bottom, the rate of decay is severely retarded by the suppressed DO levels resulting in the accumulation of vegetation on the bottom. These initial layers of partially decomposed plants are the first stages of peat. Peat produces acid which further retards the decomposition of plant matter. It is likely that acidic fresh water from surrounding waters such as the Alligator River drainage area hastened the formation of peat in this area by further retarding plant decomposition. Sphagnum moss, (Sphagnum spp) which is especially adapted to this peat stratum, usually forms the dominant vegetation on the floating mat and in turn adds to the peat layers. The sphagnum supports low-growing shrubs, sedges, and ferns. The mat eventually becomes stable, although the high water content and spongy nature of the peat does not allow it to support heavy objects such as vehicles or even large animals.

Wooded swamps form the second largest vegetative community in mainland Dare County and also within the Range. Trees such as black gum, tupelo gum, and bald cypress are found in these low swamps. They are tolerant of low flooding, and during short times when the area is not flooded due to particularly dry conditions, the seedlings of these trees become established. Once past the seedling stage, these trees can tolerate standing water. If they are destroyed by fire or timbered, they regenerate by coppicing from the stumps left at or above water level.

The water levels and types of soil (peat vs mineral soil) are two significant factors in the ecology of the county and the Range. The hydrology of Dare County mainland can briefly be described as fresh water entering the system as rain water and moving slowly through the peat and canals and ditches and finally draining in north, south, east, and west directions.

The water levels within the cleared area of the Range are controlled by gates and pumps to maintain high water levels for use in preventing fires; during controlled burning projects the water level is lowered. The adjustment is performed by the North Carolina Forest Service. During the past twenty years, canals and ditches needed for timber operations have lowered the overall water table. The exact drop in water level is not known. According to the Range personnel, the water level in some of the cedar swamps has been lowered due to this drainage, to the point of threatening the continued existence of the cedar swamp. The particular swamp mentioned is just north of the Range, but it is likely that lowered water levels have led to a decrease in other wooded swamps over the years. It is possible that areas which were wet 50 years ago now dry up annually because of the lowered water tables. [11] There has been a corresponding decrease in fur-bearing animals such as otters become established in the canal and drainage systems.

The soils are the second important factor in the vegatative communities in Dare County. The County is underlain with peat of varying depths which limits vegetative growth because of its acidity, its low oxygen level, and its lack of nutrients which are normally supplied by decomposition of organic material. Detailed information on soils is contained in Section 3.1.4.

3.2.1.3 The Dare County Range

The Dare County Bomb Range can be divided into four general vegetation areas:

1. A pocosin area occupies most of the range on the eastern side and is scattered throughout the western side. The dominant tree is pond pine which is found both well stocked and widely dispersed in open areas. Pond pine and hardwood mixtures form the transition to other forest types.

2. Loblolly and hardwood stands are found in the northwestern corner along with protrusions of mineral soil and higher elevations.

3. Wood swamps, especially gum, occupy most of the western side and are heavily concentrated in the southeastern portion. Cedar and cypress are other types of wooded swamps found on the Range. Each of these can be found mixed with hardwood to varying degrees.

4. Cleared areas are located around the Navy and Air Force operational facilities and targets.

Figure 3.2.1-A shows the types and locations of the dominant trees within the Range. The following is a description of each of these dominants with its associated understory and ground cover.

3.2.1.3.1 Pocosin Area

Pond Pine

Pond pine or pocosin occupies about 25% of the Range, generally in the northeast and central portions. This species grows to heights averaging 20 to 50 feet. (This height average is less than that of other pond pines in the Coastal Plain apparently because of the limitation of the soils, and the action of fires.) Pond pine has become more important as a timber species and is now harvested when occurring in mixed stands or adjacent to more important species. [13]

Some of the pond pine on the Range is in the area included in the 1971 fire. (Figure 3.2.1-B shows a photograph of the pine which has regenerated in the area.) Pond pine is known for its ability to coppice or regenerate from stumps and roots. After fires, the sprouts grow vigorously into new tires.

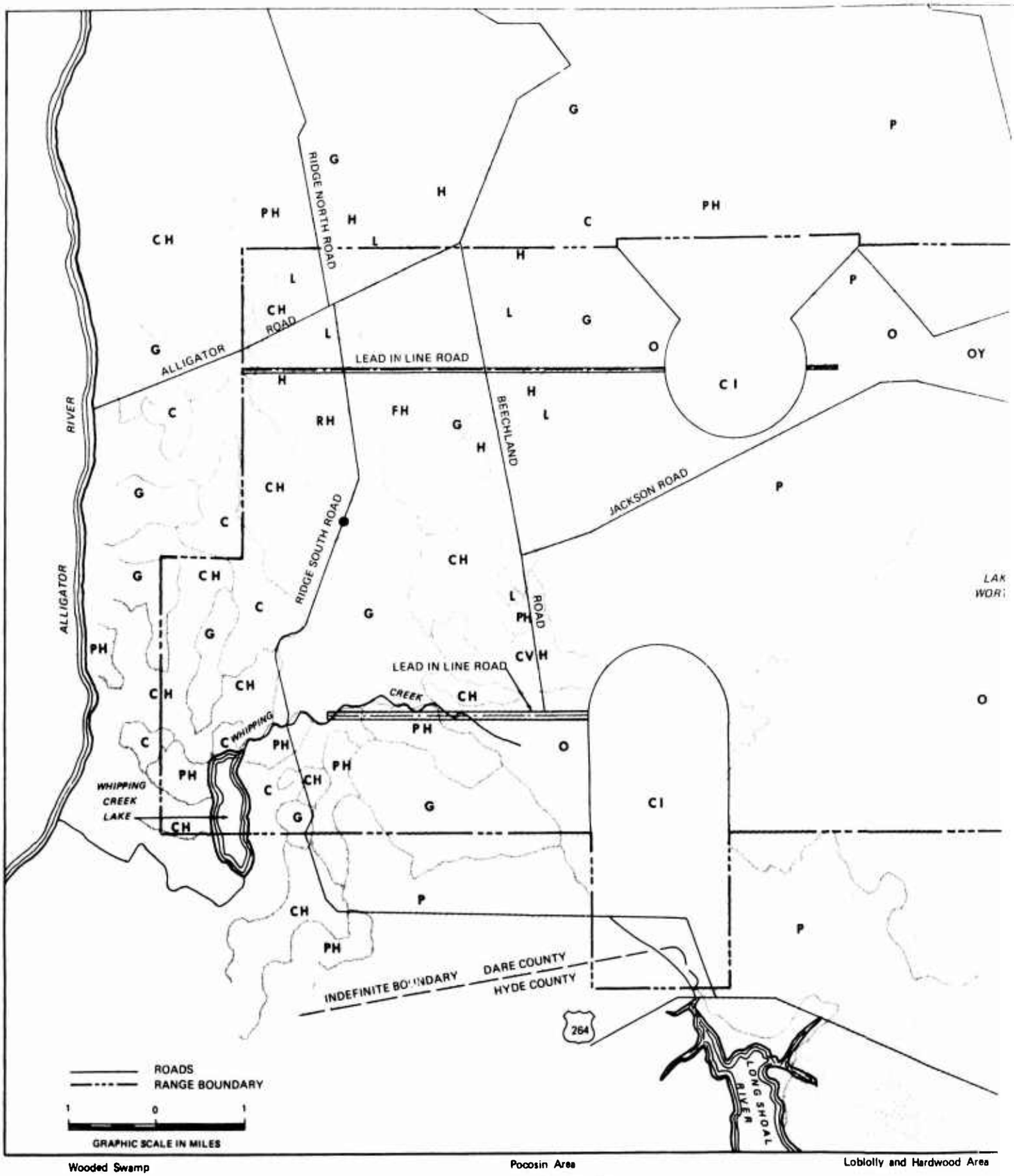
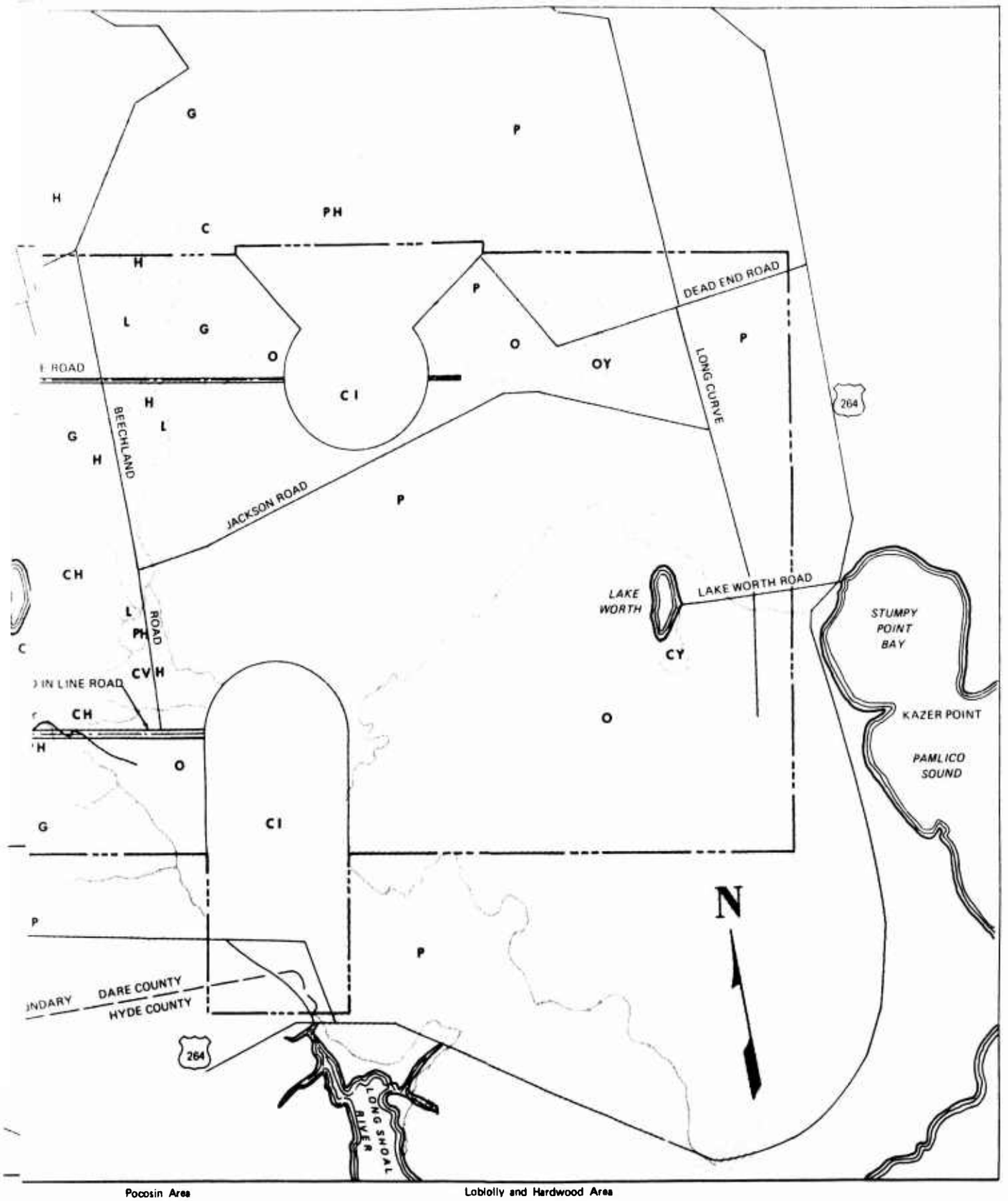


FIGURE 3.2.1-A DARE COUNTY VEGETATION MAP (Dominant Trees)



Pocosin Area

- P Pond Pine
- O Open
- PH Pine Hardwood Mixture

Loblolly and Hardwood Area

- H Hardwood
- L Loblolly

CI Cleared Area

GURE 3.2.1-A DARE COUNTY VEGETATION MAP (Dominant Trees)

FIGURE 3.2.1-B DARE COUNTY RANGE POND PINE

The pond pine vegetative community is often called a pocosin or "upland swamp" association. Plants which are often found in the understory are red bay (Persea spp.), loblolly bay (Gordonia lasianthus), sweet bay (Magnolia virginica), red maple (Acer rubra), wax myrtle (Myrica cerifera), gallberry (Ile glabra) and swamp cyrilla (cyrilla spp.). Some of these species are commonly full grown trees but in the pond pine area they are limited to shrubs. Ground cover is predominantly ferns such as Virginia chainfern (Woodwardia virginica) and grasses.

Open Areas

In the southeastern portion of the Range there are widely dispersed pond pines. The plants which comprise the understory in the pond pine area are also in this area but are widely dispersed. Large areas of green briar (Smilax rotundifolia) can be found over the lower ground cover vegetation which consists of switch cane (Arundinaria tecta), Virginia chainfern, and native grasses.

Pine Hardwoods

Pond pine is mixed with deciduous hardwood species throughout much of the western portion of the Range. These species include red maple and water oak (Quercus nigra). Some of the bays such as red bay and loblolly bay, which are shrubs in the pond pine stands, are part of the upper story in these areas. The understory is comprised of the seedlings of these trees plus shrubs such as gallberry, fetter-bush (leuco thoe sp.) and a shrub known locally as honey cup (no species identification available). Switch cane also forms much of the understory.

The pine hardwood areas form a transition between the pure pocosin areas (open and pond pine) and the mineral soil areas of hardwood and loblolly. The peat is generally shallow in the pine hardwood areas. As shown by Figure 3.2.1-A, pond pine hardwood mixtures are often found next to wooded swamps where there is standing water for at least part of the year. The pond pine hardwoods experience and absorb some of the fluctuations in water levels from these adjacent areas.

None of the trees in this area growsto a sufficient size or quality to represent merchantable timber. Also, no pure stands are found in this area; harvesting timber from mixed stands is more costly and time consuming than from pure stands.

3.2.1.3.2 Hardwood and Loblolly Area

Hardwoods

The same hardwoods foundin the pocosin area are found in the areas designated hardwood in Figure 3.2.1-A. These include black gum, red maple, water oak, red, and loblolly bay. These areas are not pure stands

of deciduous trees but often contain dispersed pond pine and loblolly pine. The trees are of variable height and aged and are not of commercial value.

Loblolly

In the northeastern section, especially around Beechland Road, there are valuable pure stands of loblolly pine. Loblolly, as mentioned before, is one of the predominant pines of the Southeastern Coastal Plain. It is a fast-growing straight tree which requires sandy soils with water close to the surface. Within the Range its presence denotes the protrusion of mineral soil or peat which is shallow enough to allow the penetration of the roots of seedlings to mineral soil.

The understory in loblolly sections consists of hardwood sprouts which never grow to full size trees. Scattered loblolly bays and red bays are also present; switch cane and ferns form most of the ground cover. Loblolly pine is available as timber.

3.2.1.3.3 Wood Swamps

Gum

Most of the wooded swamps on the Range are dominated by gum trees. There is a large gum swamp in the western portion of the Range and other gum swamps west of each of the cleared areas. Off the Range, gum swamps comprise much of the section between the Range and the Alligator River.

The predominant species in the gum swamps are tupelo gum and black gum. The tupelo gum (also called water tupelo or cotton gum) inhabits only areas which are inundated part of the year. Black gum (also called black tupelo or sour gum) is considered a weed in that it adapts easily to many types of soil and water conditions. On the Range it is found as a hardwood subspecies in the more "upland" areas and in the year round flood cypress swamps to be discussed below.

Both black and tupelo gum sprout vigorously from stumps at the water levels if cut or destroyed by fire. The gum swamps in the Dare County area do not grow to commercial size.

Associated trees in the gum swamps include red maple, sweet bay and red bay. The size and numbers of these trees depends on the duration of year that there is standing water. Associated shrubs include gallberry, fetterbush, and switch cane. The numbers of these species also depends on the water levels especially during periods of seed germination and seedling growth. Epiphyte (hanging vines) and the thick understory make this one of the more difficult areas for man to penetrate.

Cedar-Hardwood

The second most prevalent wooded swamp is the cedar-hardwood association. In these areas variable standing water controls the relative densities of hardwood species and cedar species. The hardwoods are those previously mentioned. The cedars consist of eastern red cedar (Juniperus virginiana), and Atlantic white cedar (Chamaecyparis thyoides) with the former being more numerous in these hardwood mixtures. Both species are commonly called junipers and these areas are referred to as 'juniper swamps' when the hardwoods play only a minor role.

The understory in the cedar areas is dependent on the amount of hardwood in the area. The hardwoods tend to be associated with gallberry, shrub bays, sprouting hardwoods, and other understory species and ground cover species mentioned earlier.

Cedar

Pure cedar stands occur in a few areas on the Range. The ones near Whipping Creek and on the western boundary of the Range are mixtures of eastern red and Atlantic white cedars with dispersed hardwoods. Other than the dispersed hardwoods, there is little understory since the cedar tend to grow very close together.

There is one pure stand of Atlantic white cedar on the Range which is west of the Navy cleared area. This stand is often shown to visiting Forest Service personnel since the limited supply of this species is rapidly diminishing due to its commercial value. This stand of white cedar should be protected. When found in pure stands like this one, the trees form a "glade" where the trunks are closely set together resulting in no understory and very little ground cover.

Cypress and Cypress-Hardwood Mixtures

Two small cypress swamps, which are continuously flooded, are found in the eastern portion of the Range. The cypress, or bald cypress, is a valuable, beautiful tree which has short needles clustered on slender branches; these needles drop in winter. The roots form knees which rise to the water level of the deepest flooding during the year. Cypress swamps are associated with black gum which can also survive year round flooding. Understory or ground cover is not usually present in these areas.

Bald cypress can also be found in association with hardwoods in areas which are not flooded by water. One such area exists west of the Air Force cleared area. The bald cypress in this area are widely dispersed.

3.2.1.3.4 Cleared Area

The cleared area represents a bog returned to its early stages, i.e., before being vegetated with trees and shrubs. The cleared area is covered mainly with sphagnum moss, broomsedge (Andropogan spp.), tooth ache grass (Ctenium aramaticum), Virginia chain fern, and other ferns such as Osmunda sp. Plants normally associated with bogs are also found in some areas, e.g. arrow head (Sagittaria latifolis), pitcher plant (Serracenia sp.) and sundew (Drosera sp.). The latter two are of general public interest because they are among the few plants which trap and digest insects to obtain nutrients. Sagittaria fasciculata, another type of pitcher plant, is considered rare in North Carolina, and while it was not seen in the area, the acid water and peat conditions make its presence possible. Throughout the cleared areas, there are sporadic 'lumps' of mineral soil. These contain grasses and young shrubs overlain by thick green briar.

3.2.2 FAUNA ON THE RANGE

The diversity of wildlife habitats within the Range is one of its most valuable assets. Each of the vegetative communities previously described creates a variety of distinctive niches. The juxtaposition of each of these areas with one another, furthermore, creates an ecotone or transition area. These transition areas combine the ecological parameters of cover and food provided by different types of vegetation and create other niches. Roads, canals, and other human disruptions have created (and destroyed) still more niches.

No wildlife studies on the Range or in the vicinity of the Range were found in our investigation. Because of the variety of possible niches, this report will not attempt to list all possible species to be found on the Range. The following list of higher organisms (mammals, birds, fish, and reptiles) was supplied in an interview with Walt Chasen of the North Carolina Natural Resources Commission who is familiar with this area. Because of the informal nature of this 'survey' and the lack of taxonomic identification, only common names are included in this list.

3.2.2.1 Mammals

The following list includes the dominant mammalian species in this area. The designation of high, medium, and low refers to population densities relative to those found throughout the state.

Squirrels, gray and fox	low
Rabbits, cottontail	medium
Rabbits, marsh	medium
Muskrat	medium
Mink	medium
Weasel	medium
Otter	low
Oppossum	high
Black bear	low
White-tailed deer	medium

Bobcat and cougar have reportedly been sighted. Nutria, imported South American rodents, are also reported to be in the area. [14]

3.2.2.2 Birds

Table 3.2.2-A shows a list compiled by the Department of Interior, Bureau of Sports Fisheries and Wildlife, of the birds in the area of the Lake Mattamuskeet Wildlife Refuge. (According to Steven Joyner, Assistant Refuge Manager at Lake Mattamuskeet Wildlife Refuge). This list is reportedly applicable to the Dare County Range area, although those birds which usually are found near large bodies of water such as Lake Mattamuskeet may be less common on the Range where no such open waters exist. It is possible that the Alligator River is close enough so that some birds demanding open water, but having a wider range of territory have become established on the Range. Great Blue Herons are commonly sighted within the Range; osprey are also seen on the Range and are reported to have active nests in the Whipping Creek area and on the banks of the Alligator River.

Other common birds on the Range are black duck, woodduck, quail, and mourning dove.

3.2.2.3 Fish

The acidic water within Dare County limits the number of species of fish to be found on the Range. Fish are found in the canals and the deeper swamps and creeks. The following species are found on the Range:

- Bass,
- Brim, and
- Catfish.

Brim and catfish are the most common fish on the Range. Eels are also found in the canals.

3.2.2.4 Reptiles

Reptiles on the base include:

- King snakes,
- Water moccasins,
- Copperheads.
- Several species of rattlesnakes, and
- Several non-poisonous species of snakes.

King snakes are especially numerous in the canals and the wooded swamps. Alligators have also been sighted in the wooded swamps.

Table 3.2.2-A

Birds of the Mattamuskeet and Swanquarter National Wildlife Refuge

Symbols indicative of seasonal abundance of each species are used as follows

S	March May	a	abundant
S	June August	c	common
F	September November	u	uncommon
W	December February	o	occasional
		r	rare

	S	S	F	W
Common Loon	o		c	c
Red-throated Loon				r
Horned Grebe				u
Pied-billed Grebe	u		c	c
White Pelican		r		
Brown Pelican		r	r	
Double-crested Cormorant	c	u	c	c
Anhinga		r		
Great Blue Heron	c	c	c	c
Green Heron		c	c	
Little Blue Heron		c	c	
Cattle Egret		u	u	
Common Egret	c	c	c	c
Snowy Egret	o	u	u	c
Louisiana Heron		u	u	
Black-crowned Night Heron	u	u	u	u
Yellow-crowned Night Heron			r	
Least Bittern		c	c	
American Bittern			c	c
Glossy Ibis		o		
Whistling Swan	u	r	c	a
Canada Goose	u	r	a	a
Brant				r
White-fronted Goose				r
Snow Goose				u
Blue Goose				u
Mallard	u	r	c	a
Black Duck	c	o	c	a
Gadwall	u	r	c	c
Pintail	c		a	a
Green-winged Teal	c		a	a
Blue-winged Teal	c		c	c
American Widgeon	u		c	c
Shoveler	o		o	u
Wood Duck	u	c	c	c
Redhead	u		u	c
Ring-necked Duck	o		o	u
Canvasback	o		o	u
Greater Scaup				o
Lesser Scaup	c		c	c
Common Goldeneye				u
Bufflehead	u			c
Oldsquaw				u
White-winged Scoter				r
Cardinal	c	c	c	c
Indigo Bunting	o	u		
Evening Grosbeak				r
Purple Finch				u
Pine Siskin				o
American Goldfinch				u

	S	S	F	W
Surf Scoter			r	u
Common Scoter			r	u
Ruddy Duck	u		u	c
Hooded Merganser				o
Common Merganser	o	r	o	o
Red-breasted Merganser				o
Turkey Vulture	c	c	c	c
Black Vulture	u	u	u	u
Sharp-shinned Hawk	c		c	c
Cooper's Hawk	o	o	o	o
Red-tailed Hawk	u	u	u	c
Red-shouldered Hawk	u	u	u	u
Broad-winged Hawk			o	
Rough-legged Hawk				r
Bald Eagle	u	u	u	u
Marsh Hawk			c	c
Osprey	c	c	u	r
Peregrine Falcon				r
Pigeon Hawk				u
Sparrow Hawk	c		u	c
Bobwhite	c	r	c	c
King Rail		c	c	o
Clapper Rail	c	c	c	c
Virginia Rail			u	u
Sora		u		
Yellow Rail				r
Common Gallinule	u	u	c	u
American Coot	c		c	a
American Oystercatcher		o		
Semipalmated Plover	u		u	
Wilson's Plover	u		u	
Killdeer	o	o	o	c
Black-bellied Plover	u		u	
Ruddy Turnstone	r		r	
American Woodcock			r	c
Common Snipe			u	c
Whimbrel	o		o	
Upland Plover			o	
Spotted Sandpiper	c		c	
Solitary Sandpiper	c		c	
Willet		o		
Greater Yellowlegs	c		c	o
Lesser Yellowlegs	u		u	o
Pectoral Sandpiper	r		r	
Least Sandpiper	u		u	
Dunlin				o
Short-billed Dowitcher	o		o	o
Semipalmated Sandpiper	u		u	
Western Sandpiper	r		r	
American Avocet		r		
Northern Phalarope			r	
Great Black-backed Gull			r	u
Herring Gull	u	u	u	c
Ring-billed Gull	u	u	u	c
Rufous-sided Towhee	c	c	c	c
Savannah Sparrow	u		u	c
Grasshopper Sparrow				o
Henslow's Sparrow				r
Seaside Sparrow				u

	S	S	F	W
Laughing Gull	c	r		
Bonaparte's Gull				o
Gull-billed Tern		u		o
Forster's Tern	o	o		
Common Tern		u		
Least Tern		u		
Royal Tern		u		
Sandwich Tern		r		
Caspian Tern	o		o	
Black Tern			o	
Black Skimmer		o		
Mourning Dove	c	c	c	c
Yellow-billed Cuckoo	u	c		
Black-billed Cuckoo	r			
Barn Owl	u	u	u	u
Screech Owl	c	c	c	c
Great Horned Owl	c	c	c	c
Barred Owl	c	c	c	c
Chuck-will's-widow	u	u	u	
Common Nighthawk			c	
Chimney Swift	c	c		
Ruby-throated Hummingbird	c	c		
Belted Kingfisher	c	c	c	c
Yellow-shafted Flicker	c	u	c	c
Pileated Woodpecker	c	c	c	c
Red-bellied Woodpecker	c	c	c	c
Red-headed Woodpecker	o	o	o	o
Yellow-bellied Sapsucker				c
Hairy Woodpecker	u	u	u	u
Downy Woodpecker	u	u	u	c
Red-cockaded Woodpecker	r	r	r	r
Eastern Kingbird	c	c	u	
Western Kingbird			r	
Great Crested Flycatcher	c	c		
Eastern Phoebe			u	c
Acadian Flycatcher		u		
Eastern Wood Pewee		u		
Horned Lark				r
Tree Swallow			u	c
Bank Swallow		o		
Rough-winged Swallow		c		
Barn Swallow		u		
Purple Martin	c	a		
Blue Jay	r	r	r	r
Common Crow	a	a	a	a
Fish Crow	c	c	c	c
Carolina Chickadee	u	u	c	c
Tufted Titmouse	u	u	u	u
White-breasted Nuthatch				u
Red-breasted Nuthatch			r	r
Brown-headed Nuthatch	c	c	c	c
Brown Creeper				o
House Wren	u	u	u	u
Winter Wren				o
Vesper Sparrow				u
Slate-colored Junco			r	u
Chipping Sparrow		o		
Field Sparrow				c
White-crowned Sparrow			u	u

	S	S	F	W
Carolina Wren	u	u	c	c
Long-billed Marsh Wren	u	u	u	u
Short-billed Marsh Wren				o
Mockingbird	c	c	c	c
Catbird	c	c	c	u
Brown Thrasher	u	c	u	c
Robin			u	a
Wood Thrush	u	u	u	
Hermit Thrush	u		u	c
Swainson's Thrush	o		o	
Eastern Bluebird				o
Blue-gray Gnatcatcher	o	o	o	r
Golden-crowned Kinglet				u
Ruby-crowned Kinglet	u		u	c
Water Pipit				u
Cedar Waxwing				c
Loggerhead Shrike				o
Starling	c	c	c	c
Yellow-throated Vireo	r			
White-eyed Vireo	c	c	c	
Red-eyed Vireo	c	c	c	
Black-and-white Warbler			u	r
Prothonotary Warbler	c	c		
Swainson's Warbler	r			
Worm-eating Warbler	r			
Orange-crowned Warbler			o	o
Parula Warbler		o		
Yellow Warbler	o	o		
Magnolia Warbler	r			
Black-throated Blue Warbler	o			
Myrtle Warbler	a		u	a
Black-throated Green Warbler	o			
Blackburnian Warbler	r			
Yellow-throated Warbler	c	u		
Blackpoll Warbler	o			
Pine Warbler	u	u	u	u
Prairie Warbler	c	c		
Palm Warbler			o	r
Northern Waterthrush	o		o	
Yellowthroat	c	c	c	c
Yellow-breasted Chat	o		o	r
Hooded Warbler	u	u		
American Redstart	u		u	
House Sparrow	c	c	c	c
Bobolink			r	
Eastern Meadowlark	c	c	c	c
Red-winged Blackbird	a	a	a	a
Orchard Oriole	u	u		
Rusty Blackbird				o
Brewer's Blackbird				r
Boat-tailed Grackle	r	r	r	r
Common Grackle	c	u	c	a
Brown-headed Cowbird	u	u	u	c
Summer Tanager		o		
White-throated Sparrow	u		u	c
Fox Sparrow	u		u	c
Swamp Sparrow	u		u	c
Song Sparrow	u		u	c
Snow Bunting				r

Source: U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. Birds of Mattamuskeet and Swanquarter National Wildlife Refuges. Refuge Leaflet 107-R5, October 1970.

3.2.3 ECOLOGY OF THE AREA IN RELATION TO WILDLIFE HABITATS

Because of the limited data on wildlife within the Range, the following section will discuss ecological characteristics of the Range to determine the suitability of the area for wildlife. The discussion will focus on the following areas:

1. The location of wildlife within the Range.

2. The diversity of habitats created by the succession of bogs to pond pine.

3. The diversity of habitats created by the wooded swamps.

4. Long-term drainage of the area and its affect on wildlife habitats.

5. Presence of endangered species as in indication of overall environmental quality.

3.2.3.1 Location of Wildlife

The heaviest concentration of wildlife is located around the Whipping Creek area where dense understories, vines, and ground cover make it impossible for man to penetrate the area. Hunting dogs and roaming dogs (a particular threat to deer) cannot penetrate the area. The only access is by boat via Whipping Creek. Bear as well as deer are concentrated in this area. The fur bearing mammals have become concentrated in this area and in the canals throughout the Range. Fruit and berries of the black gum, and eastern red cedar in this area also important to many species of songbirds.

3.2.3.2 Succession of Bogs to Pond Pines

The Dare County Range represents a particularly stable area in terms of wildlife due to the patterns and types of vegetative communities which exist there. Several of the communities resemble stages of succession which have been frozen in those stages by particular limiting factors. ("Succession" can be defined as a predictable process of change in ecological communities, resulting from modification of the environment by the organisms within a community, i.e., the organisms of a community change the original conditions which led to their establishment, to the point where other organisms become more suitable and can compete successfully.) Table 3.2.3-A shows the usual succession from a herbaceous bog to a hardwood forest. On the Range, the cleared areas resemble the initial stages of a herbaceous bog. The "open" areas, as described earlier, resemble the shrub stage, and the pond pine areas resemble the pine stages found in transition to hardwood species. Each of these areas is "frozen" in that particular stage by the limiting factors indicated in Table 3.2.3-A.

Table 3.2.3-A

Stages of Bog Succession

VEGETATION COMMUNITY	Herbaceous Bog	Shrub Bog	Pine Wooded Bog	Hardwood Forest
LIMITING FACTOR	Herbicides Fire	Unknown environmental conditions	Acid soil fire	climax
LOCATION ON BASE	Cleared areas	Cleared areas Open pocosin areas	Pond Pine stands	Transition Pond Pine & Hardwood mixtures only (Hardwood climax only where mixed with mineral soil.)
WILDLIFE STATUS	Insects, browsing by deer, food for: turtles snakes, birds, insects	Cover & food for rabbits, cover and food for quail, browsing by deer, food and cover for songbirds	Same as shrub bog cover and food for squirrel, cover and food for owls	Same as pine wooded bog

Mature communities on the Range, which represent these latter stages of succession (e.g., the Pond pines, gum swamps, hardwood mixtures) have a high diversity of niches, species, and patterns of energy flows. This diversity makes them able to buffer changes in species structure and physical environment. The young communities on the Range, such as the herbaceous bog area, are generally less diverse but are more productive. The maximum productivity in terms of photosynthetic matter is often reached in the earliest stages of succession, such as those that occur on the Range in the seasons directly after fires. This particular mixture of stable buffer zones and open productive areas provides the most balanced situation for wildlife. As an example, deer on the Range reportedly browse the open areas freely during non-hunting season because of the high productivity. During the hunting season, they may move into the forests where the diversity is such that food and cover are available. These forest areas are able to absorb the seasonal presence of the deer without disrupting the existing forest community.

3.2.3.3 Habitats Within the Wooded Swamps

Wildlife also benefit from the variety of wooded swamps within the Range. These wooded swamps have been discussed previously in the section on vegetation. On the Range three types of wooded swamps occur:

- year round swamps which are continually flooded--the Atlantic white cedar and the cypress swamps,
- seasonal swamps which are flooded seasonally or most of the year--the gum swamp, and
- swamps of variable wetness or flooding--the eastern red cedar swamps.

While the latter two are the most important on the Range, the three together represent a diversity of conditions providing habitat for a multitude of animals, especially reptiles and amphibians which depend on aquatic communities. Again, the diversity of conditions leads to stability in the overall environment for the wildlife. For instance, if heavy flooding occurs over an extended time, the tupelo gum trees would decrease (their seedlings require at least part of the growing season to be without flooding). The songbirds dependent on tupelo berries could turn to seeds of the bald cypress for food since an increase in the population of that species might be expected. On the other hand, if drainage occurs over an extended period of time, those songbirds might turn from cypress seeds to the berries of gum and the fruits of the eastern red cedar which could survive the dry spell.

3.2.3.4 Long-Term Drainage as an Ecological Factor

Although the diversity of the area leads to a general stability, this stability cannot of course buffer all changes. For example, the range of conditions supplied by these swamps does not buffer the effect of

lowering the water table on those animals which are dependent on the water depths directly, and not just on vegetation. The fur bearing animals on the Range have decreased, according to observation of the Range personnel because of the lowered water levels in the swamps. While the canals and ditches themselves have apparently provided habitat for many of these species, e.g., muskrat, otter, and mink, the transition for other species is more difficult. Some reptiles and amphibians whose habitat combines both land and water environments may not be able to make the transition to the steep-banked, narrow canals. For instance, the alligator which has been sighted a few times in one of these wooded swamps, probably could not survive in the canal system since it builds its nest in the mud surrounding the swamp.

3.2.3.5 Endangered Species as an Indicator of Overall Environmental Quality

Three of the species which have reportedly been sighted within the Range fall into the category of rare or endangered species. The alligator is endangered both in North Carolina and nationally. The cougar is endangered within the state, and the osprey is considered threatened nationally, although the state population is stable. [15]

Osprey are considered by some to be environmental indicators since they are sensitive to changes in environmental conditions. They are threatened nationally because of indiscriminate hunting and because DDT weakens the shells of their eggs limiting the number of eggs that actually hatch. Osprey are also very "shy" birds, easily driven off by the establishment of human activities near nesting areas. The presence of osprey within the Range area suggests that (1) the fish (which are its sole food) in the area have not accumulated toxic amounts of DDT in their tissues, (2) the supply of fish has not been depleted by other pollutants, and (3) that hunting has not been a major threat either because of the limited waterfowl hunting in the area or because there are sufficiently remote areas inaccessible to the hunter. Finally, active nests are reported on the Dare County banks of the Alligator River signifying that the amount of human disruption in the surrounding area is minimal. The importance of the presence of the ospreys on the Range is to indicate that the Range area, as a feeding area of the osprey and as an adjoining area to active nests, is an area of high environmental quality and may be important to the maintenance of wildlife for the surrounding counties.

The black bear is also an indicator of environmental quality. The Range is part of a state bear sanctuary which occupies much of the Dare County mainland. The bears are most commonly found in the Whipping Creek area because of its remoteness and impenetrability and because the fleshy bitter fruits of the black gum tree found there which are "relished" by the black bear. [162] Dare County was included in a survey of black bears conducted by the North Carolina Wildlife Resources Commission in the state bear sanctuaries. Until recently, tagging of bears with radioactive tracers was conducted in Dare County (including the Range). Tracing studies have now been moved to counties south of Dare County.

Although the Range area is important to some wildlife such as osprey and bear, it is not important to waterfowl in comparison to surrounding areas such as Pea Island Wildlife Refuge and Lake Mattamuskeet. Both of these latter areas have large open bodies of water which are important to waterfowl. The Range and surrounding area has no such large open bodies of water. The two ponds on the Range, Lake Worth and Whipping Creek, are too small to be of importance since larger fresh water lakes and ponds are located nearby.

3.3 HUMAN ENVIRONMENT

3.3.1 AREA DESCRIPTION AND DEMOGRAPHY

3.3.1.1 Geographics/Political Setting

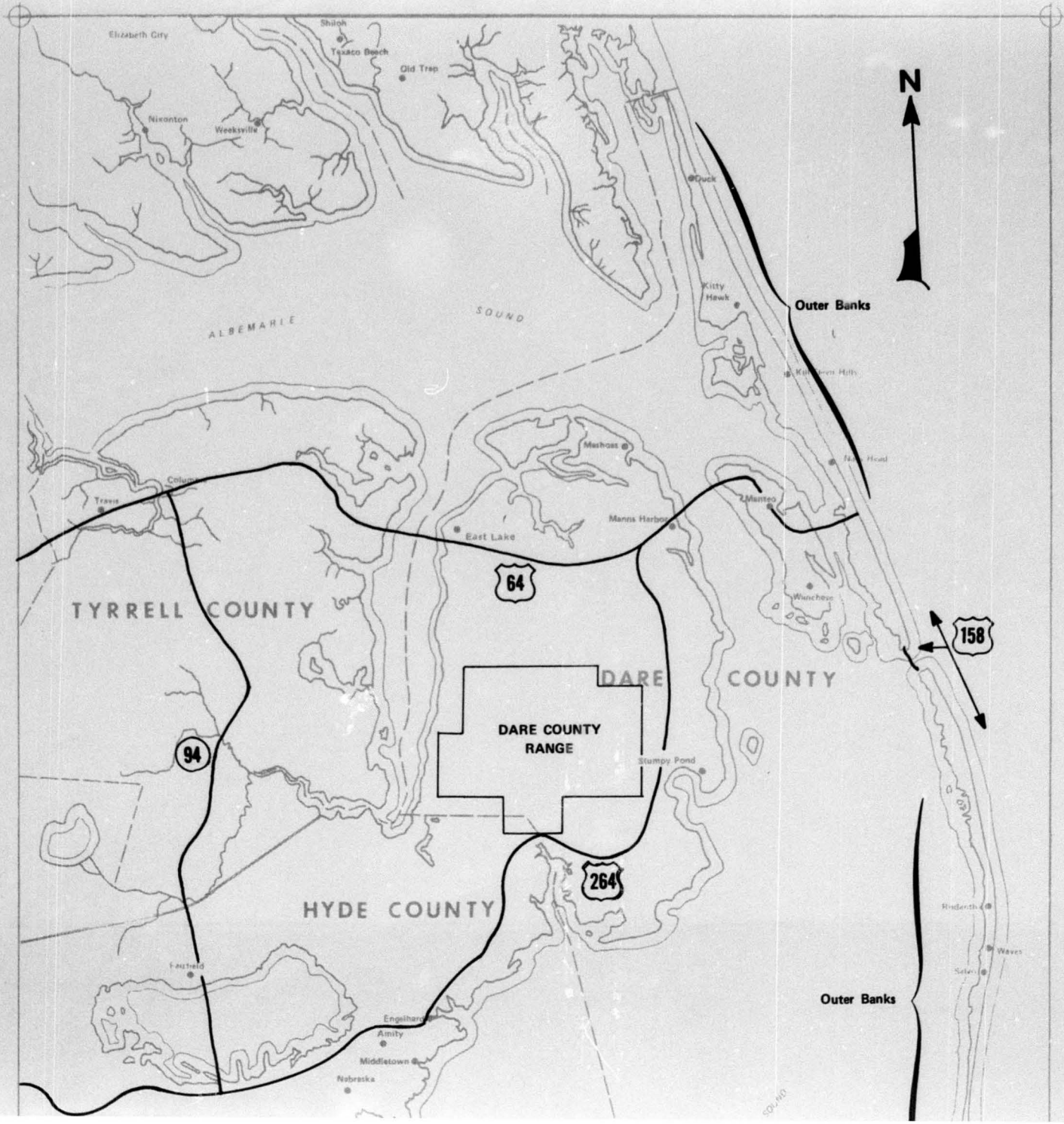
The Dare County Range is located in the State of North Carolina in the political subdivision of Dare County, the easternmost county in the state. (Less than 1% of the Range is located in the northeastern section of Hyde County.) Dare County is situated on the tip of the Albemarle Peninsula which is bounded on the north by Albemarle Sound, on the east by Croatan Sound, on the south-southeast by Pamlico Sound, and on the southwest by the Pamlico River. The entire peninsula is protected from the Atlantic Ocean by a narrow string of low-lying islands, locally referred to as the Outer Banks (see Figure 3.3.1-A). The Albemarle Peninsula is approximately 70 miles long and from 25 to 40 miles wide; the peninsula is relatively remote from major population centers. From Dare County, Raleigh, North Carolina is about 145 miles to the west; Greenville North Carolina, is about 66 miles to the southwest, and Norfolk, Virginia, is about 120 miles to the north.

In addition to Dare County, the Albemarle Peninsula is comprised of four counties: Tyrrell, Hyde, Washington, and Beaufort. Dare County is further isolated by the Alligator River which forms a natural boundary between Dare and Tyrrell Counties. Dare County's only connection to the peninsula is a low-lying area, approximately 10 miles wide abutting Hyde County. The entire peninsula is covered by numerous bays, inlets, and tidal creeks which further isolate the towns and villages from one another (See Figure 3.3.1-B).

Dare County occupies a relatively small land mass but covers a fairly large area; 246,900 acres of land and 550,500 acres of water. There are four main sections of Dare County: Cape Hatteras and the South Banks, Nags Head and the North Banks, Roanoke Island, and the Mainland. Until approximately 40 years ago when bridges were constructed between the Mainland, Roanoke Island and the Outer Banks, the four areas were accessible to each other only by boat. In addition, the four major mainland communities of Stumpy Point, Manns Harbor, East Lake, and Mashoes are separated from one another by bays, inlets, and low-lying swamp and marsh areas.

3.3.1.2 Demography

Based on the most recent census, 1970, by the U.S. Department of Commerce, Bureau of the Census, the five counties of the Albemarle Peninsula have a total population of about 66,690 with the largest population occurring in Beaufort County, 35,980, and the smallest in Tyrrell, 3,806. Population statistics for Dare, Tyrrell, and Hyde Counties for 1950-1970 are shown in Table 3.3.1-A. Within these three counties, the population density is low, with from 0-25 persons per square mile. [17]


Elizabeth City
Shiloh
Texaco Beach
Old Trap
Nixonton
Weeksville
N
Duck
Kitty Hawk
Outer Banks
ALBEMARLE
SOUND
Mashoes
Manteo
Manns Harbor
East Lake
Travis
64
TYRRELL COUNTY
DARE COUNTY
158
DARE COUNTY RANGE
Stumpy Pond
94
264
HYDE COUNTY
Fairfield
Engelhard
Amity
Middletown
Nebraska
Rodanthe
Waves
Outer Banks

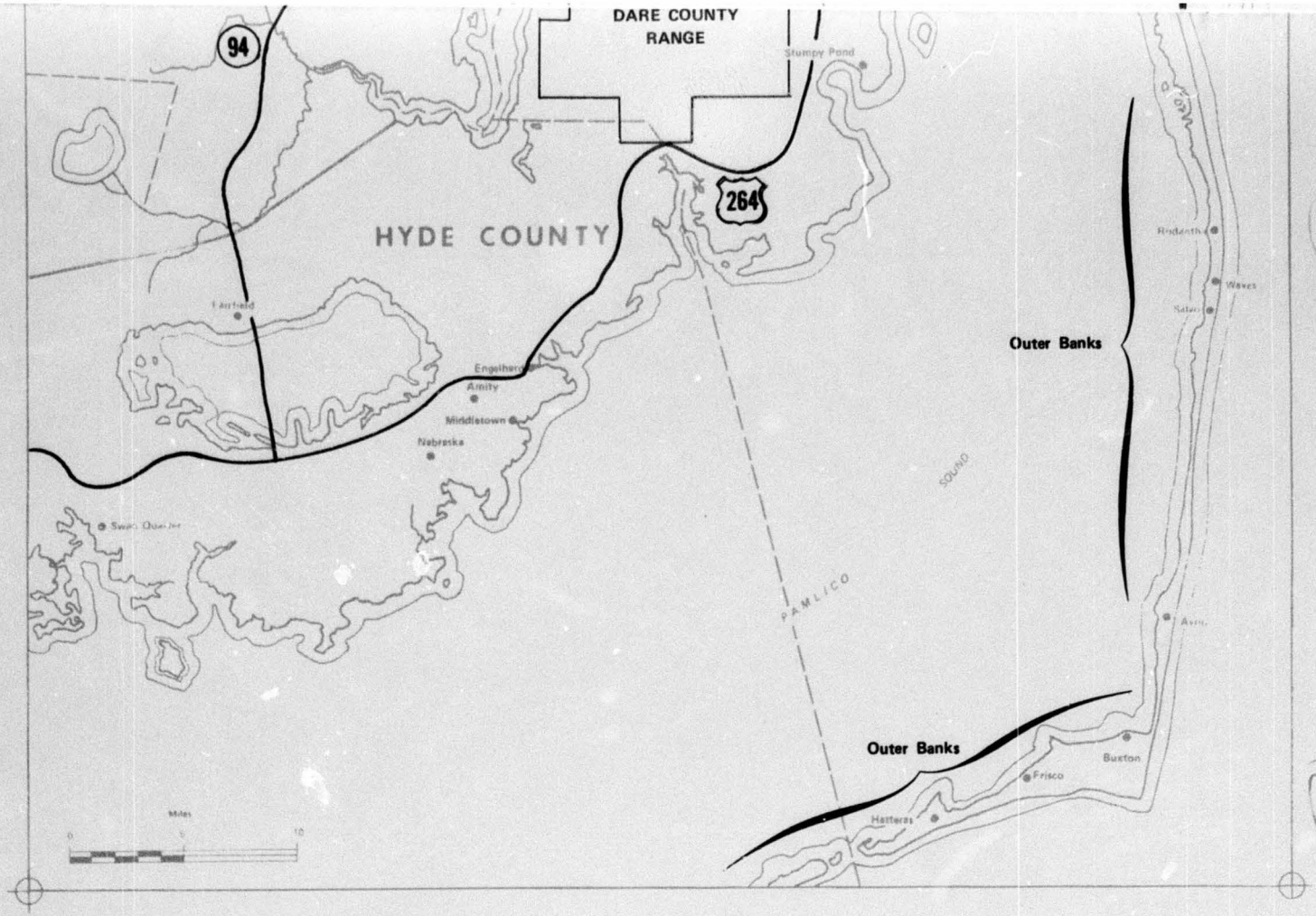
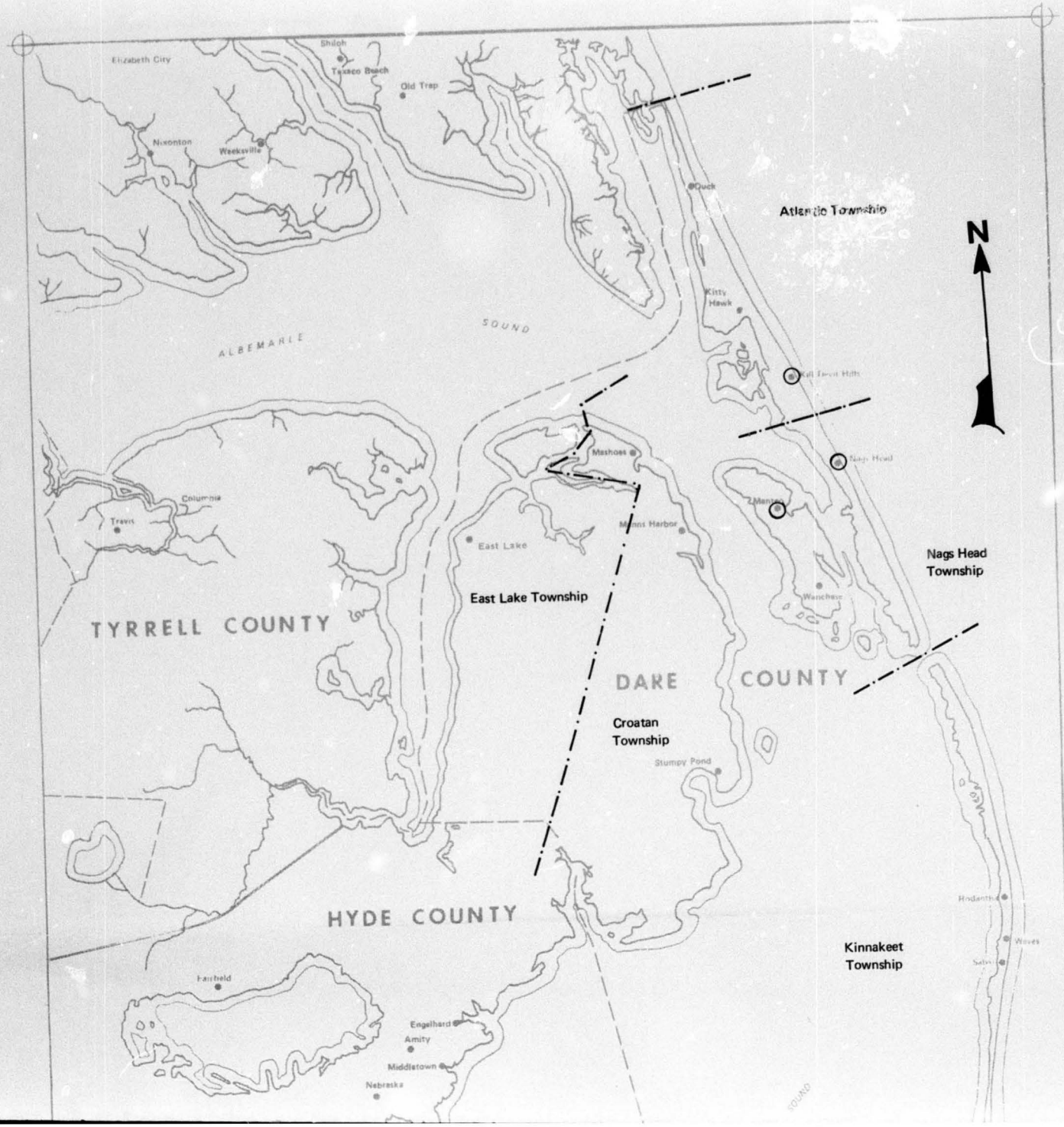


FIGURE 3.3.1–A GENERAL MAP OF DARE COUNTY AND ENVIRONS


Elizabeth City
Shiloh
Texaco Beach
Old Trap
Nixonton
Weeksville
Duck
Atlantic Township
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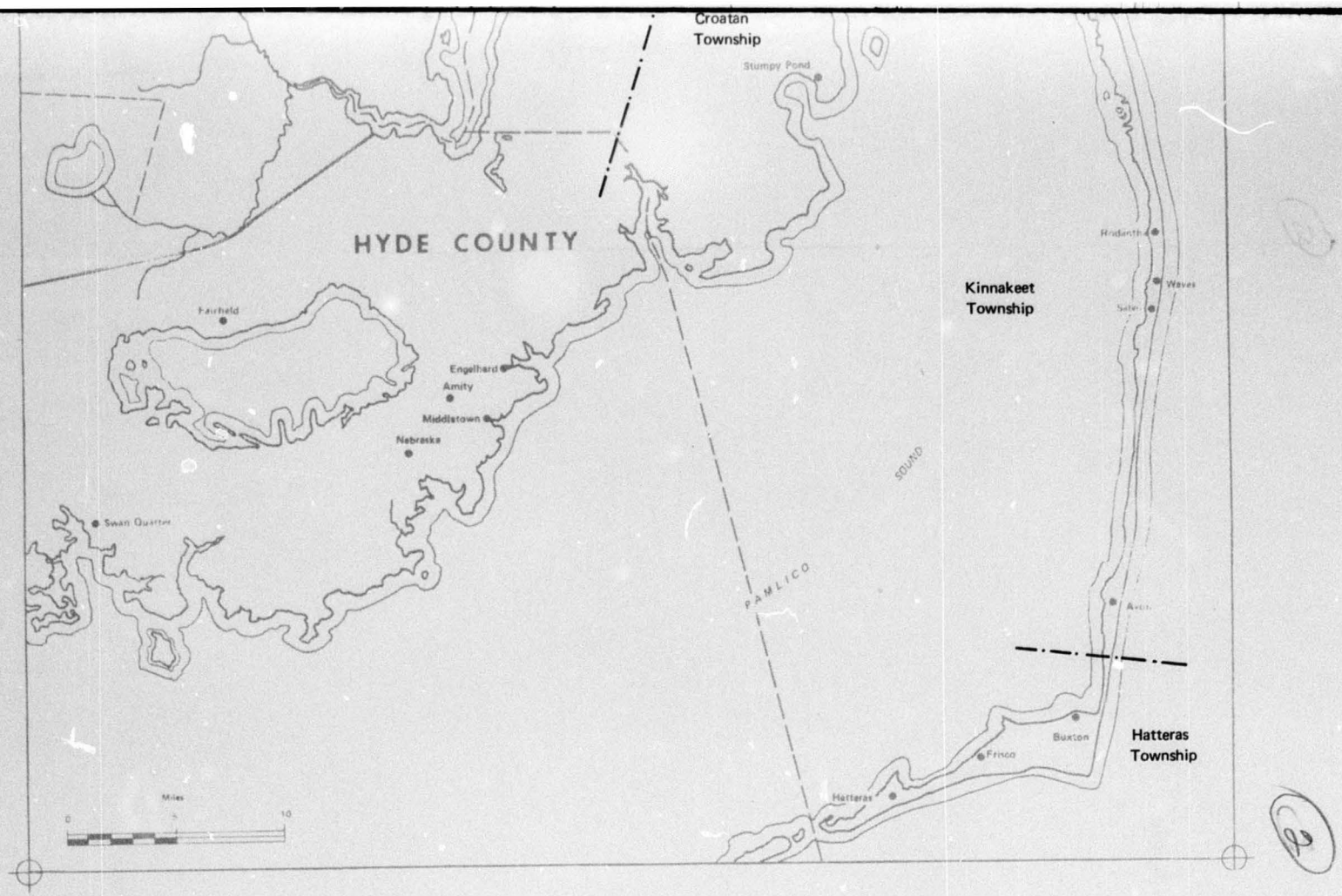
Kitty Hawk
ALBEMARLE
SOUND
Kill Devil Hills
Mashoes
Nags Head
Columbia
Travis
Manteo
Manns Harbor
East Lake
Nags Head Township
Wanchese
East Lake Township
TYRRELL COUNTY
DARE
COUNTY
Croatan Township
Stumpy Pond
HYDE COUNTY
Rodanthe
Waves
Kinnakeet Township
Salvo
Fairfield
Engelhard
Amity
Middletown
Nebraska
SOUND



Towns

Township Boundaries

FIGURE 3.3.1-B TOWNSHIPS AND INCORPORATED TOWNS IN DARE COUNTY

Table 3.3.1-A

Population of Dare, Hyde, and Tyrrell Counties, 1950-1970

	Total Population	Migration	Natural Increase
DARE			
1950(a)	5,405	-------	------
1960(a)	5,935	- 2.3 %	12.1 %
1965(b)	5,979	- 4.08%	4.82%
1970(a)	6,995	13.60%	3.40%
HYDE			
1950(a)	6,479	-------	------
1960(a)	5,765	-23.9 %	12.9 %
1965(b)	5,483	- 7.70%	2.81%
1970(a)	5,571	- .11%	1.71%
TYRRELL			
1950(a)	5,048		
1960(a)	4,520	-24.0 %	13.6 %
1965(b)	4,221	-11.39%	4.78%
1970(a)	3,806	-10.16%	.33%

(a) April 1; U.S. Department of Commerce, Bureau of the Census

(b) July 1; Carolina Population Center

Source: Profile of North Carolina Counties, Third Edition, Statistical Services Section, Office of the State Budget, Department of Administration, North Carolina, 1973.

Within Dare County, the population is concentrated in three townships: Atlantic, Nags Head, and Hatteras. The population on mainland Dare County, where the Dare County Range is located, is only 620. Table 3.3.1-B delineates the population by county subdivisions for both the 1960 and 1970 census.

Most of the population of Dare County are native-born and long-term residents. The median age of the population is 35 years with 28.7% under 18 years and 14.3% 65 and over. Table 3.3.1-C is the breakdown of the population by sex, race, and age in the six townships of Dare County.

The increase in population within Dare County during the past decade is attributable to both natural increase and migration. The population expansion on the Outer Banks is most likely linked to the fairly recent increased accessibility created by the construction of bridges and major highways into the area and the decreasing amount of coastal land available for summer or permanent homes.

The Albemarle Peninsula is both protected and isolated from the Atlantic Ocean by the Outer Banks. On the seaside of these islands, three counteracting forces are constantly at work: the ocean waves, often fetching hundreds of miles across the Atlantic before breaking on these shores; the second is the Gulf Stream, a warm current of water which passes by the tip of the Diamond Shoals off Cape Hatteras;and the third is the littoral drift, an extension of the southerly moving Labrador Current. On the sound side there is the inflow of water from rivers originating in the mountains of Virginia and North Carolina. These forces are constantly reshaping the sandy shores of the Outer Banks and the channels and shoals adjacent to them.

These forces also determine the location of inlets which connect the inner sound area to the ocean. Predictably, the location of such inlets has often changed during the history of the area severely limiting access to this region by ships and excluding larger deep draft vessels. There has always been and continues to be a need for a safe and stable channel connecting Albemarle Sound with the sea.

Table 3.3.1-B

Population of County Subdivisions
1970 and 1960

	1970	1960	% Change
Dare County Population	6,995	5,935	17.9
Atlantic township (Includes Kill Devil Hills town)	1,141	864	32.1
Kill Devil Hills town	357	268	33.2
Croatan township	540	545	-0.9
East Lake township	88	115	-23.5
Hatteras township	1,333	1,217	9.5
Kennekeet township	565	434	30.2
Nags Head township (Includes Manteo and Nags Head towns)	3,328	2,760	20.6
Manteo town	547	587	-6.8
Nags Head town[1]	414	---	---

[1]Nags Head town incorporated from part of Nags Head township.

Table 3.3.1-C

1970 Census of Population
General Population Characteristics, North Carolina

	Population								
		Sex		Race			Age		
	Total	Male	Female	White	Negro	Other	Median Age	Percent under 18 years	Percent 65 years and over
Dare County									
Atlantic township	1,141	555	586	1,138	3	--	41.4	27.3	13.6
Croatan township	540	263	277	534	5	1	34.1	28.5	13.7
East Lake township	83	44	44	88	--	--	34.3	31.8	19.3
Hatteras township	1,333	693	640	1,263	61	9	28.3	25.5	11.6
Kennekeet township	565	274	291	564	1	--	39.1	27.1	14.9
Nags Head township	3,328	1,574	1,754	2,900	425	3	32.6	32.3	12.5

Source: 1970 Census, U.S. Department of Commerce, Bureau of the Census.

The centers of population fluctuated with the locations of the inlets. Between 1700 and 1775, the development of the area was severely limited by the lack of a stable channel between the inner bay area and the Atlantic Ocean. In the 1580's the Raleigh colonists utilized Port Ferdinado, opposite the southern end of Roanoke Island, where an adjacent inlet occurred. In the 1600's Roanoke Inlet, located 10-12 miles north of this point, was utilized due to greater depths; but by the early 1700's Roanoke Inlet had begun to shoal badly making it difficult to locate even a ten-foot channel. By 1730 there was no direct, reliable outlet through the banks from the Roanoke Island area. Without a connection to the sea, Roanoke Island was no longer desirable for settlement and much of the population shifted inland or to the Outer Banks.

Storms and hurricanes are also factors controlling the population and its distribution within the area. The two presently existing inlets - Oregon Inlet and Hatteras Inlet - are the result of a particularly severe hurricane in September of 1846. Flooding of low-lying areas by storms and excessively high tides along with the poor foundation conditions limited the desirability of many areas for homes.

The area of the Atlantic Ocean adjacent to the Outer Banks is characterized by rough seas, severe storms, and hidden shoals resulting in numerous shipwrecks. For this reason the area is often referred to as "the Graveyard of the Atlantic."

Many reasons have accounted for the lack of development, the primary ones being the relative isolation from mainland areas by virtue of being a peninsula; along with the low-lying topography, lack of a stable connection to the Atlantic Ocean, and the treacherous conditions to shipping activity. Settlers found it more advantageous to settle along the Chesapeake Bay where more favorable conditions for navigation and land-based transportation existed.

3.3.2 LOCAL GOVERNMENT

3.3.2.1 History

Dare County was not formed until 1870. Previous to that time, Roanoke Island and the northern coast of what is now Dare County were part of Currituck County, the southern coast including Cape Hatteras was part of Hyde County, and the mainland was part of Tyrrell County. In 1870, the General Assembly of North Carolina voted to take away these parts of Currituck, Hyde, and Tyrrell Counties to form Dare County in memory of Virginia Dare, the first child born of English parents in America.

3.3.2.2 Distribution of Authority

Dare County is governed by a five-member elected Board of County Commissioners. Also elected are a Sheriff, Registrar of Deeds, and the Clerk of Court. The county seat is located in Manteo on the eastern side. The five member Dare County Planning Board is appointed by the Board of Commissioners to undertake the planning process in the County. The County Manager, also appointed by the Board of Commissioners, has substantial input into the planning process.

For tax purposes, the county is divided into six townships: Hatteras, Kennekeet, Nags Head, Atlantic, Croatan, and East Lake. Incorporated towns within Dare County include Manteo, Nags Head, and Kill Devil Hills (see Figure 3.3.1-B).

Authority to pass zoning regulations is vested in the Dare County Board of Commissioners. However, only Kitty Hawk has zoning regulations. [19] The five-member Kitty Hawk Zoning Board is appointed by the County Board of Commissioners and meets monthly. There are plans for zoning the north end of Roanoke Island in order to retain the single family residential character of the area. Developers in Southern Shores, in the northern end of the beach in Dare County, are presently seeking zoning regulations.

The Dare County Building Inspector enforces the Dare County Building Code which is the standard North Carolina State Building Code for one and two family dwellings. [20] Within the code is a provision for minimum flood heights for buildings, but this provision applies only to structures near the Outer Banks beaches and not to any part of the mainland.

3.3.3 LAND USE

3.3.3.1 Present Land Use

When the Dare County Range was built in 1964, the land in the environs was primarily vacant. In 1960, the total population of the mainland was 660, concentrated at Stumpy Point, Manns Harbor, Mashoes, and East Lake. [21] The mainland is still undeveloped, and has experienced a population decrease of 32 from 1960 to 1970. [22] Land uses other than vacant are almost exclusively single family residential. The 209 [22] households on the mainland accounted for approximately one half of one percent of the total area of the mainland in 1970. Since 1970, three dwellings have been built at Stumpy Point, one at East Lake, and a trailer park at Manns Harbor. [56]

The only industrial land use on the mainland of Dare County is for a small, seasonal fishing industry. Commercial land use on the mainland consists of a few scattered gasoline stations along Highway 264 and a country store in each of the four towns. Small boat landing facilities at Stumpy Point, Manns Harbor, Mashoes, and East Lake are the extent of recreational land use on the mainland.

The Range constitutes approximately 25% of the total mainland area and is the largest land use other than vacant land use. Although the Range area (approximately 45,000 acres) has been untouched except for about 6000 acres of clearing, its use is restricted for safety purposes. The Range can be fished and hunted only with permission from the Air Force or Navy.

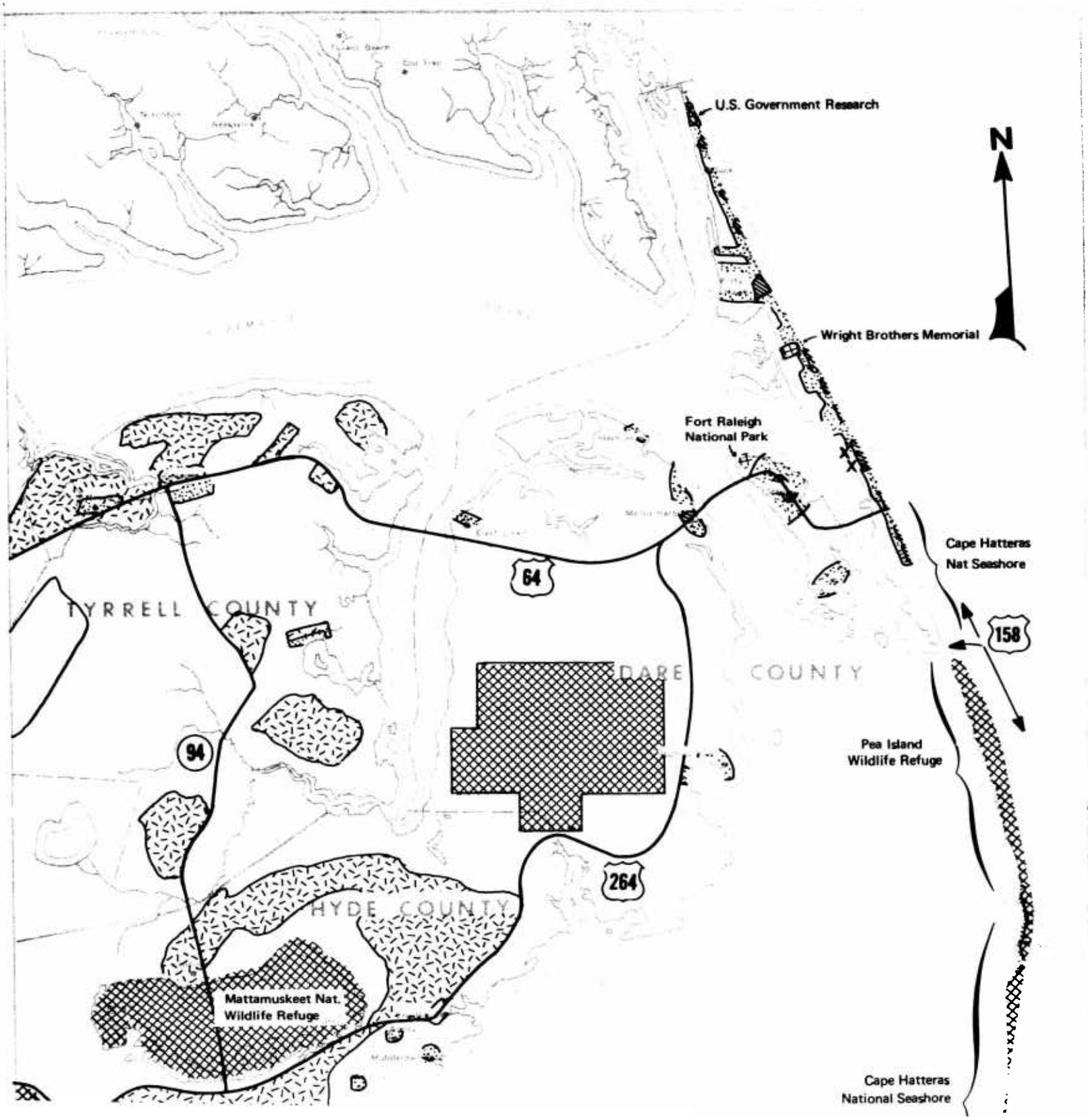
Located across the Albemarle and Pamlico Sounds is the beach region known as the Outer Banks. Land use for this area is depicted in Figure 3.3.3-A. The most comprehensive data available on land use are in the Sketch Development Plan for Dare Beaches undertaken for the Dare Beaches Water and Sewer Authority by Stevens Associates. The geographical limits of the Dare Beaches extend from Currituck County line in a southerly direction for approximately 33 miles to Oregon Inlet including the incorporated towns of Nags Head, Kill Devil Hills and the communities of Kitty Hawk, Southern Shores, and Duck.

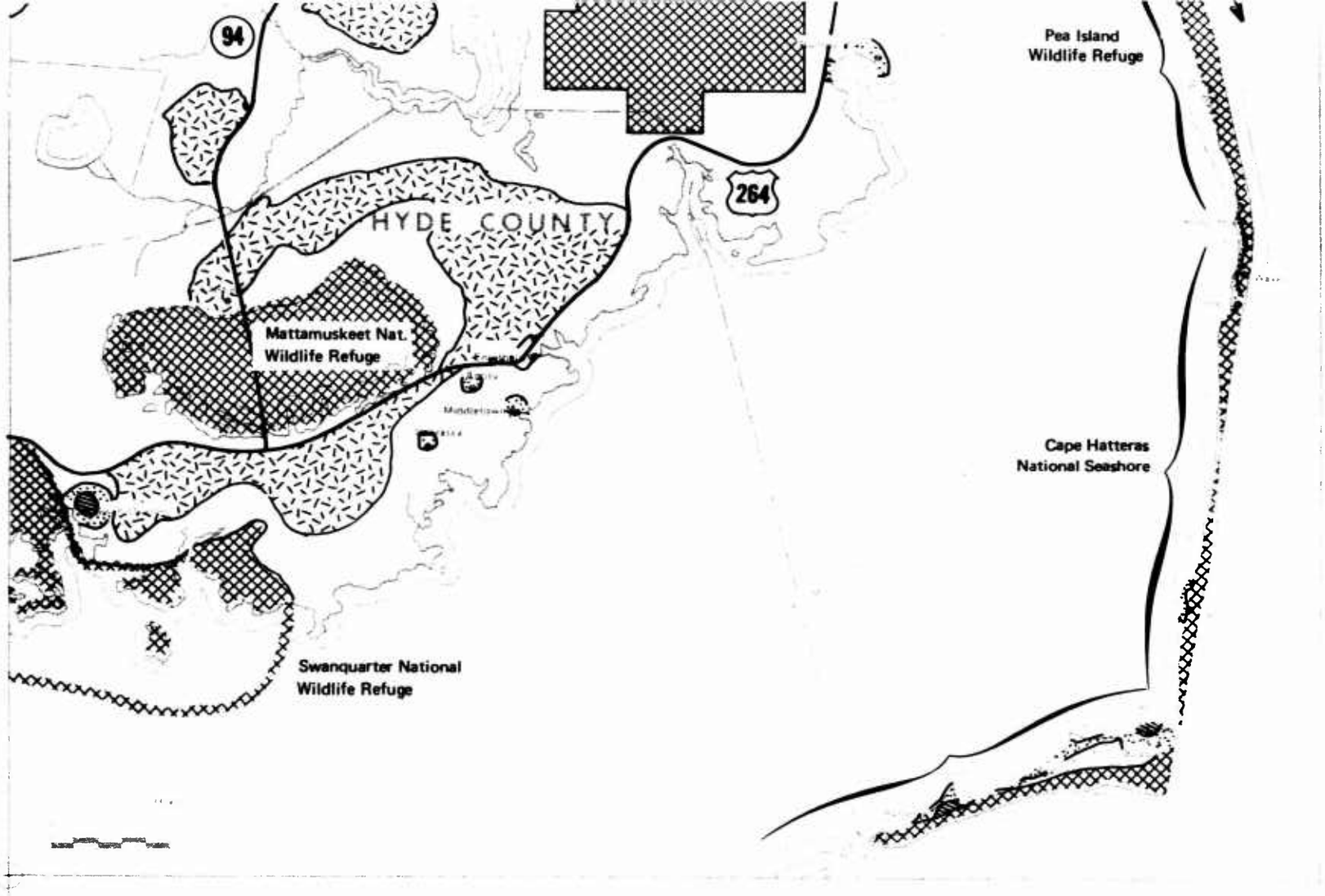
About 20% of the total land area of the Dare Beaches is developed. [23] Commercial development in the Dare Beaches area is recreationally oriented with restaurants, gift shops, entertainment facilities, and gasoline service stations comprising over 60% of the total. Other commercial uses consist primarily of grocery stores, fishing piers, and commercial services such as realty offices, laundromats, and barber shops. A large percentage of all developed land in the Dare Beaches area is occupied by motels, hotels, and other commercial residential uses. Most of the land uses in this classification are located between the Route 158 Bypass and the ocean extending from the Kitty Hawk area southward to the Whalebone Junction of Nags Head.

It is impossible to distinguish rental cottages from permanent residences because a single family resort dwelling may be used part time by the owner and rented to other persons for the remainder of the time. However, concentrations of permanent residences are in the Duck area, Southern Shores, Kitty Hawk Village, Collington, areas in Kill Devil Hills and Nags Head west of Route 158 Bypass, and in South Nags Head.

The major public lands in Dare Beaches are held by the federal government, consisting of approximately 5000 acres located in the southern portion of Bodie Island. The only other public uses are for churches, post offices, town halls, and fire stations. Industrial land use consists of two parcels; one parcel, located in Nags Head, is used for the manufacture of concrete, and the parcel, located in the Kitty Hawk area west of the 158 Bypass is used for generation of electricity for peak load requirements.

Federal land use dominates the southern portion of the Outer Banks. Cape Hatteras National Seashore, as shown in Figure 3.3.3-A, begins where Highway 264 meets Highway 158 in Nags Head Township and runs south the length of the Outer Banks in Dare County with the exception of the Pea Island Wildlife Refuge which runs from Oregon Inlet to Waves.


U.S. Government Research
N
Wright Brothers Memorial
Fort Raleigh
National Park
Cape Hatteras
Nat Seashore
64
158
TYRRELL COUNTY
DARE COUNTY
94
Pea Island
Wildlife Refuge
264
HYDE COUNTY
Mattamuskeet Nat.
Wildlife Refuge
Cape Hatteras
National Seashore



Key

- Federal
- Commercial
- Residential
- Vacant and Forest
- Agricultural
- XX Industrial

FIGURE 3.3.3-A EXISTING LAND USE

South of Oregon Inlet are the towns of Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, and Hatteras. The population of these towns was 1898 in 1970. [21] Residential land use is a large portion of the developed land. In 1970, there were 210 households in Kennekeet Township and 467 in Hatteras Township. Tourist-oriented development is not as dense as the Dare Beaches end of Dare County, but it is substantial. Hatteras Township has a half dozen motels and a few restaurants. Other commercial uses consist of grocery stores, fishing piers, service stations, and a bank.

Manteo, the county seat, is located on Roanoke Island. The population was 547 in 1970. [21] The town of Manteo has a residential character, but because it is the governmental center of the County, the public buildings such as the Courthouse, the County Manager's Office, City Manager's Office, and the Library are located there. Most of the commercial land use is along Highway 64 and Budleighly Street, consisting of drug stores, grocery stores, hardware stores, clothing stores, and an alcoholic beverage store. Although the population of Manteo is small, it is nonetheless the center of commerce. The newspaper (the Coastland Times), the police station, the fire department, and the telephone company are located there; nearby is the Manteo Airport.

On the southern end of Roanoke Island is the small Port of Wanchese. This town is a small commercial fishing port with some sport-fishing industry at the dock.

The existing land use in Tyrrell County is shown in Figure 3.3.3-A. The majority of the county, 85%, is forest. Cleared land for agriculture and supporting residential and commercial development represents 15% of the total land area. The major population area is Columbia, the county seat. [24]

Of 402.4 land acres in Hyde County, 275.3 acres were forest in 1964. [25] In 1971, cropland and pastures accounted for 63.1 acres while recreational uses accounted for 124.7 acres. Areas within 10 miles of the Range are vacant.

3.3.3.2 Community Development Plans

The Dare County Planning Program [14] is still in its early stages. Phase I, the Preliminary Development Plan, was submitted to the County on June 1, 1974. The objectives of this Plan are "to create a comprehensive planning system which consists of a plan for growth and development, as system for implementing the plan, and a method of administration..." [14] After Phase I is complete, the next step in the planning process will be to describe in detail the development characteristics of communities and districts, to prepare a composite county-wide land use plan from the district plans. Finally, Phase III will provide the legislative and administrative mechanisms for implementing the plan.

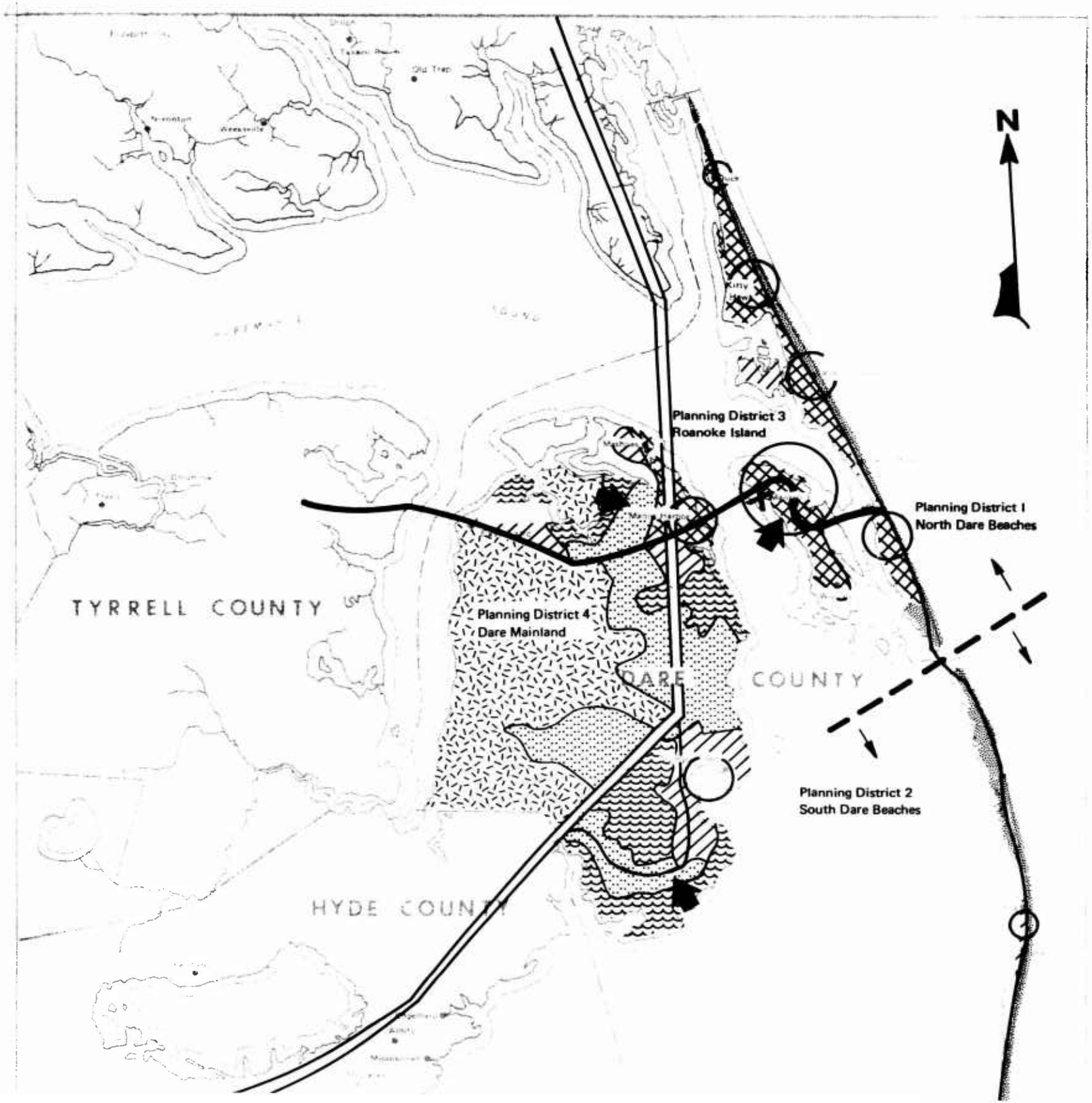
The Air Force has not been contacted to provide input to the planning program nor have they received a copy of the preliminary development plan for review.

The General Development Plan, Figure 3.3.3-B, shows the proposed future development plan for Dare County. North Dare Beaches, Planning District No. 1, is expected to possess a development character of medium-to-high density, with limited vehicular access to the Beaches and with reservations of land for public use. South Dare Beaches, Planning District No. 2, will have concentrated zones of urbanization containing independent community service centers. The residential character will be low-to-medium density. Roanoke Island, Planning District No. 3, will contain mixed uses and densities and is expected to be the required center for community facilities and services. Dare mainland, Planning District No. 4, will be mainly rural and agricultural in character with urban areas at key transportation interchanges. [14]

The Dare Beaches Sketch Development Plan was completed in March 1973 by the Dare Beaches Water and Sewer Authority. The participating units were Dare County, Kill Devil Hills, and Nags Head. The limits of the Dare Beaches extend from the Currituck County line in a generally southerly direction for approximately 33 miles to Oregon Inlet. The conclusion of the plan was that Dare Beaches' population will continue to grow at a significant rate, and that this should be planned growth. [23] The fundamental goal of the Development Plan is to achieve an optimum living and working environment for the residents of the Dare Beaches area. As part of the fundamental goal, the plan seeks to encourage a pattern of land use which will ensure protection and conservation of natural resources, balance residential and commercial land use, avoid overcrowding, allow for efficient delivery of public services, enhance recreational industry, and stimulate intergovernmental cooperation. The Sketch Development Plan was centered as an initial guide and working basis for the design and cost estimates for a water and sewer system to serve the residents of the Dare Beaches area; before the plan is implemented by the adoption of various land use controls, further studies will have to be undertaken.

Short-term development plans include agricultural development of the mainland, a port at Wanchese, a large hotel and dock complex at Hatteras, and a continued influx of retired population at Hatteras. Agricultural development by First Colony Farms, created a year ago by Malcom P. McLean, is expected to increase. First Colony Farms owns nearly 600 square miles, principally in Dare and Tyrrell Counties. On this land, Mr. McLean plans to raise thousands of cattle and develop the nation's largest hog-growing operation, planned ultimately to produce a million head a year, and to raise the thousands of acres of corn and soybeans needed to sustain the livestock, as well as winter wheat to precede the soybeans in a double-cropping sequence. A slaughtering plant, probably under separate ownership, may eventually be attracted to the area. [57]

A General Soil Map and Interpretations has been done by United States Department of Agriculture for Dare County. [6] In the interpretation of the soil map, it was emphasized that the general soils map was prepared for broad planning purposes only, and does not accurately depict specific


N
Planning District 3
Roanoke Island
Planning District 1
North Dare Beaches
TYRRELL COUNTY
Planning District 4
Dare Mainland
DARE COUNTY
Planning District 2
South Dare Beaches
HYDE COUNTY

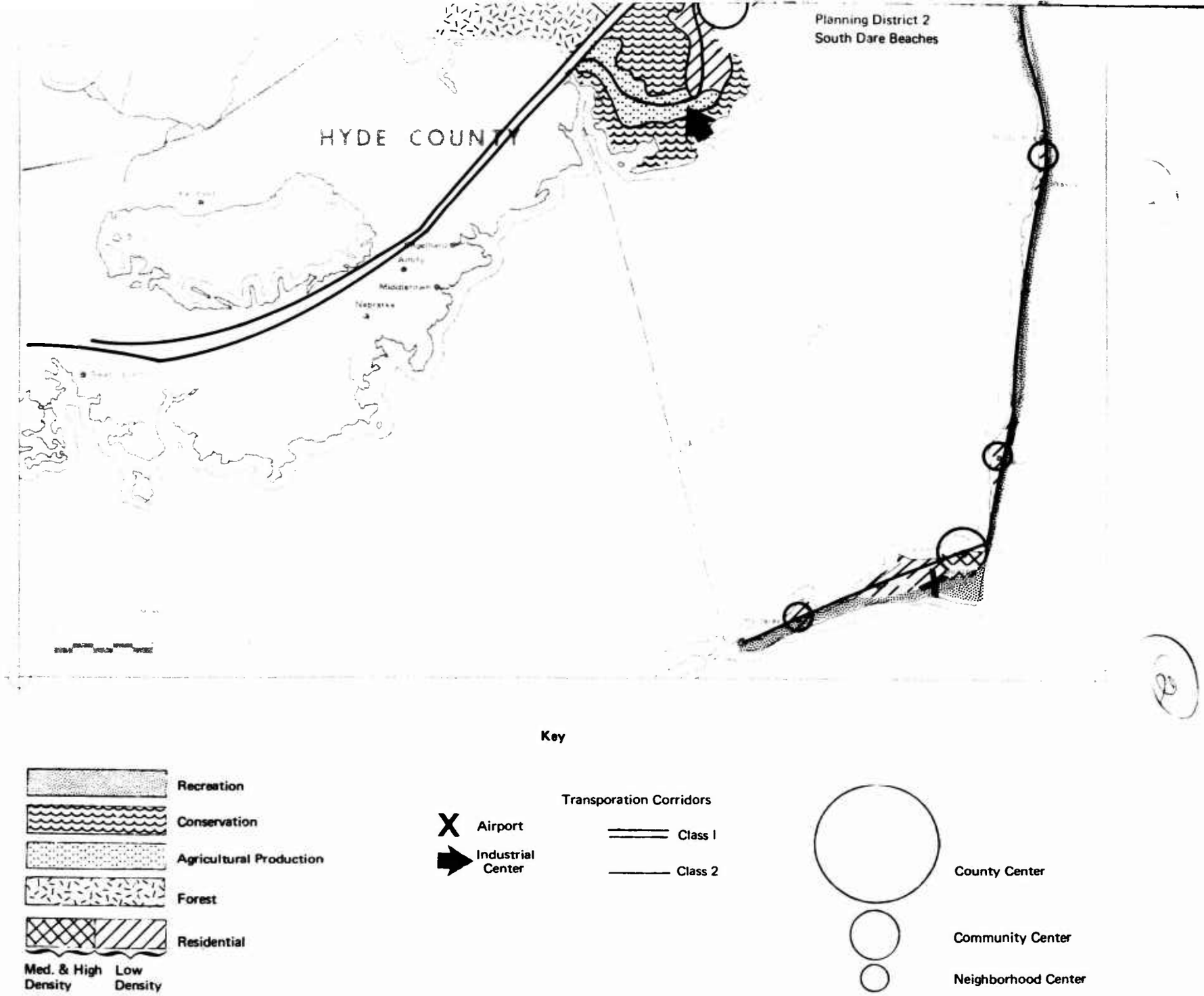


FIGURE 3.3.3-B GENERAL DEVELOPMENT PLAN

soil types on individual tracts of land. The different types of soils and their locations are examined in Section 3.1.4. The two principal soil associations on the range are the Dare-Pungo-Ponzer Association and the Wasda-Bladen Association.

The soils of the Dare-Pungo-Ponzer Assocation are extremely wet year round, are extremely acid unless limed, have large amounts of wood throughout the profile, contain high percentages of unstable organic materials, and are extremely susceptible to fire when dry. These characteristics for organic soils of this association indicate a limited potential for agriculture and forestry, and essentially no potential for industrial land use. Agricultural development has taken place on these soils, but it requires sound management practices and large capital investments. Although corn, soybeans and small grains are potential crops for these soils, indications are that these acreages may be best utilized for pasture or forage crop production.

The soils of the Wasda-Bladen Association respond well to applications of lime and fertilizer but a complete drainage system must be installed and maintained in order to offset the high water table and periodic flooding. Potential uses of soils in this association are limited to agriculture and forestry.

Table 3.3.3-A, Soil Interpretation for the Dare Mainland, corresponds to Figure 3.1.4-A in the Soils section. These are merely general interpretations not specifically addressing the Range. To determine the potential of the Range for agriculture, it is necessary to make a detailed soil survey.

The Wanchese port development is planned to serve the commercial fishing industry by providing a refuge during bad weather and a place to discharge catches. Docking 180 vessels, the port is expected to cost a total of 23.6 million dollars, and has a completion date of 1980. The port is planned to attract a food packaging industry, thus partially stabilizing the seasonal economy. [58]

In Hatteras, a large Ramada Inn and sport fishing dock are under construction and planned to be completed sometime in 1975. In addition to the hotel, an increase is expected in residential homes for retired people.

3.3.3.3 North Carolina Legislation Affecting Land Use

The Dredge and Fill Act [39] requires a permit from the Department of Conservation and Development before dredging any estuarine waters, marshlands or tidelands. "Estuarine waters" are defined as the waters of the bay, sounds, rivers, and tributaries seaward of the dividing line between coastal fishing waters and inland fishing waters agreed upon by the Department of Conservation and Development and the Wildlife Resources Commission. "Marshland" is defined as any marsh subject to regular or occasional flooding by tides. The Department may deny an application for

Table 3.3.3-A

SOIL INTERPRETATIONS
GENERAL SOIL MAP
DARE COUNTY, NORTH CAROLIN

SOIL ASSOCIATIONS	% OF ASSOC.	LIMITATIONS FOR			
		DWELLINGS WITH SEPTIC TANK FILTER FIELDS	RECREATION		
			CAMP SITES	PICNIC AREAS	INTE PLAY
PACTOLUS-WAKULLA-WAGRAM 1%					
Pactolus	35%	Sev.Fl.Wt.LFC	Mod.Wt.Text.	Mod.Wt.Text.	Mod.Wt.
Wakulla	30%	Slt.to Mod.LFC	Sev.Text.	Sev.Text.	Sev.Tex
Wagram	20%	Slight to Mod.	Mod. Text.	Mod. Text.	Mod. Te
NEWHAN-COROLLA-DUCK 13%					
Newhan	35%	Slight LFC.Slope	Sev. Text.	Sev. Text.	Sev. Te
Corolla	25%	Sev.LFC. Wt.	Sev. Text.	Sev. Text.	Sev.Tex
Duck	25%	Sev.LFC Wt.Fl.	Sev.Fl.Wt.	Sev.Wt.Fl.	Sev.Wt.
DARE-PUNGO-PONZER 70%					
Dare	40%	Sev.Fl.	Sev.Fl.	Sev.Fl.	Sev.Fl.
Pungo	25%	Sev.Fl.	Sev.Fl.	Sev.Fl.	Sev.Fl.
Ponzer	20%	Sev.Fl.	Sev.Fl.	Sev.Fl.	Sev.Fl.
WASDA-BLADEN 10%					
Wasda	65%	Sev.Fl.Wt.	Sev.Fl.	Sev.Fl.	Sev.Fl.
Bladen	20%	Sev.Fl.Wt.Perm	Sev.Fl.	Sev.Fl.	Sev.Fl.
CAPERS 5%					
Capers	90%	Sev.Fl.Wt.	Sev.Fl.	Sev.Fl.	Sev.Fl.
DUNE SAND 1%					
Dune Sand	90%	Sev.LFC Slope	Sev.Text.	Sev.Text.	Sev.Te

DEFINITIONS OF SOIL LIMITATIONS

NONE TO SLIGHT - Soils have properties favorable for the rated use. Limitations are so minor that they can be easily overcome. Good performance and low maintenance can be expected from these soils.

MODERATE - Soils have properties moderately favorable for the rated use. Limitations can be overcome or modified with planning, design, or special maintenance.

SEVERE - Soils have one or more properties unfavorable for the rated use. Limitations are difficult and costly to modify or overcome requiring major soil reclamation, special design, or intense maintenance.

Source: U.S. Department of Agriculture, Soil Conservation Service, Raleigh, North Carolina

Table 3.3.3-A

SOIL INTERPRETATIONS
GENERAL SOIL MAP
DARE COUNTY, NORTH CAROLINA

LIMITATIONS FOR					SUITABILITY FOR			
RECREATION			LIGHT INDUSTRIES	ROADS AND STREETS	GENERAL AGRICULTURE		WOODS	PASTURE
ES	PICNIC AREAS	INTENSIVE PLAY AREAS						
			1/	2/	3/	4/		
xt.	Mod.Wt.Text.	Mod.Wt.Text.	Sev.Fl.Wt.	Mod.Fl.	Good	Good	Good	Good
	Sev.Text.	Sev.Text.	Slight	Slight	Fair	Fair	Fair	Fair
.	Mod. Text.	Mod. Text.	Moderate	Slight	Good	Good	Good	Good
.	Sev. Text.	Sev. Text.	Sev.Text.Fl.	Sev.Text.Fl.	Poor	Poor	Poor	Poor
.	Sev. Text.	Sev.Text.Wt.Fl.	Sev.Text.Fl.	Sev.Text.Fl.	Poor	Poor	Poor	Poor
.	Sev.Wt.Fl.	Sev.Wt.Fl.	Sev.Wt.Fl.	Sev.Wt.Fl.	Poor	Poor	Poor	Poor
	Sev.Fl.	Sev.Fl.	Sev.Fl.BS	Sev.Fl.TSC	Poor	Poor	Fair	Poor
	Sev.Fl.	Sev.Fl.	Sev.Fl.BS	Sev.Fl.TSC	Poor	Poor	Fair	Poor
	Sev.Fl.	Sev.Fl.	Sev.Fl.BS	Sev.Fl.TSC	Poor	Good	Good	Good
	Sev.Fl.	Sev.Fl.	Sev.Fl.Wt.	Sev.Fl.Wt.	Poor	Good	Good	Good
	Sev.Fl.	Sev.Fl.Wt.	Sev.Wt.Cor.	Sev.Fl.Wt.	Poor	Good	Good	Good
	Sev.Fl.	Sev.Fl.	Sev.Fl.BS	Sev.Fl.BS	Poor	Poor	Poor	Poor
	Sev.Text.	Sev.Text.	Sev. Slope	Sev. Text.	Poor	Poor	Poor	Poor

re so minor that they can be
ected from these soils.

mitations can be overcome or

Limitations are difficult
, special design, or intense

ABBREVIATIONS FOR LIMITING FACTORS:

Fl - Flood Hazard
Wt - Water Table
Sh-Sw - Shrink-Swell Potential
Perm - Permeability
Text - Texture

LFC - Low Filter Capacity
Cor - Corrosion Potential
TSC - Traffic Supporting Capacity
BS - Bearing Strength

Sev. - Severe Mod. - Moderate Slt. - Slight

1/ Structures whose footings are in subsoil.

2/ Refers to roads and streets that have subsoil for base.

3/ Tobacco, peanuts and truck.

4/ Corn, soybeans and small grain.

a dredge or fill permit upon finding that the proposed dredging and filling will have a significant adverse effect on (1) the use of the water by the public; (2) the value and enjoyment of the property of any riparian owners; (3) public health, safety, or welfare; (4) the conservation of public or private water supplies; or (5) wildlife or fresh water, estuarine or marine fisheries.

The Wetlands Protection Act [40] allows the Department of Conservation and Development to protect coastal marshes by adopting rules and regulations following public hearings and map preparations.

The Sand Dunes Protection Act [41] requires the obtaining of a permit from the Board of County Commissioners to alter or build upon a sand dune.

The three aforementioned acts have a substantial impact upon land use in Dare County but have limited impact on the Range. However, the newly passed Coastal Area Management Act [42] will have an impact on the whole county, including the Range. Under the Act, Dare County must prepare a land use plan, within 300 days after the adoption of the State Guidelines, which must be adopted within 210 days after July 1, 1974, the effective date of the act. If the county fails to prepare such a plan, the Coastal Resources Commission will prepare and adopt a plan. The plan will give special attention to the protection and appropriate development of "areas of environmental concern" as established by the Coastal Resources Commission. No land use plan is effective until it is approved by the Commission. Within 20 months after July 1, 1974, the County Board of Commissioners will adopt an implementation and enforcement plan. Under the Act every person, before undertaking any development in any area of environmental concern, must obtain a permit from the Coastal Resources Commission.

The impact of the Coastal Management Act on the land within the Range is uncertain. The State of North Carolina has not yet prepared the state guidelines nor has it identified areas of environmental concern. Until the Coastal Management Act is implemented by the state and county, it is impossible to precisely assess its impact on the land area encompassed by the Range.

3.3.4 ECONOMIC AND SOCIAL FACTORS

3.3.4.1 Economy

The economy of Dare County is largely supported by the summer tourism industry. Tourists are attracted to the area because of the beaches and National Park on the Outer Banks, the Wright Memorial and Jocky Ridge (largest sand dune on the East Coast) and the National Park at the site of the first settlement on Roanoke Island. Since the tourism industry provides a large employment only during the summer months, the County is trying to establish a more stable economic base by extending the tourist season and by establishing industries which will provide winter employment.

3.3.4.1.1 Employment

Table 3.3.4-A shows the typical employment pattern in the County. [26] The work force expands from between 2500 and 3000 during the winter months to over 5000 during the months of June, July, and August, with an unemployment rate ranging from 15% in January to less than 1% during July, August, and September. As can be seen from Table 3.3.4-B, most manufacturing, construction, transportation, and agricultural employment have small increases in employment during the summer while retail trade, service, and "other non-agricultural occupations" show large increases. [26] Data on employment in the Dare Beaches area (Outer Banks north of Oregon Inlet - Kill Devil Hills, Nags Head, etc.) are shown in Table 3.3.4-C.[27] The Dare Beaches area is responsible for over half the employment in the County during the summer months. In this area over 60% of the fluctuation in employment can be attributed to eating and drinking establishments, hotels, and entertainment--those services directly tied to the tourist industry.

Table 3.3.4-D compares employment in Dare County with that of surrounding communities. [26] The employment patterns are quite different in the surrounding counties. They are dependent on manufacturing and agriculture for about 30 to 40% of their employment, whereas these represent only about 2% of Dare's employment.

The average per capita income in Dare County was $2,368 in 1970 and $1,233 in 1962, and average weekly earnings in 1971 were $90.16 per week. In the surrounding counties of Tyrrell, Hyde, and Washington the 1970 per capita incomes were $1,522, $1,668, $2,578, respectively.

3.3.4.1.2 The Tourist Industry

It is estimated that expenditures by travelers in Dare County in 1973 were $47,936,000 making it the sixth ranking county in travel income in the State with about 5% of the total income (in contrast Tyrrell County had $96,000 in travel expenditures, Hyde $650,000 and Washington $1,440,000 in the same period). [28] In 1971, an estimated 1-1/2 million tourists visited the area during June, July, and August. [29] Most travelers to Dare County are from North Carolina (42%) and the four adjoining states (20%).

The tourist industry in Dare County is centered on the Outer Banks and Roanoke Island.

Tourist attractions in the County are shown in Figure 3.3.4-A. In the North End of Roanoke Island is the Fort Raleigh National Historic Site located at the site of the first Raleigh settlement. Nearby is the Roanoke Island Historical Park - a recreated Indian village of the late sixteenth century, and the Elizabethan Garden - a representation of an English garden of the same period. A play "The Lost Colony" which dramatizes the history of the first English settlement in the area is performed nightly during the summer months.

Table 3.3.4-A

1972 Dare County Civilian Work Force

	Total Civilian Work Force	Employed	Unemployed	Rate of Unemployment
January	2540	2160	380	15.0
February	2510	2510	360	14.3
March	2820	2490	330	11.7
April	3520	3300	220	6.3
May	3920	3820	100	2.6
June	5070	5020	50	1.0
July	5240	5210	30	.6
August	5270	5240	30	.6
September	4080	4060	20	.5
October	3460	3420	40	1.2
November	3130	3040	90	2.9
December	2850	2620	230	8.1

Source: North Carolina State Department of Employment Security, Research Department, Civilian Work Force - County Data, 1972.

Table 3.3.4-B

Type of Employment in Dare County

	February 1972	%	August 1972	%	Average 1972
Manufacturing	50	2	80	2	60
Construction	120	6	200	4	210
Transportation, Communications, Public Utilities	60	3	110	2	80
Retail Trade	390	18	1,140	22	750
Finance, Insurance Real Estate	130	6	340	6	190
Service	240	11	220	23	640
Government	450	21	440	8	450
Other, Non-Manufacturing	50	2	80	2	80
Other, Non-Agricultural	650	30	1,600	30	1,060
Agricultural	10	<1	30	<1	20
Total	2,150		5,240		3,540

Source: North Carolina State Department of Employment Security, Research Department, Civilian Work Force - County Data, 1972.

Table 3.3.4-C

1972 Dare Beaches Employment

Occupation	Park Employment	% Total	Year Round Employment	% Total
Fisheries			40*	1.1
Construction	117	7	116	16
Manufacturing	37	2	35	5
Retail Trade				
Eating + Drinking Places	518	21	53	7.4
Auto Retail + Service Stations	162	7	23	3.2
Other Retail	297	11	96	13
Finance, Insurance, Real Estate	262	11	99	14
Services				
Hotel + Lodging	645	26	172	24
Entertainment + Recreation	200	2	33	5
Other Services	44	2	28	4
Public Administration	78	3	63	9
Total	2,460		718	

*Estimate 70 people employed 7 months per year.

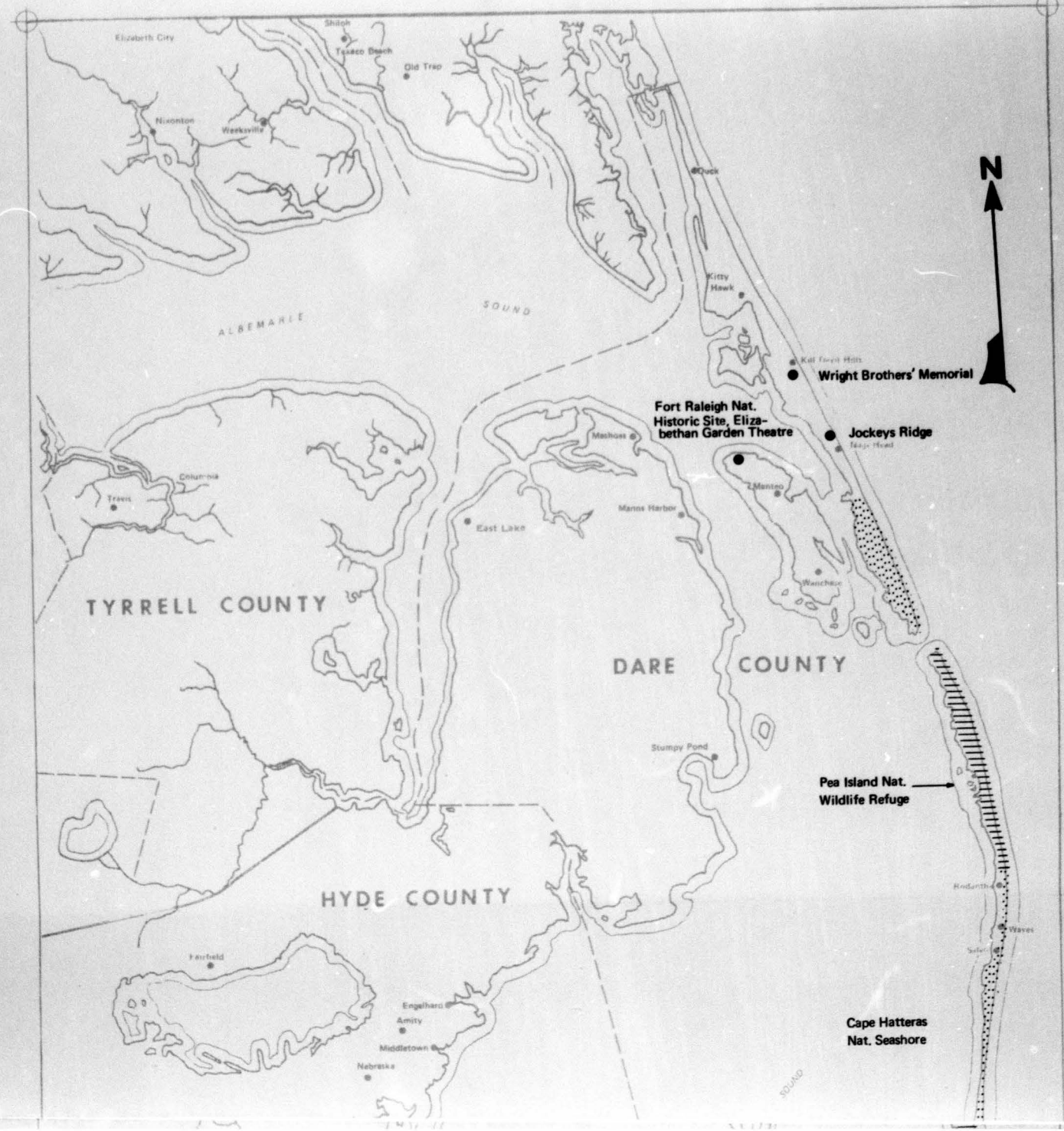
Source: Stevens Associates. "Economic Study of the Dare Beaches."

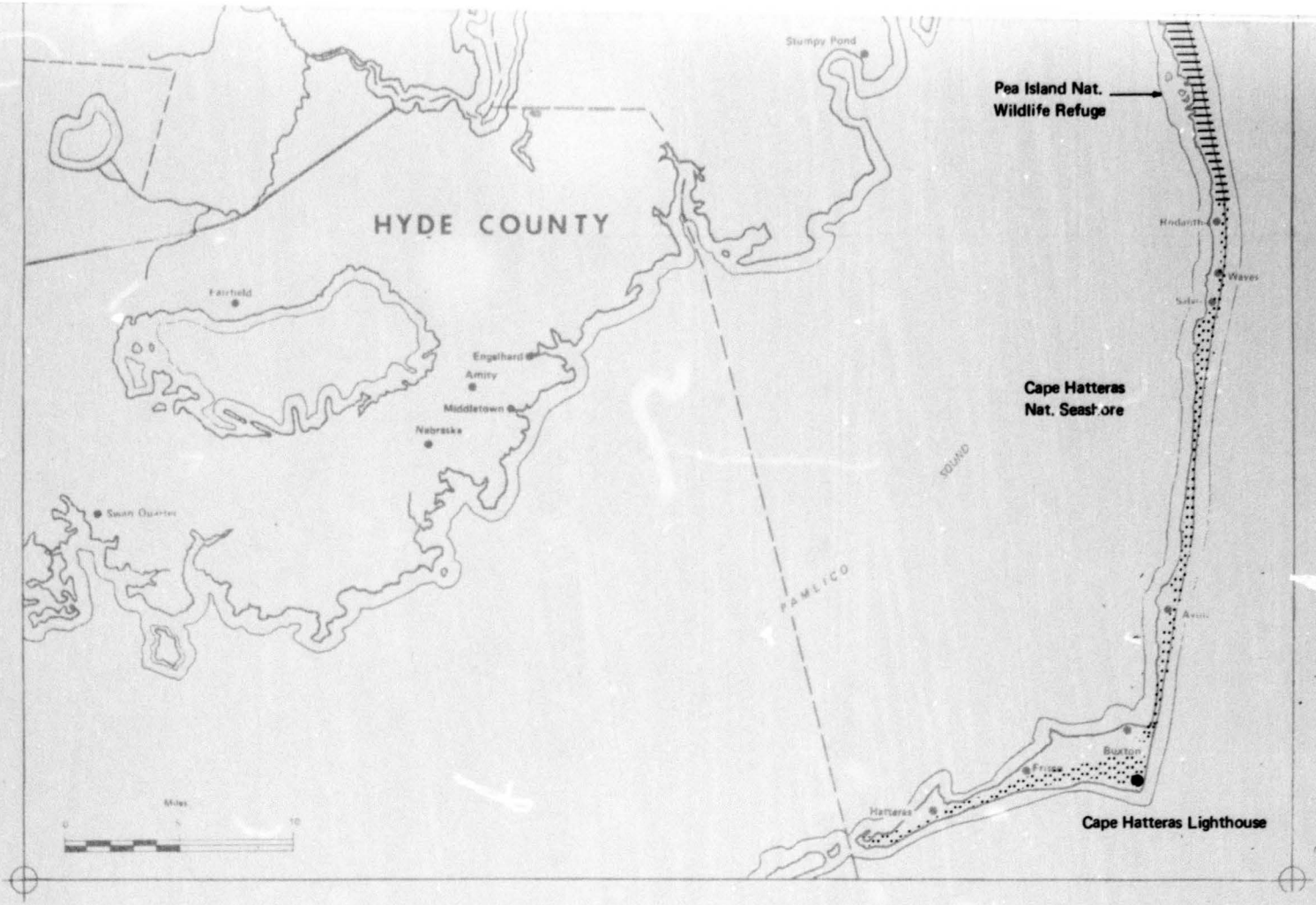
Table 3.3.4-D

1971 Employment in Dare and Surrounding Counties

	Total Employment	Manufacturing	% of Total	Non-Manufacturing	% of Total	Public Administration	% of Total	Agricultural	% of Total	Other	% of Total	Average Rate of Unemployment
Dare	3030	50	2	1570	52	460	15	20	4	930	31	5
Tyrrell	1100	170	15	280	25	220	20	270	25	160	15	8.3
Hyde	1530	130	8	340	22	270	18	510	33	280	18	11
Washington	3200	370	12	950	30	770	24	540	17	750	18	7.5

Source: North Carolina State Department of Employment Security, Research Department, Civilian Work Force - County Data, 1972.


Elizabeth City
Shiloh
Tessaco Beach
Old Trap
Nixonton
Weeksville
ALBEMARLE
SOUND
Duck
Kitty Hawk
Kill Devil Hills
Wright Brothers' Memorial
N
Fort Raleigh Nat. Historic Site, Elizabethan Garden Theatre
Jockeys Ridge
Nags Head
Mashoes
Manteo
Manns Harbor
East Lake
Columbia
Travis
Wanchese
TYRRELL COUNTY
DARE COUNTY
Stumpy Pond
Pea Island Nat. Wildlife Refuge
HYDE COUNTY
Rodanthe
Waves
Salvo
Fairfield
Engelhard
Amity
Middletown
Nebraska
Cape Hatteras Nat. Seashore
SOUND



Pea Island Nat. Wildlife Refuge

Cape Hatteras Nat. Seashore

FIGURE 3.3.4-A TOURIST ATTRACTIONS IN DARE COUNTY

On the Outer Banks tourists are attracted by the seashore. The 70 mile Cape Hatteras National Seashore has 5 camping areas, nature walks, and nighttime activities. The Cape Hatteras Lighthouse is the tallest lighthouse on the East Coast and open to the public. From Hatteras, visitors can take a ferry to Ocracoke Island. The Pea Island Wildlife Refuge attracts many wild fowl, including some geese, and attracts bird watchers from spring to autumn.

Along the coast there are the remains of some of the numerous ships wrecked on the Outer Banks over the years. Jocky Ridge at Nags Head is the highest sand dune on the U.S. coast. It is a popular climbing area and visitors can rent kites for sky surfing there. Kill Devil Hills was the site of the Wright brothers' first flight. The area is commemorated with a National Memorial and visitors' center.

Recreational activities typical of a tourist area are available on the Outer Banks. There are two 18-hole golf courses and numerous miniature golf courses. In addition, sport fishing - both surf casting and deep sea fishing are popular.

As a result of the tourists, the beaches along the coast (except for the National Seashore area) are lined with hotels, rental cottages, restaurants, and shops. The North Carolina Accommodations Directory lists 10 places to stay in Kitty Hawk, 26 in Kill Devil Hills, 61 in Nags Head, 10 in Buxton, and 7 in Hatteras. Manteo has 5 motels.

There are no tourist attractions on the mainland, but a few hotels house transients. In addition to the summer tourist industry, the area caters to sport fishermen in the fall and to hunters and inland fishermen. Hunting and inland fishing at one time represented a large percentage of the economy of mainland Dare County. Inland fishing has been declining over the past decade. Fishermen now tend to own motor boats and fish in the sounds. The decrease in hunting has occurred with the decrease in fur bearing animals, which has been mainly attributed to the increase in access in the marshes and swamps as a result of draining and building roads. This led to overhunting in the area. Draining the swamps also affected the natural habitat of some species. Bear hunting is now prohibited because of the declining bear population. [30]

3.3.4.1.3 Agriculture

Agricultural employment in Dare County has traditionally been small. The last 10 years it has never exceeded 30 people or about 2% of the work force. The total farm income in Dare County for 1971 was $97,000 of which $36,000 was from crops, $30,000 from livestock and $1,000 from government payments. [31] Farm tracts included 1,354 acres of which 279 were harvested cropland 100 acres improved pasture; the rest was in unimproved pasture, idle cropland, woods, waste, or homesites. Crops grown in Dare include corn, soybeans, sweet potatoes, and Irish potatoes.

3.3.4.1.4 Manufacturing

One concrete products manufacturing plant, located in the Outer Banks, which employs about 37 people, is responsible for almost all the manufacturing employment in the County. The only other significant factors in the economy not directly related to the tourist industry are public administration and the construction industry.

3.3.4.1.5 Property Tax Income in Dare and Hyde Counties

In 1973, Dare County collected $938,859.37 [32] in revenues including real and personal property taxes and various licensing fees. Table 3.3.4-F shows the sources of property taxes in the County for 1973.[32] Almost 95% of the property tax base was attributable to the Outer Banks area and Roanoke Island and only 5% was attributable to the mainland which contains the Range.

First Colony Farms, Inc., owns 177,135 acres of the 246,900 acres of land in Dare County. All its land ownership is on the mainland where it accounts for about 90% of the land ownership. As shown in Table 3.3.4-G, the land owned presently by First Colony Farms was taxed $22,208.72 in 1973.

Since the Dare County Range is not assessed separately, an exact figure for taxes attributable solely to the Range is not available. However, an estimate of $5,810 in taxes attributable to the Range for 1973 can be made, based on the acreage of the Range compared with the total acreage held by WESTVACO. The taxes attributable to the 302 acres of the Range in Hyde County in 1973 were approximately $110.

The taxes on the Range can be assumed to be approximately 1% of the total property taxes and 15% of the mainland property taxes in Dare County in 1973.

The property in Dare County was taxed at 70% valuation in 1973 and was taxed at 100% valuation in 1974. By 1975, Dare County plans a revaluation of the entire County which will result in higher valuation and taxes. [33]

3.3.4.2 Health Care Services

Currently Dare County has only one practicing physician who is located in Cape Hatteras. He has a general office practice. Outside the County the closest health care facilities are a health clinic in Columbia (38 miles from Manteo) and a 150 bed hospital in Elizabeth City (68 miles from Manteo).

Until the spring of 1974, there was a clinic in Manteo that was staffed by one permanent physician and several physicians who rotated from Columbia. This clinic was closed when the permanent physician moved out of the County; however, it is hoped that it will reopen as soon as possible.

Table 3.3.4-F

1973 Taxes, Dare County

Mainland	Total Valuation (Personal & Real)	Property Tax	Percent of Total Property Tax
East Lake	1,633,287	18,782.86	
Manns Harbor	1,121,322	12,895.34	
Mashoes	159,313	1,832.10	
Stumpy Point	451,480	5,192.11	
Total	$ 3,365,404	$ 38,702.41	5.4%
Outer Banks & Roanoke Island			
Avon	1,912,676	21,996.82	
Buxton	2,346,213	26,981.80	
Collington	2,482,336	28,550.23	
Frisco	1,353,504	15,565.83	
Hatteras	2,394,141	27,532.16	
Kill Devil Hills	11,493,433	132,178.43	
Kitty Hawk	10,707,900	123,143.14	
Manteo Inc.	2,166,643	24,916.61	
Manteo (Outside)	5,608,845	64,502.41	
Kill Devil Hills (Outside)	284,866	3,276.07	
Nags Head	13,761,957	158,265.19	
Rodanthe	1,021,702	11,749.77	
Wanchese	1,886,309	21,692.86	
Salvo	737,197	8,478.00	
Waves	434,235	4,993.17	
Total	58,591,950	673,823.09	94.6
TOTAL	$61,957,361	$712,525.50	100.0

Source: Dare County Tax Records 1973. Dare County Courthouse, Tax Assessor's Office, Dare County, North Carolina.

Table 3.3.4-G

1973 Taxes - WESTVACO
(Now Owned by First Colony Farms)

	Acres of Land	Assessed Value	Property Taxes
Manns Harbor	15,308.60	215,376	2,476.82
Stumpy Point	20,469.00	139,845	1,678.14
Mashoes	15,303.80	125,123	1,438.91
East Lake	126,055.03	1,444,731	16,614.41
	177,136.43	1,925,075	22,208.28

Source: Tax Assessor's Office, Dare County, North Carolina.

The shortage of health care services is a major problem for the County particularly during the summer months. Not only does the influx of 1-1/2 million visitors cause a heavy demand for the available services, but traffic makes traveling to Hatteras from other parts of the County quite time consuming. Therefore,many permanent residents in the Manteo and Dare beaches are routinely receiving their care from physicians in Columbia.

Dare County maintains an ambulance service with 6 vehicles operated by the Sheriff's office. The County recently acquired a helicopter which can be used to transport emergency patients to hospitals (by helicopter the trip to Elizabeth City takes approximately 18 minutes). Most of these patients are taken to Elizabeth City because it has a larger hospital with more facilities. During July 1974, the ambulance service made approximately 160 calls. [34]

3.3.4.3 Schools

Dare County has two elementary schools, one in Manteo and one in Kitty Hawk, a high school in Wanchese, and a combination elementary and high school in Hatteras. In 1972-73, 1614 pupils were enrolled in public schools in the County: 465 in Hatteras school, 505 in Manteo high school, 449 at Manteo elementary, and 195 in Kitty Hawk elementary.

All the schools except Kitty Hawk are presently at or over capacity and are expanding their current facilities through additions or use of temporary trailers. [35]

3.3.4.4 Utilities and Waste Disposal

3.3.4.4.1 Dare County Range

The Range uses no commercial utilities other than one telephone supplied by the Norfolk and Carolina Telephone and Telegraph Company, Elizabeth City, North Carolina. The Range generates its own electricity, has a well for its water supply, and has septic tanks for sewage disposal. Solid waste generated on the AF Range is taken to Manteo.

3.3.4.4.2 Dare County

The towns of Manteo, Kill Devil Hills, and Nags Head have centralized water systems. There is a non-public water company serving Hatteras, Buxton, and Avon. The remainder of Dare County, including all of the mainland, is served by individual wells. The Dare Beaches Water and Sewer Authority is in the planning process of a country-wide water system serving the beaches north of Oregon Inlet and Roanoke Island.

Manteo is the only town in Dare County with a municipal sewerage system. However, other private sewerage systems exist. "Ocean Acres" development in Kill Devil Hills has a 60,000 gallon system for its own subdivisions.

Both the Ramada Inn and Holiday Inn have their own systems. Sewage in all other parts of Dare County, including the mainland, is handled by individual septic tanks. The Dare Beaches Water and Sewer Authority is in the process of planning a sewerage system serving Dare Beaches and perhaps Roanoke Island.

Virginia Electric and Power Company provides electricity to the beach area north of Oregon Inlet and to the whole of Roanoke Island. Areas south of Oregon Inlet are supplied by the Cape Hatteras Electric Membership Corporation. North Carolina Power and Light Company supplies power to the mainland of Dare County.

A small amount of bottled gas is used for heating and cooking and is sold by private retail gas companies. Fuel oil, principally used for heating, is supplied by a number of small retail companies.

Telephone service is supplied to the County by Norfolk and Carolina Telephone and Telegraph Company.

3.3.5 HISTORY AND ARCHAEOLOGY

3.3.5.1 Regulations

The National Environmental Policy Act of 1969 (NEPA) establishes historical and archaeological preservation as a national environmental objective. The policy declaration specifies a "continuing responsibility of the federal government to use all practicable means, consistent with other essential considerations of national policy...to fulfill the responsibilities of each generation as a trustee of the environment for succeeding generations," and to "assure for all Americans...aesthetically and culturally pleasing surroundings," and to "preserve important historic, cultural, and natural aspects of our national heritage..." [36].

The requirements of NEPA are both substantive and procedural. They require the decision-maker to discover and articulate in advance the consequences of the proposed action in relation to historical and archaeological impacts. NEPA is broad in that it mandates consideration of all important historic and archaeological sites.

The National Historic Preservation Act of 1966 established policy guidance and mechanisms for efforts toward historic preservation and protection from governmental depredation. In its substantive provisions the Historic Preservation Act provides for the maintenance by the Secretary of the Interior of an expanded national register of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture [37], this document has become known as the National Register of Historic Places. Under the Act, if a federal agency has direct or indirect jurisdiction over a proposed federal, federally assisted, or federally licensed undertaking that would affect any property listed on the National Register, the head of that

agency has two responsibilities under Section 106 before approving the project. The agency must "take into account the effect of the undertaking" on the National Register Property and "shall afford the Advisory Council on Historic Preservation...reasonable opportunity to comment with regard to such undertaking." [37]

Executive Order No. 11593 issued in the furtherance of the purposes and policies of NEPA and the National Historic Preservation Act of 1966 requires all federal agencies to locate and nominate to the Secretary of the Interior, all sites which appear to qualify for listing on the National Register of Historic Places (Section 2(a)). It further requires that the head of the agency refer any questionable sites to the Secretary of the Interior for his opinion respecting their eligibility for listing (Section 2(b)). After the nomination of listings, if the agency proposes to alter substantially the property in question, it should not act with respect to the property until the Advisory Council on Historical Preservation (Department of the Interior) has an opportunity to comment.

Compliance with NEPA, however, does not constitute compliance with Executive Order No. 11593 and the National Historic Preservation Act. [38] The procedure and substance of these laws must be complied with independently.

3.3.5.2 Historical Sites

The Dare County Range is located in southern mainland Dare County, an area which by virtue of its low-lying topography and relative isolation has been bypassed by most major historical events of the region. Consultation with the Historical Section, Department of Cultural Affairs, North Carolina, revealed no known historical properties within the project area. [62] The National Register of Historic Places, 1972, designates two properties in Dare County protected under the National Historic Preservation Act of 1966; neither property is located on or near the Bomb Range.

The first historic property is the Fort Raleigh Historic Site, an area of 159.66 acres located four miles south of Manteo, Roanoke Island on U.S. 158. This property marks the site of the first English settlement in the New World. The second historic property is the Wright Brothers National Memorial located on 425.4 acres in Kitty Hawk, on the Outer Banks. This site commemorates the first attempts at flight by the Wright Brothers in 1903. No historic properties have been registered for either Hyde or Tyrrell Counties.

Despite the lack of historic properties within the area of the project site, Dare County is replete with history most of which is centered on Roanoke Island and the Outer Banks. Roanoke Island was discovered in 1584 by Sir Walter Raleigh who chose it as a site for future settlement. At this time, the area was inhabited by two Indian tribes, the Roanokes and the Croatans who eventually migrated inland with the arrival of the

English. The first colony was established in 1585, but lasted less than a year. Failure was due to trouble with the Indians and general hardship. In 1587, a second group of 112 Englishmen founded the first permanent colony. The colony was isolated from England until 1591, due to the war with Spain, by which time the inhabitants had disappeared, thus the name "Lost Colony." The only clue to their disappearance was the word "Croatan" carved on a tree.

Settlement of this area was abandoned until about eighty years later in 1669, when the island was used for raising cattle. The first permanent residents followed, being a diverse group including stockmen, pilots or boatmen to guide ships through the ever changing inlets, and those seeking isolation. Later, the conditions of the area fostered livelihoods based on scavenging the numerous shipwrecks which occurred along the Outer Banks to producing oil from the whales washed up onto these shores.

Other historical events included the exploits of Edward Teach (Blackbeard the Pirate) in the early 1770's, the foraging raids by British soldiers during the Revolutionary War to acquire beef, the battle over Roanoke Island for control of the sound area of North Carolina during the Civil War, to the first successful attempts at flight by the Wright Brothers at Kitty Hawk.

3.3.5.3 Archaeological Sites

Consultation with the Archaeology Section, Department of Cultural Affairs, North Carolina, revealed no known archaeological sites within the area of the Range. To date, no archaeological surveys have been performed within the region. If any archaeological features do exist within the Range, they may be hampered from discovery by the peat bogs which cover the area. [62]

4.0 IMPACT ON DARE COUNTY RANGE

In this section we will discuss the impact of the fee acquisition of the Dare County Range by the Air Force. Since this implies continued use of the area as a training range, the environmental impact of the use is also discussed. The proposed fee acquisition will have an impact primarily on the economy and on future land use in the area. Most of the other impacts discussed in this section will result from continued use of the area as a training range. Impacts of known proposed changes in range operations will be discussed in Section 5.0.

4.1 PHYSICAL ENVIRONMENT

4.1.1 ATMOSPHERIC REGIME

4.1.1.1 Analysis Methodology

4.1.1.1.1 Aircraft Emissions

Aircraft flight operations are the principal source of air pollutants at the Dare County Range. Five classes of pollutants are emitted in the exhaust jets from operating aircraft:

(1) Carbon Monoxide (CO)
(2) Hydrocarbons (HC)
(3) Nitrogen Oxides (NOx)
(4) Sulfur Oxides (SOx)
(5) Suspended Particulates (SP)

CO, NOx, SO_x, and SP emissions are classified as pollutants because of potential effects of these materials on public health and welfare. HC emissions have no direct effects on health or welfare but are precursors to a sixth pollutant class--total oxidants--which is formed in the atmosphere and which is detrimental to health and welfare.

4.1.1.1.2 Air Quality Regulations

The body of federal law which provides for prevention and control of air pollution is called the Clean Air Act and includes the following specific acts and amendments:

1. Clean Air Act of 1963 (P.L. 88-206);
2. Motor Vehicle Air Pollution Control Act (P.L. 89-272, 1965);
3. Clean Air Act Amendments of 1966 (P.L. 89-675);
4. Air Quality Act of 1967 (P.L. 90-148);
5. Clean Air Amendments of 1970 (P.L. 91-604).

Through this Act, the federal government has embarked upon a vigorous and comprehensive program to maintain acceptable air quality in the United States and to control the emission of pollutants from sources which affect air quality.

The Act required the Administrator of the Environmental Protection Agency to issue standards for ambient air quality. Standards were issued in April 1971 for six pollutants and are listed in Table 4.1.1-A. The standards include primary standards which are intended to protect public health and secondary standards which are intended to protect public welfare (primarily property). In the judgment of the EPA Administrator, the primary standards are requisite to protect the public health with allowance for an adequate margin of safety, and the secondary standards are requisite to protect the public welfare from any known or anticipated effects associated with the presence of air pollutants in the ambient air.

The EPA Administrator also has issued standards for the control of pollutant emissions from certain types of sources. As of this time, standards have been issued for mobile sources, including automobiles, trucks, and aircraft, and for stationary sources including steam-generating plants and a variety of industrial processes. These standards prescribe maximum allowable emission rates of specific pollutants from these sources and time limits for the implementation of the standards.

The Act also requires each state to institute an air quality control program and to issue a State Implementation Plan defining measures to be taken by the state to achieve the ambient air quality standards within the state. These measures include monitoring of air quality within the state, maintaining inventories of emission sources within the state, and prescribing emission control measures, in addition to the federal controls, which are necessary to achieve air quality levels which meet the standards.

4.1.1.2 Analysis Procedure

The process employed to relate air quality in a locality to the emissions from sources which affect that locality is referred to as "dispersion analysis." A variety of dispersion analysis methods have been developed which predict the distribution of pollutants from emission sources taking into account the effects of the source characteristics and meteorological conditions. For a simple pollutant source, a simple analysis method can be used. Complex arrays of sources require that relatively complex dispersion analysis methods be used to obtain valid indications of the impact of the sources.

4.1.1.3 Air Quality Analysis

4.1.1.3.1 Dispersion Model

In conducting an air quality analysis for a specific emission source it is appropriate to begin with a simplified analysis procedure which will provide an approximate measure of the impact of the source with a minimum effort. This approach is desirable when the impact of the source is judged to be small. In the case of the Dare County Range, the impact of the aircraft emissions is expected to be small because of three factors:

Table 4.1.1-A

National Ambient Air Quality Standards

POLLUTANT	STANDARD DESCRIPTION
Carbon Monoxide (primary and secondary standards are the same)	- 10 milligrams per cubic meter (9 ppm), maximum 8-hour concentration not to be exceeded more than once per year. - 40 milligrams per cubic meter (35 ppm), maximum 1-hour concentration not to be exceeded more than once per year
Nitrogen Dioxide* (Primary and secondary standards are the same)	- 100 micrograms per cubic meter (0.05 ppm), annual arithmetic mean.
Hydrocarbons (Non-methane) (Primary and secondary standards are the same)	- 160 micrograms per cubic meter (0.24 ppm), maximum 3-hour concentration (6-9 a.m.) not to be exceeded more than once per year. For use as a guide in devising implementation plans to meet the oxidant standards.
Particulate matter	
Primary Standard	- 75 micrograms per cubic meter, annual geometric mean. - 260 micrograms per cubic meter, maximum 24-hour concentration not to be exceeded more than once per year.
Secondary Standard	- 60 micrograms per cubic meter, annual geometric mean, as a guide to be used in assessing implementation plans to achieve the 24-hour standard. - 150 micrograms per cubic meter, maximum 24-hour concentration not to be exceeded more than once per year.

*The measurement method specified in the NO_2 standard is being revised. However, changes in the standard will not affect the maximum allowable concentration.

Table 4.1.1-A (Continued)

POLLUTANT	STANDARD DESCRIPTION
Sulfur Dioxide Primary Standard	- 80 micrograms per cubic meter (0.03 ppm), annual arithmetic mean. - 365 micrograms per cubic meter (0.14 ppm), maximum, 24-hr concentration not to be
Secondary Standard	- 1300 micrograms per cubic meter (0.5 ppm) maximum 3-hour concentration not to be exceeded more than once per year.
Photochemical Oxidants (Primary and secondary standards are the same)	- 160 micrograms per cubic meter (0.08 ppm) maximum 1-hour concentration, not to be exceeded more than once per year.

(1) There are no aircraft ground operations on the Range except for limited helicopter operations.

(2) There are no other significant sources of pollutants either within the Range or in the immediate surroundings.

(3) The nearest populated areas which could be affected by pollutant emissions from the Range are at a considerable distance from the Range.

Because of these factors, a simplified analysis has been conducted and the results are sufficient to demonstrate that the impact of the aircraft emissions at the Range is negligible. Therefore, no detailed analysis was undertaken.

The model is based upon events occurring within an atmospheric box as depicted in Figure 4.1.1-A. The box is defined to contain the average flight path used by the aircraft in their practice bombing runs. All emissions from the aircraft are assumed to originate within the box.

The maximum concentration of pollutants will exist at the downwind face of the box, and the average concentration at this face is equal to the mass rate of emission within the box divided by the volumetric rate of air flow through the box. This ratio can be written as:

$$\overline{X_i} = M_i / U_w \, y \, z$$

where

$\overline{X_i}$ = average mass concentration of pollutant i at the downwind face of the box

M_i = average rate of emission of pollutant i within the box

U_w = mean wind speed

y = box width

z = box height

The emission rate within the box can be expressed in terms of the flight activity within the box and the emission characteristics of the aircraft engine:

$$M_i = \frac{nl}{U_a} m_f E_i$$

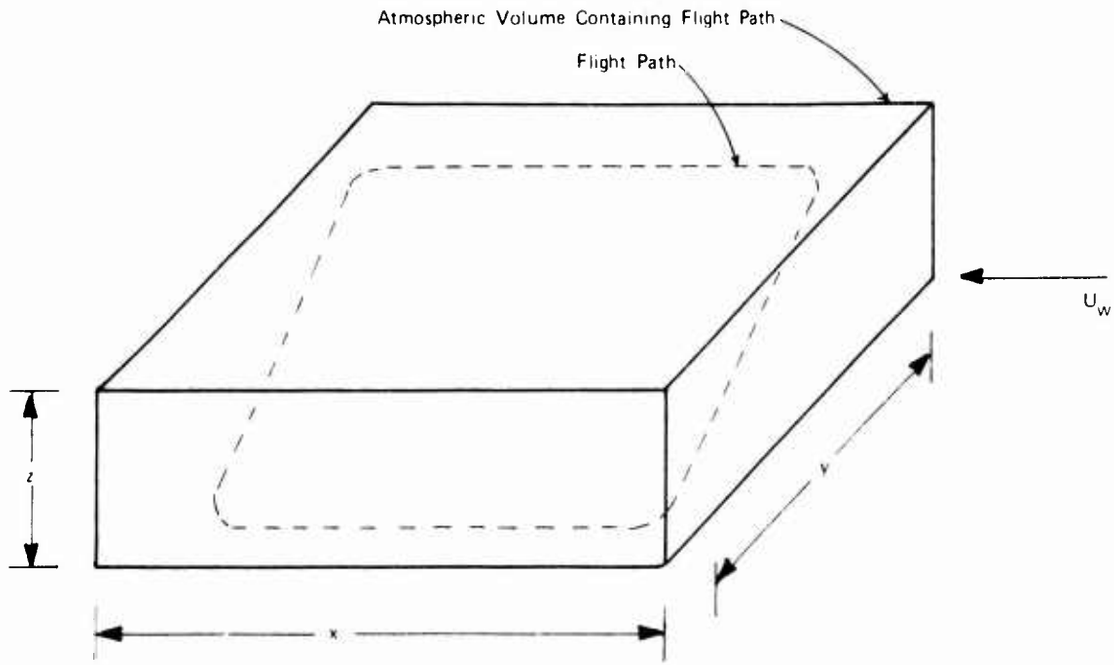


FIGURE 4.1.1-A DISPERSION MODEL USED IN AIR QUALITY ANALYSIS

where

n = number of sorties occurring within the box per unit time

l = sortie path length

U_a = average aircraft flight speed

m_f = aircraft fuel consumption rate

E_i = emission index for pollutant i (ratio of mass of pollutant emitted to mass of fuel consumed)

Using appropriate values of the variables in the model, the model has been used to calculate annual average and short-term (1 hour to 24 hour) average pollutant concentrations which result from aircraft operations at the Range. These calculated concentrations can be compared to federal air quality standards to evaluate the impact of the aircraft emissions.

4.1.1.3.2 Model Input Data

The input data used in the dispersion model are discussed below.

Wind speed (U_w). A mean annual wind speed of 19,000 meters per hour (11.8 mph) was used as this is the mean wind speed reported for Cape Hatteras. A short-term wind speed of 1600 meters per hour (1 mph) was used.

Box width (y). A box width of 3200 meters (2 miles) was used since that is a typical length of the crosswing leg of the training flight paths.

Box height (z). A box height of 800 meters (2500 ft) was used since this is the maximum altitude attained in the low-level and training flight paths.

Number of sorties (n). An annual average sortie rate of 4.9 per hour (43,000 per year) was used since this is the rate reported for the Air Force Dare Range. The short-term sortie rate used was 80 per hour which is the maximum frequency of aircraft operations during periods of intensive use of the range.

Sortie path length (l). A path length of 13,000 meters (8 miles) was used since this is the approximate length of the training flight paths which are flown over the Air Force Range.

Aircraft flight speed (U_a). An average flight speed of 8.0×10^5 meters per hour (500 mph) was used.

Fuel consumption rate (M_f). A fuel rate of 7300 kilograms per hour was used since this is the reported rate for an F-4 aircraft operating at full military power.

Pollutant emission indices (E_i). Emission indices used are those reported for the J-79 engine operating at military power. These values are as follows:

Pollutant	CO	HC	NOx	SOx	SP
Emission Index (gr/kg)	1.9	0.5	11.4	0.4	1.3

The use of the above input data is equivalent to assuming that all sorties over the Range are flown at low altitude by F-4 aircraft at full military power. These assumptions are conservative in that the emissions from F-4 aircraft are higher than the average emissions from the aircraft which actually use the Range. The assumption of low-level flight and full-power operation also are conservative.

4.1.1.4 Analysis Results

Pollutant concentrations at the downwind boundary of the Range, as determined with the box model, are listed in Table 4.1.1-B along with the maximum allowable concentrations specified by the federal air quality standards. It can be seen from the table that both the annual average and short-term calculated pollutant concentrations are less than the standards by factors ranging from 50 for the short-term particulate standard to 16,000 for the annual sulfur dioxide standard. These results were obtained with a simple but valid model and with several conservative approximations. It can be concluded, therefore, that the air quality impact of the aircraft operations at the Range is negligible both in the immediate vicinity of the Range and in the surrounding areas. No further analysis of air quality impact is considered necessary.

4.1.2 NOISE

4.1.2.1 Noise Due to Aircraft Operations - Background

In the last several years, there has been a continued development of a variety of measures and criteria for environmental noise due to aircraft operations. As a result, there has developed a considerable amount of confusion relative to such noise measures and criteria, their relationship to each other, and their applicability, interpretation, and use in land use planning and environmental impact studies. To aid in the proper understanding of this situation, this section includes a short summary of the characteristics of several aircraft noise measures of interest and the methods currently used to evaluate the noise impact upon the surrounding area.

4.1.2.1.1 The Measures of Single Noise Events or Sources

The most basic measure of a single noise event is in terms of sound pressure level (SPL), in decibels (dB). This measure is based on equal weighting of all audible frequencies making up the noise signal. Since the ear is not equally sensitive over this audible frequency range, however, the SPL measure is not a good indicator of the subjective loudness level of

Table 4.1.1-B

Maximum Air Pollutant Concentrations at Dare County Range
(Concentrations in Micrograms per Cubic Meter)

	Annual Average		Short Term	
Pollutant	Calculated	Federal Standard	Calculated	Federal Standard
CO	0.02	none	4.4	10,000 (8-hr average)
HC	0.006	none	1.2	160 (3-hr average)
NO_x	0.14	100	26	none
SO_x	0.005	80	0.9	365 (24-hr average)
SP	0.016	60	3.0	150 (24-hr average)

a noise signal. To account for this, various modifications of the SPL, incorporating frequency weighting characteristics based on well-established criteria for subjective loudness properties of noise signals, have been developed and are widely used. The most commonly used is the so-called "A-weighted" sound level, expressed in dBA. A-weighted sound levels are widely applied as a measure of a variety of transportation, industrial, and community noise sources. Some typical values of sound levels in dBA are shown in Table 4.1.2-A.

Psychoacoustic studies carried out in the early 1960's, particularly by Kryter [45], concluded that the frequency weighting used for subjective loudness measures were not adequate as measures of subjective annoyance to aircraft noise. These studies which were carried out shortly after the introduction of a jet-powered aircraft into commercial service, investigated the apparent higher level of annoyance associated with jet aircraft as compared with that of propeller-driven aircraft having the same overall SPL or the same loudness level. Kryter found that the differences in the spectral distribution of jet aircraft noise (generally more noise in the higher frequency region) relative to propeller-driven aircraft noise resulted in a higher annoyance to most of the people tested in his studies. To correlate this relationship more properly, Kryter developed the concept of Perceived Noise Level (PNL), a single-number noise measure, for a prescribed noise event such as an aircraft flyover. The PNL is characterized by both the absolute sound pressure levels of the noise event, and by the spectrum (i.e., frequency content) of the noise. This information is converted into a perceived noisiness by the use of annoyance criteria which have been developed experimentally. Thus, the PNL, in terms of Perceived Noise Decibels (PNdB) is a calculated measure relating the physical levels of noise and judgments of the subjective annoynace associated with the noise.

Subsequently, a refinement of the PNL measure was introduced to include the effects of the duration of the noise (above some threshold value) and a correction for the presence of strong pure-tone components in the noise signal. The reasons for these refinements to the more basic PNL were that further experiments indicated that the subjective reaction (annoyance) to aircraft noise was dependent upon both the maximum level and the duration of the single event time-history, and that the pure tone (whine) resulting from the front compressor of turbofan engines was both of high intensity and of particular annoyance. This modified measure was termed the Effective Perceived Noise Level (EPNL) and is expressed in terms of Effective Perceived Noise Decibels (EPNdB). Thus, both the PNL and EPNL measure contain objective and subjective noise factors, and both are evaluations of a single noise event.

4.1.2.1.2 Noise Environment Descriptors

In addition to the measure of the single noise event, the descriptor of the overall noise environment requires the number and distribution of these occurrences during some specified period of time. For discrete measures, such as aircraft operations, a 24-hour period is used, leading to the formulation of a daily noise environment descriptor. For general

Table 4.1.2-A [43,44]

Sound Level and Loudness of Typical Noises in Indoor and Outdoor Environments
(noise levels given in dBA)

dB(A) Ref. 0.0002 μbar	SUBJECTIVE IMPRESSION	COMMUNITY (Outdoor)	HOME OR INDUSTRY (Indoor)	RELATIVE LOUDNESS (Human Judgment of Different Sound Levels)
130		Military Jet Aircraft Take-Off With After-Burner @ 50 ft (130)	Oxygen Torch (121)	32 Times as Loud
120	Uncomfortably Loud			
110		Turbo-Fan Aircraft @ Take-Off Power @ 200 ft (118)	Riveting Machine (110) Rock-N-Roll Band (108-114)	16 Times as Loud
100	Very Loud	Jet Flyover @ 1000 ft (103) Boeing 707, DC-8 @6080 ft Before Landing (106)	Pile Driver @ 50 ft (101)	8 Times as Loud
90		Power Mower (96) Boeing 737, DC-9 @ 6080 ft Before Landing (97), Motorcycle @ 25 ft (90)	Newspaper Press (97), Inside Subway Train - NY (95)	4 Times as Loud
80		Car Wash @ 20 ft (89), Prop. Plane Flyover @ 1000 ft.(88), Diesel Truck, 40 mph @ 30 ft (84), Diesel Train, 45 mph @ 100 ft (83)	Food Blender (88), Milling Machine (85), Garbage Disposal (80), Symphony Orchestra (Audience)(80)	2 Times as Loud
70	Moderately Loud	High Urban Ambient Sound (80), Passenger Car, 65 mph @ 25 ft (77), Freeway @ 50 ft from Pavement Edge, 10 a.m. (76 ± 6)	Living Room Music (76), TV-Audio, Vacuum Cleaner (70)	REFERENCE LOUDNESS 70 dBA
60		Air Conditioning Unit @ 100 ft (60)	Cash Register @ 10 ft (65-70), Electric Typewriter @ 10 ft (64) Dishwasher (Rinse) @ 10 ft (60), Conversation (60)	1/2 as Loud
50	Quiet	Large Transformers @ 100 ft (50)	Typical Business Office (55)	1/4 as Loud
40		Bird Calls (44), Lower Urban Ambient Sound(40)		1/8 as Loud

fluctuating community or environmental noise sources, such as more-or-less continuous lines of traffic, or ambient noise levels in remote areas, a statistical descriptor would be more appropriate.

In the latter case, the distribution of sound levels in dBA is obtained by recording the levels continuously over a relatively long period of time (i.e., long enough to satisfy statistical sampling considerations) and the noise environment is then described in terms of a medium sound level, L_{50}, together with a standard deviation from this value; or in terms of L_{10}, L_{50}, and L_{90}, defined as the noise level values exceeded 10, 50, and 90 percent of the time, respectively; or in terms of the equivalent energy value, L_{eq}, which has recently been adopted by the EPA as the applicable environmental noise descriptor [5]; or in terms of the Noise Pollution Level, as defined as L_{eq} plus a factor times the standard deviation of the sound level.

Of more immediate interest are the descriptors that have been developed and used for the discrete events of aircraft operations. Many such composite descriptors of daily noise exposure levels have been developed. Two of particular interest, because of their use in the United States for military applications are the Composite Noise Rating (CNR) and the Noise Exposure Forecast (NEF), both developed by Bolt, Beranek, and Newman, Inc. [46] These composite noise descriptors are obtained, respectively, from the PNL and EPNL values for the individual aircraft events, and correction factors are applied for the number of such events occurring within certain specified times during a 24-hour period. Weighting factors are utilized for the operations occurring during time periods to account for the increased sensitivity to noise in the evening or nighttime hours.

Calculations of these composite levels in terms of their corresponding single-event measure are as follows:

$$CNR = PNL + 10 \log (N_D + 16.7\ N_N) - 13$$

$$NEF = EPNL + 10 \log (N_D + 16.7\ N_N) - 88$$

where

N_D = number of flights during the day (0700 - 2200)

N_N = number of flights during the night (2200 - 0700)

The calculations are seen to be quite similar; the principal difference being the specific noise measure used for individual aircraft noise intrusions. Note also that the summation of the noise events is on a "10 log N," or energy basis. These characteristics have been suggested by evidence obtained from psychoacoustic experimental studies.[46,47]

The Environmental Protection Agency, under authority granted by Congress under the Noise Control Act of 1972, has developed a recently published criteria and levels on environmental noise.[46] This study by the EPA included an evaluation of the various noise exposure descriptors currently in use and subsequently the selection of an "equivalent sound level," L_{eq}, and a "weighted equivalent sound level" L_{dn} as the most

appropriate measures of environmental noise exposure for interference and annoyance for indoor and outdoor activities. The basic single-event noise level in these measures is also the A-weighted sound level. The descriptors L_{eq} and L_{dn} are in fact long-term average values of the A-weighted sound level, calculated on an energy basis.

In this case, the formulation becomes

$$L_{dn} = 10 \log \frac{1}{24} \left[15 \left(10^{Ld/10}\right) \quad 9 \left(10^{\left[\frac{Ln + 10}{10}\right]}\right) \right]$$

where

L_d = L_{eq} for the daytime (0700 - 2200)

L_n = L_{eq} for the nighttime (2200 - 0700)

Here a 10 dB nighttime weighting is used on the nighttime equivalent sound level. Note that in this formulation, the single-event measure does not appear directly, but is included in the energy-summed values of L_{eq}.

The relationships between the single event noise measures (PNL, EPNL, dBA) vary with aircraft type, type of operation, and with the measurement distance from the aircraft. As a consequence, the correlations among the noise exposure descriptors will vary with the specific airport situations. Approximate correlations can, however, be established assuming average mixes of aircraft types and operations schedules. Following such a procedure for a range of airport situations has led to the approximate equivalences shown in Table 4.1.2-B. (The significance of values chosen is discussed in Section 4.1.2.1.4.)

Table 4.1.2-B

Approximate Equivalence of Noise Exposure Descriptors

NEF (dB)	L_{dn} (dB)	CNR (dB)
30	65	100
40	75	115

4.1.2.1.3 Noise Exposure Calculations

The basic noise data obtained experimentally for each aircraft operation of interest are presented in terms of noise level as a function of distance from the aircraft. Using this basic information, both the single-event noise measures and the overall noise exposure descriptors can be evaluated, for a given set of conditions, at any point or site of interest. Generally,

for most airport situations, a series of contours is developed, each contour delineating zones or areas around the airport which are above or below prescribed values of the noise exposure descriptor of interest. The methodology for the development of these contours is straightforward, but lengthy in cases in which there are several types of aircraft and a variety of flight paths and patterns to consider. For application to the Dare County Range, it has been more expedient to calculate the magnitude of the noise exposure descriptor at a few selected points where the noise levels are clearly the most intense.

The noise exposure levels developed in this manner are useful as guides in land use planning and zoning, and in the assessment of the environmental impact of proposed changes in the airport activities.

The depiction of noise exposure in this manner has its limitations, however, since many variable factors are inherent in the prediction of the basic single-event noise measure itself, and in the assumptions of flight profiles, and meteorological conditions. On the basis of the assumption normally utilized in such forecast descriptors, noise exposure values are generally considered to have a variability of as much as $\pm$ 5 dB.

4.1.2.1.4 The Interpretation and Use of Noise Exposure Data

Empirical relationships have been developed between various levels of noise exposure and expected levels of community response. These relationships have been evolved from an accumulation of case histories involving aircraft noise complaints near civil and military airports and from psychoacoustic studies. The relationships derived for the NEF methodology are shown in Table 4.1.2-C.

In addition to the assessment of community response in terms of noise exposure levels, guides for evaluating the probable impact of aircraft operations for various categories of land use have been concurrently developed for the CNR [47] and NEF [46] methodologies. These developments have been based upon the noise complaint case histories, together with information on speech interference criteria, subjective tests on noise acceptability, and on noise insulation provided by typical building construction methods.

In these guides, different considerations are given precedence for the differing land uses. For example, in determining the effects of noise upon residential land use, case history experience, annoyance judgments, sleep sensitivity, speech communication criteria, and the need for freedom from noise intrusions would be important; for concert halls, the need for freedom from noise intrusion is probably the most important criterion.

Table 4.1.2-C

Expected Response of Residential Communities to
Noise Exposure Forecast Zones

Noise Exposure Forecast (dB)	Zone	Description of Expected Response
Less than 30	A	Some noise complaints are possible and noise may interfere with some activities.
30 to 40	B	Individual reaction may include vigorous repeated complaints, and concerted group action is also a possibility. Construction of homes, schools, churches, etc., should not be undertaken without a complete analysis of the situation.
Over 40	C	Serious noise problems are likely. No activity, nor building construction of any sort, should be carried on without a complete analysis of the situation.

Figure 4.1.2-A and Table 4.1.2-D present the interpretations of land use compatibility with respect to NEF values for generalized land uses--residential, educational, public, commercial, industrial, and agricultural (or open). In this figure and table, the compatibility interpretation for the lowest NEF values has the notation "satisfactory with no special noise insulation requirements required for new construction," indicating that there should be no adverse effects from aircraft noise. The interpretations at higher levels of noise exposure generally define a range in which new construction or development should not be undertaken unless needed noise insulation features are included in the building design and site development. For more extreme noise exposure, many of the land uses are assigned an interpretation which says that the new construction or development should not be undertaken.

The land use categories encompass a rather wide range of human activities having varying sensitivities to noise intrusions. Hence the interpretations should be taken as guides, not as absolute criteria applicable to all activities or sites falling into a given classification. In application to a specific site, some adjustments in boundaries or interpretations may be desirable. Typical influences to consider include:

- Previous community experience, and previous complaint history in the immediate neighborhood.

- Influence of the existing noise environment due to industrial or surface transportation noise sources. For example, the introduction of aircraft noise in a rural area where existing background noise levels are very low would produce a much more apparent change in noise environment, and likely more pronounced reaction from residents, than would aircraft noise introduced in a dense urban area long exposed to traffic noise.

- Time period of land use activities. The basic NEF values consider both daytime and nighttime operations, with a heavy weighting factor applied for nighttime operation. Such considerations are particularly appropriate for residential land planning but may lead to over-estimation of NEF values for activities which are confined to daytime hours only, such as schools.

The NEF values for noise compatibility interpretation boundaries in Figure 4.1.2-A are based upon the type of building construction which would normally be used where aircraft noise is of no concern. Thus, the land use compatibility ratings for schools assume building construction involving single glazing in classrooms. Special noise abatement considerations incorporating double glazing or elimination of windows entirely for example, have not been considered. Obviously, for many buildings, added noise insulation can be provided during construction.

LAND USE CATEGORY	NOISE SENSITIVITY CODE[1]	LAND USE AND COMMUNITY RESPONSE INTERPRETATIONS[2] NOISE EXPOSURE FORECAST VALUE (20 25 30 35 40 45 50 55)
RESIDENTIAL - SINGLE AND TWO FAMILY HOMES, MOBILE HOMES	1	A, I; B, II; C, II; C, III
RESIDENTIAL - MULTIPLE FAMILY APARTMENTS, DORMITORIES, GROUP QUARTERS, ORPHANAGES, RETIREMENT, HOMES, ETC.	2	A, I; D, II; B, II; C, III
TRANSIENT LODGING - HOTELS, MOTELS	3	A; D; E
SCHOOL CLASSROOMS, LIBRARIES, CHURCHES, HOSPITALS, NURSING HOMES, ETC.	1	A; D; C
AUDITORIUMS, CONCERT HALLS, OUTDOOR AMPHITHEATERS, MUSIC SHELLS	1	F; C
SPORTS ARENAS, OUT-OF-DOOR SPECTATOR SPORTS	3	F; C
PLAYGROUNDS, NEIGHBORHOOD PARKS	3	A; B; C
GOLF COURSES, RIDING STABLES, WATER-BASED RECREATIONAL AREAS, CEMETERIES	4	A; B; C
OFFICE BUILDINGS, PERSONAL, BUSINESS AND PROFESSIONAL SERVICES	3	A; D; B; E
COMMERCIAL - RETAIL, MOVIE THEATERS, RESTAURANTS	3	A; D; E
COMMERCIAL - WHOLESALE & SOME RETAIL, INDUSTRIAL/MANUFACTURING, TRANSPORTATION, COMMUNICATIONS & UTILITIES	5	A; D; E
MANUFACTURING - NOISE SENSITIVE COMMUNICATIONS - NOISE SENSITIVE	3	A; D; F
LIVESTOCK FARMING, ANIMAL BREEDING	4	A; G; C
AGRICULTURE (EXCEPT LIVESTOCK FARMING), MINING, FISHING	5	A

Notes: 1. Relative ranking of land uses with respect to noise sensitivity.

Noise Sensitivity Code	Approximate Noise Exposure Forecast Value where New Construction or Development is not Desirable
1	30
2	35
3	40
4	45
5	50-55

2. Interpretations are listed in Table 3.3.3-C.

Source: 46

Figure 4.1.2-A NOISE COMPATIBILITY INTERPRETATION

Table 4.1.2-D

Noise Compatibility Interpretations for Use with Figure 4.1.2-A

General Land Use Recommendations*

A. Satisfactory, with no special noise insulation requirements for new construction.

B. New construction or development should generally be avoided except as possible infill of already developed areas. In such cases, a detailed analysis of noise reduction requirements should be made, and needed noise insulation features should be included in the building design.

C. New construction or development should not be undertaken.

D. New construction or development should not be undertaken unless a detailed analysis of noise reduction requirements is made and needed noise insulation features included in the design.

E. New construction or development should not be undertaken unless directly related to airport-related activities or services. Conventional construction will generally be inadequate and special noise insulation features must be included. A detailed analysis of noise reduction requirements should be made and needed noise insulation features included in the construction or development.

F. A detailed analysis of the noise environment, considering noise from all urban and transportation sources should be made and needed noise insulation features and/or special requirements for the sound reinforcement systems should be included in the basic design.

G. New development should generally be avoided except as possible expansion of already developed areas.

Community Response Predictions**

I. Some noise complaints may occur, and noise may, occasionally, interfere with some activities.

II. In developed areas, individuals may complain, perhaps vigorously, and group action is possible.

III. In developed areas, repeated vigorous complaints and concerted group action might be expected.

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*Land use recommendations are based upon experience and judgmental factors without regard to specific variations in construction (such as air conditioning and building insulation) or in other physical conditions (such as the terrain and the atmosphere). These features and others involving social, economic, and political conditions must be considered in recommending individual use and density construction combinations in specific locations.

**Community response predictions are generalizations based upon experience resulting from the evolutionary development of various national and international noise exposure units in particular, the Composite Noise Rating (CNR). For specific locations, considerations must also be given to the background noise levels and the social, economic, and political conditions that exist.

Source: (46)

4.1.2.2 Noise Related to Dare County Range

4.1.2.2.1 Background

As discussed in the previous section, the noise environment due to aircraft operations may be determined in terms of any one of several noise measures and overall noise exposure methodologies, using the basic aircraft noise source data and the operational information on flight patterns and sortie frequency.

The assessment of the noise environment due to current aircraft operations at the Dare County Range has been made in terms of Noise Exposure Forecast (NEF) calculations for specific points of interest outside the Range. The basic noise source data utilized in these calculations are also given for each flyby event in terms of both Effective Perceived Noise Level (EPNdB) and Sound Level (dBA).

4.1.2.2.2 Operational Data

The current yearly schedule of aircraft usage of the Dare County Range has been present in Section 2.3. For purposes of noise exposure evaluations, these operations have been broken down into the number of sorties of each aircraft in each of the types of training patterns. For example, the average daily total of Air Force nuclear target sorties with the F-4 aircraft includes 15 visual runs and 5 radar runs. Similar activity analyses have been carried out for each of the major types of aircraft used by the Air Force, Navy, and Air National Guard in order to establish at each point of interest the number and pattern of the training flybys.

4.1.2.2.3 Flybys of Sites of Interest

The sites of interest have been chosen to include those sites outside the Range at which the noise exposure is relatively high, and those sites at which noise exposure level calculations are of interest due to present or proposed land use activities. The sites chosen include the following:

A. Alligator River--west of Air Force Lead n Line Road
B. Alligator River--west of Navy Lead n Line Road
C. Route 264--south of Air Force Non-Nuclear Targets
D. Downwind Legs of Air Force Non-Nuclear Training Runs (2 locations for righthand and lefthand patterns)
E. North of Navy Non-Nuclear Targets
F. Long Curve Road, close to Range Boundary
G. Stumpy Point Village (Air Force East Entry Holding Area)
H. Air Force West Entry Holding Area, North of Phelps Lake (Flyover of Pettigrew State Park).
I. Oregon Inlet (Navy Range Exit)

Sites A through G are shown on Figure 4.1.2-B. The locations of sites H and I are shown on the smaller scale map of Figure 2.3.1-C.

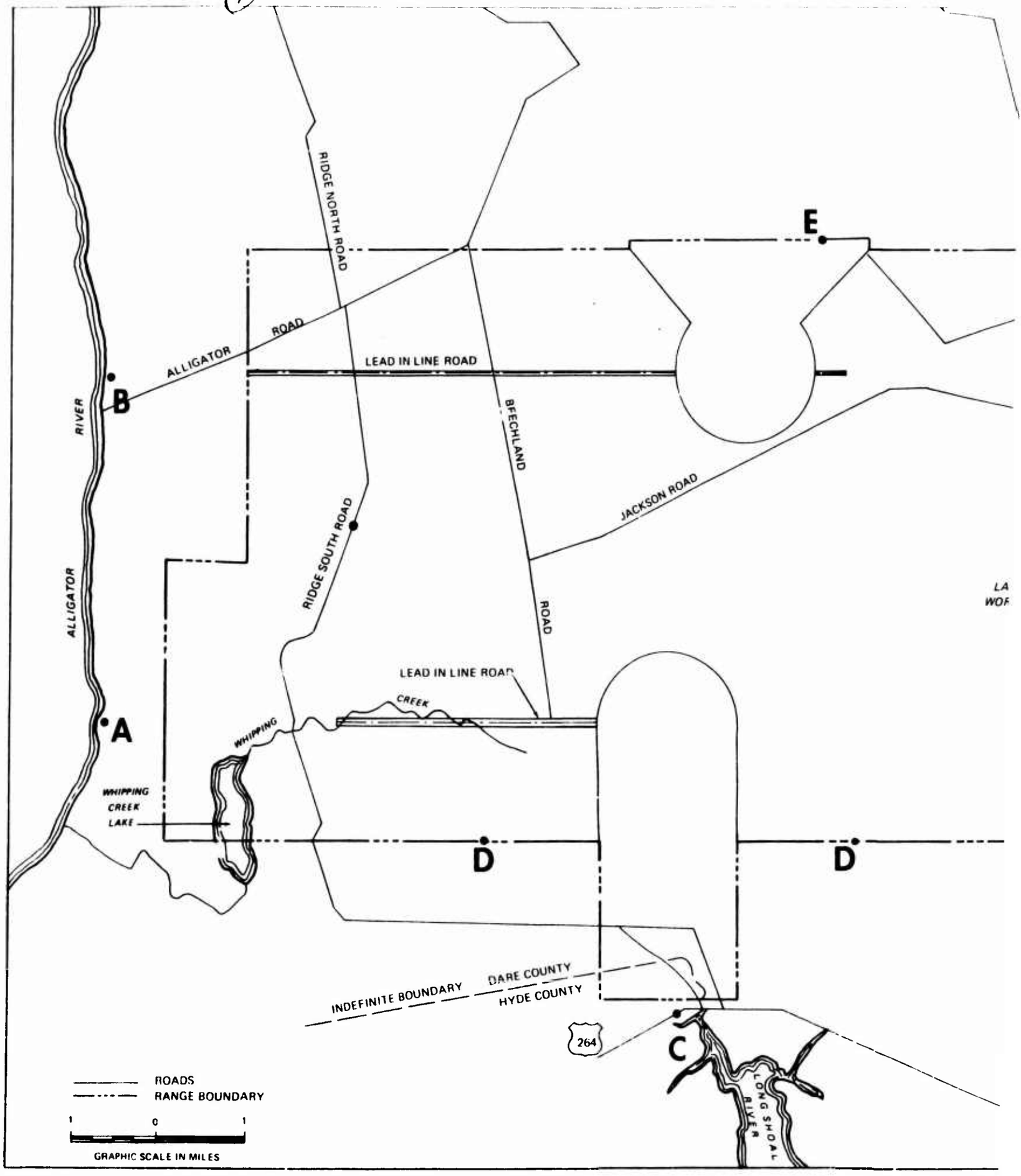

FIGURE 4.1.2–B SITES OF INTEREST FOR NOISE EXPOSURE CALCULATIONS

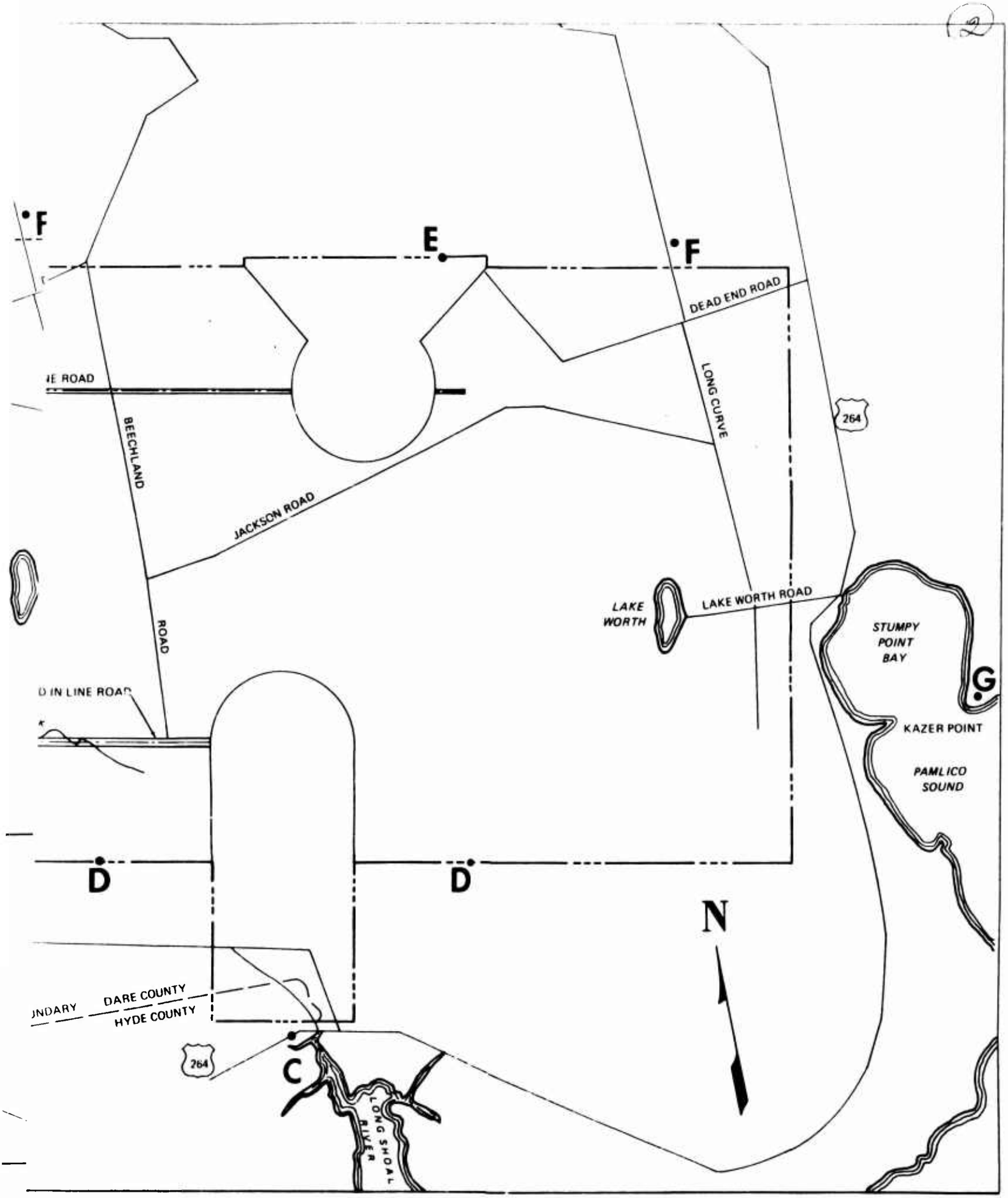

FIGURE 4.1.2–B SITES OF INTEREST FOR NOISE EXPOSURE CALCULATIONS

The assumed flyby activities per day at each of these sites are as follows:

A. 15 visual runs at 300 ft altitude and 5 radar runs at 1000 ft altitude, with F-4 aircraft.

B. 27 F-4 and 61 A-6 runs at 2000 ft altitude, 2.4 F-4 and 5.4 A-6 runs at 10,000 ft altitude.

C. 16.5 F-4, 16.5 A-7, and 12 F-105 runs at 1000 ft altitude; 19.5 F-4, 19.5 A-7, and 10 F-105 runs at 2000 ft altitude; and 19.5 F-4, 19.5 A-7, and 18 F-105 runs at 8000 ft altitude.

D. 11 F-105, 18 F-4, and 18 A-7 runs at 2500 ft altitude on each side.

E. One F-4 and one A-6 run at 200 ft altitude.

F. One F-4 and one A-6 run at 700 ft range.

G. Worst case is four F-4 aircraft in holding pattern at 2500, 4500, 6500, and 8500 ft altitudes, making 10 passes each (one-hour holding pattern).

H. Worst case is four F-4 aircraft in holding pattern at 1500, 3500, 5500, 7500 ft altitude, making 10 passes each (one-hour holding pattern).

I. Three F-4 and 7 A-6 flyovers at 3000 ft altitude.

4.1.2.2.4 Aircraft Noise Data

The basic data on the single-event noise levels, as a function of distance to the aircraft for each of the major aircraft types using the Range, have been obtained in terms of Effective Perceived Noise Levels for takeoff, approach, and cruise power conditions. Training flights involving bombing, strafing, and laydown operations are generally carried out at engine power levels between military power and cruise power levels; accordingly, the noise levels for each of these training operations were assumed to be the average values from the military power takeoff and cruise power conditions augmented by a velocity correction. Some representative values of these noise levels in terms of both EPNdB and dBA are shown in Table 4.1.2-E for air-to-ground slant range distances of 1000 and 5000 feet.

Table 4.1.2-E

Typical Aircraft Noise Levels for Range Missions

	Noise Levels			
	1000 Ft Range		5000 Ft Range	
Aircraft	EPNdB	dBA	EPNdB	dBA
F-4 (AF, NAVY)	115	107	98	86
A-7 (AF)	105	97	87	76
A-6 (NAVY)	115	107	100	87
A-4 (NAVY)	105	98	85	75
F-105 (ANG)	112	105	97	85
F-15 (AF)	105	95	91	76
F-14 (NAVY)	105	97	84	73

4.1.2.2.5 Noise Exposure Forecast Values at Sites of Interest

The calculated values oi noise exposure forecast for each of the sites of interest are as follows:

A. Alligator River--South: NEF value of 47 dB. Exposure Zone is very narrow, however, with NEF reduced to 30 dB at 3000 ft lateral distances.

B. Alligator River--North: NEF value of 41 dB. Exposure Zone is narrow, with NEF reduced to 30 dB at 5000 ft lateral distances.

C. Route 246--South: NEF value of 41 dB.

D. Downwind Legs--AF Range: NEF values of 32 dB. Thus NEF is 30 dB or higher within approximately a 5-mile wide corridor entering the AF Range from the South.

E. North of Navy Range: NEF value of 41 dB. Only two flights per day but very low altitude. Exposure Zone is very narrow, with NEF reduced to 30 dB at 1000 ft lateral distance.

F. Long Curve Road: NEF value very low, about 10 dB.

G. Stumpy Point Village: NEF value of 23 dB.

H. Pettigrew State Park: NEF value of 26 dB.

I. Oregon Inlet: NEF value of 28 dB.

A map of the Dare County Range and approximate contours for NEF 30 and 40 is given in Figure 4.1.2-C. As indicated, the noise exposure zones with NEF values of 30 dB or more due to Range operations are restricted to a small area at the north entry, to two relatively narrow areas leading into the Range from the West, and a somewhat larger area, about 5 miles wide, at the Southern Range entry.

4.1.2.2.6 Noise Exposure Impact

The principal measures normally used of the magnitude of the noise exposure impact are in terms of the number of inhabitants, schools, hospitals, and housing units within NEF contours of 30 dB and above. For the Dare County Range operations, the areas encompassed by the NEF 30 contour, as shown on Figure 4.1.2-C do not include any inhabitants or buildings exclusive of those on the Range itself. Thus, the noise assessment indicates that the noise impact in these terms is essentially zero. Even these areas, according to the land use compatibility guidelines associated with the NEF methodology, are considered suitable for agricultural activities, transportation and communication, and other commercial low-density uses, and livestock farming.

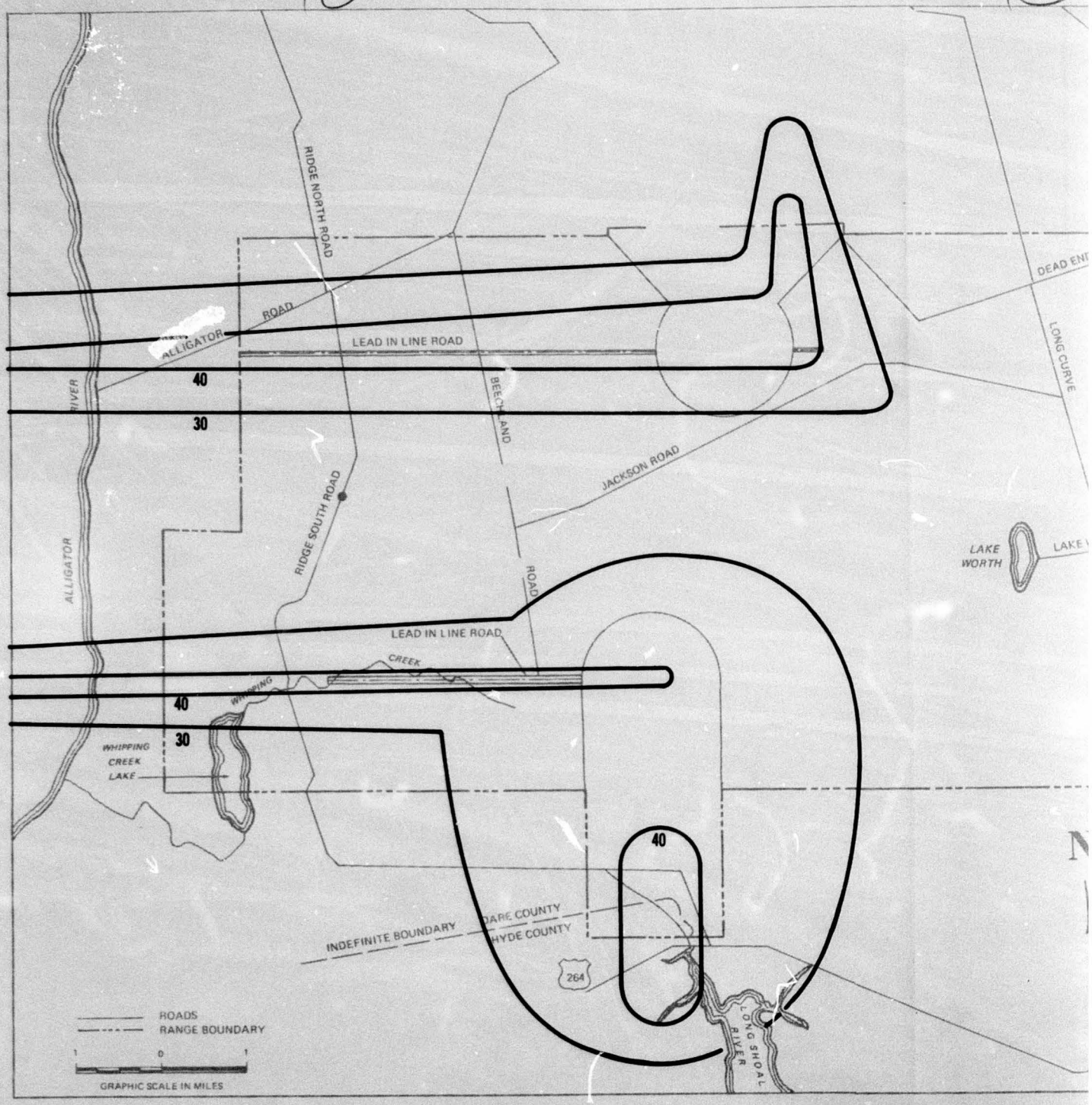

FIGURE 4.1.2-C APPROXIMATE NOISE EXPOSURE PRECAST CONTOURS DUE TO CURRENT RANGE OPERATIONS

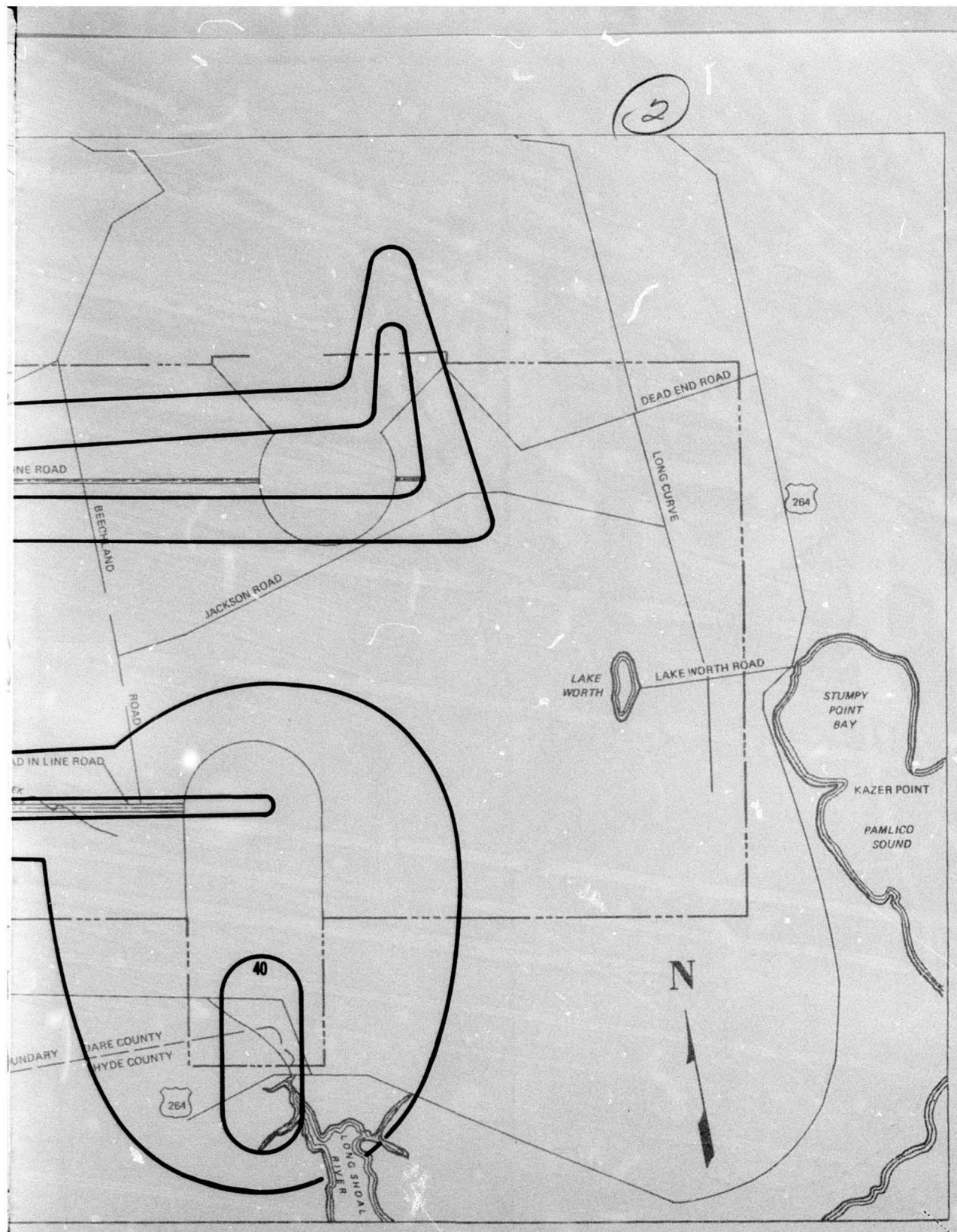

FIGURE 4.1.2-C APPROXIMATE NOISE EXPOSURE PRECAST CONTOURS DUE TO CURRENT RANGE OPERATIONS

4.1.2.2.7 Noise Due to Ordnance

In addition to the noise resulting from the aircraft operations themselves, the range activities, involving bombing and strafing, will also generate some noise within local regions. The practice ordnance used in these activities, as described in Section 2.3, does not contain explosions except for the spotting charges used in the practice bombs. These spotting charges do not produce any significant noise levels. The strafing operations, using 20 mm gms, will generate high noise levels due to the firing and to the supersonic velocity of the charges. These noise levels will be essentially confined to the immediate vicinity of the range targets and should not, therefore, be an annoyance factor to any of the habitated areas in the environs of the Range.

4.1.2.3 Noise Related to Aircraft Transits to the Dare County Range

Some flights to the Range from the various home bases of the aircraft using the Range utilize the low level routes shown on Figure 3.1-A. These flights from Air Force bases are usually at a minimum altitude of 1000 feet AGL, while some of the low level flights from Navy Oceana are flown at altitudes as low as 200 feet AGL.

At these low altitudes the noise levels generated by aircraft flyovers can be extremely high, particularly directly below the flight route. As indicated on Table 4.1.2-E, the noise levels at a 1000 feet distance for the noisiest aircraft using the Range (F-4 and A-6) is 115 EPNdB. At a distance of 200 feet, these aircraft would produce a noise level of approximately 125 EPNdB (or 123 dBA), an "uncomfortably loud" level according to the subjective criteria given in Table 4.1.2.1-A.

The maximum number of occurrences per day of these high noise levels along a given low level flight route would most likely not exceed ten. Nevertheless, assuming ten overflights at 1000 feet altitude, the equivalent value of the noise exposure forecast would be equal to 37. If two of ten overflights were at 200 feet, the NEF value would increase to over 40 dB. The noise-affected zone would be quite narrow, however, dropping to below NEF 30 at lateral distances greater than 1000 feet. Thus, for these low level routes, high noise levels could occur, both in terms of daily noise level and in terms of each single event. However, the areas of such high noise intensity could be narrow, of the order of one-half mile in total width.

4.2 BIOTIC ENVIRONMENT

The following discussion focuses on possible impacts on vegetation and wildlife of noise, controlled burning and accidental fires, herbicide application, water pollution, and air pollution as they are related to range operation. Possible impacts, as indicated by laboratory test and other documentation are included wherever such information is available. These are followed by discussions of applicability to the impact on vegetation and wildlife within the Range.

4.2.1 NOISE

As described in Section 4.1.2, the noise exposure forecast levels at certain locations around the perimeter of the Range can exceed 40 dB, and the noise level due to a single sortie into the Range can be as high as 115 EPNdB.

The effects of increased noise levels on wildlife is practically unknown. Most noise studies have been done on laboratory animals in an effort to determine human reactions to noise levels. The studies that have been done indicate that the effects of noise may fall into the following general categories:

(1) Noise levels may cause a reduction in sensitivity in animals, analogous to a human's loss in hearing. This may cause particular hardship in animals that depend on auditory signals for locating prey and predators, for courtship and mating, and for staking out territories.

(2) Noise levels can mask auditory signals for these same activities. Masking can interfere with some animals' communication of information such as danger, distress, or recognition of a mate or young.

(3) Noise levels can change behavior patterns such as breeding habits and migratory patterns. Avoidance of noise, another change in behavior pattern, can curtail exploratory behavior and limit access to food and shelter.

(4) Noise levels can change physiological reaction, although this has been shown only under laboratory conditions. Laboratory animals exposed to acute levels of noise showed changes in blood pressure and chemistry, hormonal changes, and changes in reproductivity. [48]

Behavior pattern disruption, in the form of avoidance, is the most commonly observed reaction to noise. This and other behavior pattern disruption can be mitigated by adaption or habituation, i.e., the organism learns to differentiate between those noises that signal danger. Deer have been observed grazing close to the runway of a busy heliport, whereas other deer have disappeared quickly at the first sound of a rifle. [48] This confirms reports of Range personnel that deer graze around the targets while the targets are in use, and do not appear to be

affected by the roar of the jets. On the other hand, the deer are reported to run for cover at the sound of a pick-up truck which they may associate with hunters.

Birds may also be able to adapt to repeated exposure to noise although the results of tests are unclear. Habituation has occurred in starling as repeated efforts have attempted to drive starlings away by the use of noise. Starlings have become habituated even to the sound of their own distress signals. [49] On the other hand, habituation may not occur in some species. Adult condors were found to be very sensitive to noise and abandoned their nests when disturbed by sonic booms, blasting, or even traffic noise. [49] From these two examples it would seem that the sensitivity to individual noise occurrence may depend on the amount of adaption of the species to noise.

From observations on the Range, it appears that there are many species there that have adapted to the high noise levels. The Whipping Creek area on the perimeter of the Range has one of the highest noise levels and also has the highest concentration of wildlife. It may be that refuge from hunters and stray dogs may be more of a motivation for location than noise levels. The reported presence of osprey nests on the banks of the Alligator River (where aircraft approaching the nuclear target are at approximately 1000 feet overhead) indicates that even more sensitive (or 'shy') organisms may have adapted.

Adaption minimizes behavioral changes but does not prevent harm from masking of auditory signals or decreased sensitivity to those signals. More study is needed to determine the overall impact of noise to the wildlife on the Range.

4.2.2 FIRES

Two types of fires occur on the Range. One type is the prescribed or controlled burning done by the North Carolina Forest Service on the cleared area. These controlled fires are designed to decrease the vegetative biomass that is the fuel for such fires. The controlled burning usually occurs after herbicide application and a frost, since the 'burn' is most successful if some of the vegetation has already been killed.

The number of acres treated by controlled burning varies from year to year. For example, in the 1970-1971 burning season about one-half of the cleared area on the AF Dare Range and about one-third of the cleared area on the Navy Dare Range were burned (total of 2700 acres). In 1973-1974 about 2000 acres were subjected to controlled burning.

The second type of fire is the accidental type most of which are set by the incendiary action of the ordnance. Most of these are small, and concentrated around the cleared target areas. In the fire season (spring, and to some extent, late fall) these small fires may occur several times each day. Two larger uncontrolled fires have occurred in recent years. Some of the effects of fire on vegetation and wildlife are as follows.

Adverse impacts:

(1) Fire, of course, destroys existing vegetation and the habitats provided by that vegetation.

(2) Fire tends to reverse the natural order of vegetational succession leading to less diverse communities of lower order species.

(3) Fire drives away higher order organisms such as mammals and birds, reptiles, and amphibians (who manage to escape) from established territories, including feeding and nesting areas. Lower order organisms such as many amphibians and anthropods are generally destroyed by the fire.

Beneficial impacts:

(1) Fire has a selective effect in that it is more limiting to some organisms than others, and this favors the development of organisms with a high tolerance for fire.

(2) Fire can act as a 'decomposer' of detritus, releasing CO_2 and other gases to the atmosphere and minerals to the soil. Light surface fires can also aid bacteria in decomposing plants, making mineral nutrients quickly available to new plant growths.

(3) Fire stimulates the growth of nitrogen-fixing legumes (the underground 'fruits' of plants). These legumes are able to convert free nitrogen to a form available for intake by plants. Population of quail and other organisms dependent on legumes for food often increase after a fire.

(4) Fire can create ecotones, or 'edge habitats' for organisms which need both open highly productive areas and diverse area for cover. [8]

The adverse impact of both the controlled burning fires and the small frequent fires may not be significant. In the controlled burning, shrubs, pond pines, switch cane, and other vegetation are destroyed. The habitats created by this vegetation have usually been previously damaged by herbicide application. The fire reverses the order of succession creating an area of low order vegetation, e.g., sphagnum moss, ferns, broomsedge, but in doing so creates the valuable combination of highly productive and highly diverse habitats discussed previously as beneficial to wildlife. In the highly acid environment of this area, decomposition is slow and the fire may be beneficial in making minerals available to new plant life although more study is needed to determine if this is the case. Finally, the presence of a large number of quail on the edges of the cleared area may indicate that the fire stimulates legume production in the cleared area, and creates the needed ecotone for quail.

The large scale wildfires involve a greater magnitude of destruction. While some of the same effects described above apply to the large-scale fires (e.g., reversal of successional patterns, creation of ecotones,

release of mineral nutrients), the amount of habitat destruction on many outweigh these other effects. In a wildfire, many organisms like squirrels, and rabbits may not escape and are often destroyed by the fire. Even a few deer were trapped and killed by the 1971 fire. Lower organisms, such as insects and even soil microorganisms are killed in these intense fires. Those organisms which do escape are forced into the surrounding area where they must compete for food and shelter in an area where territories have already been established and the populations or organisms may already be at an equilibrium with the environment.

Without future study it is difficult to determine whether these wildfires are necessary for the long-term maintenance of this sub-biome. In the general description of the area (Section 3.2), it was noted that soil conditions and fires are the limiting conditions of this pine sub-biome which prevent it from changing into a deciduous hardwood vegetation similar to the rest of the biome. It is known that the long-leaf pine vegetation that dominates much of the sub-biome exists because of its resistance to fire and fire, is an important factor in its maintenance. Although information is available on this, it is possible that the pond pine pocosin vegetation within and surrounding the Range also has become established because of its resistance to fire and its ability to quickly reestablish itself by sprouting after a fire.* Thus wildfires, although temporarily destructive, may be an important factor in the long-term maintenance of this vegetation and the wildlife it supports.

4.2.3 HERBICIDE APPLICATION

As discussed in Section 2.3.3, four chemicals are used in the herbicide program. Only laboratory studies have been done on these herbicides and these have focused on the potential hazards to wildlife exposed to the chemicals. The studies done to date do not include potential effects on phytoplankton and other non-target plants. Because of the limited coverage of these tests, and because no field studies have been done on the Range to determine the actual exposure of wildlife to these chemicals, the actual impact of these chemicals is not known.

A brief summary of the known environmental aspects of the chemicals follows. For more detailed information see Appendix B.

Silvex is considered slightly toxic to mammals, relatively non-toxic to birds, and, when in the ester formulation used on the Range, toxic to fish. The ester formulation is also toxic to oysters and shrimp. It is doubtful however that sufficient concentrations would ever reach nearby shrimp and oyster populations, since Silvex is only slightly soluble in water and relatively non-persistent.

2,4,5-T (ester on 2,4,5) is relatively non-toxic to birds, but toxic to fish in the ester formulation. Oysters and shrimp are not adversely affected. Since it is insoluble in water and moderately persistent it is likely that 2,4,5-T remains in the application area and does not move as rapidly into the surface water system as the other chemicals used.

Dalapon (Dowpon) is considered relatively non-toxic to mammals, birds, fish and arthropods. It is also considered non-persistent, and although

very soluble in water, may degrade before reaching the canals on the Range, if a wide buffer zone is left.

Picloram (Tordon) is considered to be relatively non-toxic to mammals, birds, fish, and oysters and does not appear to affect soil organisms. The chemical may be the most hazardous in the long term because of its persistence. Although relatively non-toxic, its solubility and persistence may result in a buildup of a concentration that could harm vegetation within Dare County Range and in the surrounding waters.

4.2.4 AIR POLLUTION

The levels of air pollution caused by the operations of the Range (as discussed in Section 4.1.4) are not expected to be high enough to cause harm to wildlife in the area. This is based on the fact that air pollution levels are considerably lower than the state primary standards for air pollution, i.e., those levels which cause harm to humans.

Vegetation may be more sensitive to air pollution injury than wildlife. When plants are injured by an air pollutant, visual symptoms usually develop characteristics of the specific pollution.

Since the pollutant normally undergoes chemical change soon after it contacts the plant tissue, these visible symptoms are usually the only bases for diagnosing air pollution injury. Accordingly, samples of vegetation near operational areas were collected and photographed and compared to photographs of diagnostic symptoms as presented in Recognition of Air Pollution Injury to Vegetation: A Pictoral Atlas, issued by the Air Pollution Control Association. [53] Photographs of vegetation areas not directly adjacent to range operations were also used. The pollutants investigated were primary pollutants from jet exhaust, NOx, hydrocarbons, and carbon monoxide. Particulates were also investigated because of their release during controlled burning.

(1) NOx is important to vegetation in that it participates in photochemical reactions which produce ozone and peroxyacyl nitrates (PANs), two highly phytotoxic oxidants. Symptoms of ozone damage vary considerably but include mottling, surface bleaching, and wilting. Symptoms of PAN injury include air pockets, glazing, and bleaching. No symptoms of either of these pollutants was noted among vegetation collected from the Range.

(2) Hydrocarbons, such as ethylene may act as growth hormones, e.g., reducing growth, preventing flowers from opening, when present in the atmosphere in concentrations as low as 1 ppm. Plants recover rapidly, however, and usually do not show visible effects unless growth is severely retarded over a long period of time. No such symptoms were noticed during visual inspection of the Range.

(3) Carbon monoxide may produce internal ethylene in plant tissue and thus cause effects similar to those above. Levels of CO necessary to cause injury similar to ethylene, however, are from 1,000 to 10,000 times higher than those reported for ethylene. These levels are way above ambient conditions, and as stated above, no visual retardation of growth was noted or expected due to this cause.

(4) Particulates are not considered phytotoxic pollutants, unless they are concentrated to such a degree that they coat the plant and cut off light penetration. No such concentrations were noted.

Spotting was seen on some plants on the fringes of the cleared areas, apparently caused by drift of herbicides from a recent application.

4.2.5 WATER QUALITY

As a natural background quality, water found in swamps often has a high concentration of color, is low in dissolved oxygen, is acidic, and contains substantial organic and inorganic material. [54] The water quality test results shown in Table 4.2.5-A approximate these typical conditions. These tests involved only two samples and therefore are not necessarily indicative of the water quality of the Range or even the sample location (which is not known). From this limited sampling it appears that color, the chemical oxygen demand, dissolved solids, and total organic carbon are relatively high. Iron is the only other item which shows concentrations above those recommended by the U.S. Public Health Service Standards for drinking water. [55] These relatively high level items could be from natural sources, Range operation or other sources.

The sources of pollution from Range operations are as follows:

Ordnances and Discharges - Most of the ordnance items are constructed of steel, although plastic is used in the "rockets." Because of the probable low oxygen levels in the water, it is likely that the steel and

Table 4.2.5-A

Water Quality Tests in Drainage Canals

Item	mg/l unless noted	Sample I 2/14/73	Sample II 5/10/73
Color	units	750	750
Turbidity	units	2	1
COD		121	103
Dissolved solids		186	161
Oils and greases		<0.3	1.1
Surfactants		0.1	<0.1
Phenols		<0.001	<0.001
Chlorides		16	20
Fluorides		<0.1	<0.1
Nitrates		5	<1.0
Phosphates		0.4	<0.1
Sulfates		95	31
Cadmium		<0.01	<0.1
Chromium (Hexavalent)		0.03	0.5
Chromium (total)		<0.05	0.5
Copper		<0.02	<0.02
Cyanides		<0.01	<0.01
Iron		0.44	0.85
Lead		<0.05	<0.05
Manganese		<0.05	<0.05
Silver		<0.01	<0.01
Zinc		0.05	0.05
Mercury		0.005	0.005
Total Organic Carbon		41.0	48.0

plastic remain undecomposed in the peat. The phosphoros used for the spotting charge burns in the presence of oxygen in the air to form P_2O_5 or phorphoros pentoxide. As the particles fall into surface water, the P_2O_5 reacts with water to form phosphoric acid, H_3PO_4. Only minute quantities of phosphoric acid are formed and these become diluted quickly. However, in areas near targets where there is a larger quantity of ordnances falling within a limited area, small ponds are formed, and the water in these small ponds may eventually become more acid than surrounding water.

Septic tanks - Two septic tanks are present on the Range serving approximately 25 people for daytime use. The limited use of these septic tanks makes any potential impact insignificant.

Vehicle washracks - Part of the maintenance procedure for Range vehicles includes washing. Some alkaline soap is used, but most of the washing is done by simply rinsing the vehicles with water. The water quality tests discussed earlier were originally done to determine whether the vehicle washrack constituted a polluting source. The conclusion of the laboratory was negative.

4.2.6 SURROUNDING AREAS

About eight counties are exposed to low level flights enroute from SJAFB to the Dare County Range. These counties are exposed to 2 to 4 overflights typically having four jets each flying at minimum of 1,000 ft at 420 knots/hr (true air speed) during the hours of 7:30 am to 5:00 pm. This involves high noise levels for brief periods of time sporadically throughout the day.

Table 4.2.6-A shows information on the environmental parameters of these counties. Forest, primarily loblolly and pond pine, occupies about 50-75% of all these counties. Wetlands in all the counties are primarily bogs, and swamps. Fresh water marsh is found in Craven, Beaufort, Tyrrell, and Dare Counties. Salt marsh is found only in Dare County, but this area is not exposed to low level flying. The Roanoke and Alligator Rivers are the two major rivers which drain these counties. Fresh water lakes and ponds occur only in Northhampton, Washington, and Dare Counties. [11]

In the bog and wooden swamps, deer are found in most counties. Bears are also found in most counties but are plentiful only in Washington County. Other wildlife includes raccoons, minks, muskrats, otters, grey squirrels, and woodcocks which are present to various degrees in these counties. [11] It is unlikely that the noise adversely affects these animal populations, i.e., the noise is not frequent enough to impair hearing or mask a significant amount of auditory signals. Avoidance behavior may be present but because the exact pathway of noise disturbance varies and because of the sporadic nature of the noise, locations of resident populations are not expected to be affected.

Table 4.2.6-A

Summary Environmental Data Near Low Level Routes

County	Type of Forest	Amount of Land Forested	Types of Wetland	Importance of Wetland to Waterfowl	Other Wildlife	Recreational Area	Acre/ Person
Craven	Loblolly, some pond pine, oak-gum-cypress	50-75% forest	Bog, swamp fresh water	Swamp provides winter habitat for ducks. Great Lakes affords sanctuary for ducks.	Deer, bear, minks, Otters	Croatan National Forest	.013
Beaufort	Loblolly, some pond pine, oak-gum cypress	50-75% forest	Bogs, swamp, fresh marsh	Marsh and shallow river waters, support ducks and geese	Deer plentiful bear, raccoon, wildcat		.002
Martin	Loblolly, some pond pine, oak-gum-cypress, oak-hickory	50-75% forest	Swamp, bog, Roanoke River	Flood creeks, support woodducks, mallards	Deer plentiful, some bears, minks, muskrat		.002
Bertie	Loblolly, oak-gum-cypress, some hardwood-pine	50-75% forest	Swamp, bogs Roanoke River	Swamps support woodducks	Deer, wild turkey, few bear, raccoon, muskrat		.002
North Hampton	Oak-gum-cypress some oak-hickory hardwood-pine	50-75% forest	Lake, large ponds, some swamp, Roanoke River	Ponds important for woodducks	Deer, some wild turkey, no bears, grey squirrels, raccoons, etc.		.008
Washington	Oak-gum-cypress, some loblolly, pond pine	50-75% forest	Lake Phelps, Pungo Lake, bog, swamp	Phelps and Pungo Lakes provide sanctuary for mallards, geese, ducks	Deer common, bear abundant, grey squirrels, woodcocks	Pettigrew Park	.386
Tyrrell	Pond pine, some loblolly, oak-gum-cypress	50-75% forest	Bog, swamp, marsh, Alligator River	Insignificant duck or other water fowl population	Bear, deer uncommon wildcats, raccoons		.386
Dare	Pond pine, some loblolly, oak-gum-cypress	50-75% forest	Bog, swamp, fresh marsh, salt marsh, ponds	Outer banks important to ducks, cranes	Deer, bear, osprey, others described in Section 3.2.2	Pea Island National Refuge, Cape Hatteras National Seashore	.386

Water fowl are found in all counties but are most plentiful in those counties which have open fresh water. Water fowl are most important in the following counties.

Craven County - Great Lake in the Croatan National Forest supplies sanctuary for ducks. Five smaller lakes (Great, Catfish, Long, Little, and Ellis) also provide habitat. The low level flying path is about thirty miles away from these lakes (although there are other flight operations from a nearby military base).

Northhampton County - Roanoke Rapids Lake and eight large ponds comprise most of the fresh water acreage in this County. The low level flight pathway is nearby (about 10-15 miles away but not directly over these water bodies). It passes over part of the large waterbody which includes the Kerr Reservoir in Virginia which connects with the Roanoke Rapids Lake.

Washington County - Phelps Lake and Pungo Lake comprise most of the fresh water acreage and are important bird sanctuaries. These lakes are in direct line with the approach to the Dare County Range; thus it is likely that some flights pass over these lakes. Air Force flight instructions require 5-mile distance from Pungo Lake, but a holding pattern is near Phelps Lake.

The effect of sporadic high noise level increases of short duration on water fowl is not known. The noise is probably not frequent enough to impair hearing or mask auditory signals for significant duration. Behavioral reactions may occur, with the most important being avoidance (e.g., changes in migratory patterns or residences). The migratory patterns of the Canadian geese are the only patterns to change significantly in the region, and this is reportedly not due to noise or aircraft disturbance. [12] No changes have been reported in resident populations near these pathways.

Although no supersonic flights are authorized in regard to the Dare County Range activities, both Phelps Lake and Lake Mattamuskeet have been exposed to sonic booms. Lake Mattamuskeet, a National Wildlife Refuge, has recorded six sonic booms in the past year. (Six overflights not related to the sonic booms were also recorded.) The Department of Interior, Bureau of Sport Fisheries and Wildlife (BSFW) which operates the Refuge indicates that the number of sonic booms per year has decreased in recent years. The BSFW is not sure as to what effect these sonic booms have, but is worried that it might be affecting the breeding habits of some of the birds in residence there. One study on terns in Florida showed a 99% failure of tern's eggs to hatch in a year when numerous sonic booms occurred, after 50 years of continuous breeding success. These flights apparently were extremely low-altitude supersonic flights directly over the breeding areas, which apparently caused the birds to be driven off their nests and caused damage to the uncovered nests. [12] No direct supersonic overflights have occurred

over Lake Mattamuskeet. The Air Force has advised all units using the Dare County Range that flight within five miles of Lake Mattamuskeet and Pungo Lake below 10,000 ft is prohibited during the period of water fowl migration which typically extends from November to January. At Lake Mattamuskeet the only significant changes in breeding habits are that the osprey have increased in terms of numbers of active nests, and the eagles have decreased. The cause of the decrease in active eagle nests is unknown.

Pea Island National Refuge and Bodie Island, both on the Outer Banks in Dare County, may experience overflights but are not in the pathway for low level practice flying. It is likely that these overflights are at altitudes of 5000 feet or above. Sonic booms may also occur over this area although no records are readily available.

4.3 HUMAN ENVIRONMENT

4.3.1 ECONOMY AND EMPLOYMENT

The Dare County Range contributes to the local economy by providing employment for 23 local residents and purchasing goods and services in the local community. A summary of the economic impact is shown in Table 4.3.1-A. The Navy Range is staffed by 9 civilians, and the Air Force Range staff currently includes one civilian. The contract with the North Carolina Forest Service for fire prevention and suppression provides for the salaries of 13 people. Approximately one-third of these people live in Dare County, the rest in Englehard.

Except for the one civilian, the Air Force Range is staffed with personnel temporarily assigned to the range from SJAFB for periods of 1 week to 6 months. Because no quarters are available on the Range, the Air Force contracts locally to provide housing. Currently, housing is provided by the Manteo Motel Corp. Air Force personnel receive an additional allowance of approximately $11 per day temporary duty (TDY) allowance for food. Assuming that approximately half of this is spent in the local community, this would amount to about $500 per week for the 14 military personnel.

The Dare County Range has a contract with a supplier in Englehard to provide gasoline and diesel fuel. The current fuel requirements are approximately 1500 gallons each of gasoline and diesel fuel at a cost of over $1200 per month.

Contracts for maintenance on the Range are advertised competitively. Sometimes they are awarded locally. Table 4.3.1-B shows the contracts for the past several years. Although not all of these contracts were awarded within the community, most out-of-state contractors employ at least some local people or purchase from the local community. It is estimated that this contribution to the economy is $10,000 per year.

Small service contracts with local firms for maintenance of furnaces, etc., are estimated to be about $200-300 per year.

The North Carolina Forest Service contract currently provides $198,519 for the following services: equipment maintenance, communications, insurance, helicopter service, tanker aircraft, herbicide spraying and miscellaneous expenses.

The acquisition of the Dare County Range by the Air Force will result in a loss of tax revenue to the County. Taxes on the land occupied by the Range was estimated to be $5,810 in 1973. This represented about 15% of the County and less than 1% of the total tax revenue in the County. In addition, tax revenue from the small parcel of land in Hyde County of approximately $110 will also be eliminated.

Table 4.3.1-A

Impact of the Range on Local Economy (Annually)

Annual Civilian Salaries (approximate)*	
Air Force Range	$ 15,000
Navy Range	100,000
North Carolina Forest Service	100,000
Total	$215,000
Goods and Services:	
Range Fuel Supplies	$ 14,000/year
AF Housing	18,000/year
Estimated TDY Allowance	26,000/year
Maintenance Contracts:	10,000/year
Forest Service:	198,519/year
Total	$266,519
Grand Total	$481,519

*Does not include overtime pay.

Table 4.3.1-B

Maintenance Contracts for Dare County Range

1970	Painting Towers	$17,000
1971	Asphalt Helicopter Area	$ 4,000
1972	Painting Towers	$33,100
1973	--	
1974	Dredging for Strafe Target	$18,400
Average yearly maintenance expenditure		$14,500
Estimated yearly local expenditure		$10,000

4.3.2 LAND USE

The fee acquisition of the Dare County Range will have no direct impact on land use of the Range, since the land will continue to be used for the same purpose. The potential impact on adjacent land uses depends on the type of use. In general, the only uses which might be affected are those for residential or recreational purposes, whereby potential inhabitants or recreators may be kept away because of aircraft noise. Since there are other more desirable areas in the region for these uses, the impact is not considered significant. Other potential uses for adjacent land include farming and wildlife preservation. Neither of these uses would be affected by the operation of the Range.

4.3.3 AIR TRAFFIC

The Dare County Range is a federally controlled restricted air space which carries the designation R-5314. The designated using agency is 4th Tactical Fighter Wing, Seymour Johnson AFB, North Carolina, tel. (919) 736-6561. The 4TFW serves a coordinating function in scheduling the various tactical fighter units into range/block times. The restriction is against any aircraft flying in the reserved block air space except when under direct control (radio contact) of the Range Control Officer. R-5314 is divided into nine (9) sub areas as shown in Figure 2.3.1-B.

Block space restrictions are indicated in Table 2.3.1-E.

R-5314 is rather uniquely located (physically it is just inside Cape Hatteras) in the sense that it is substantially removed from any major air terminal. The closest major terminal is Norfolk (about 70 nautical miles north; Raleigh/Durham and Wilmington are about 150 miles west and southwest, respectively. The closest low altitude airway is V472 (servicing Elizabeth City) which passes within about 10 miles of the northwest corner of R-5314. The closest high altitude airway J-79 passes within 40 nm of the same northwest corner. It seems fair to say that the existence of R-5314 has no impact on commercial air traffic. As a matter of fact, the 4TFW has never received a request for the use of air space from the controlling agency - FAA.

There are a number of small airports located in the vicinity of R-5314. There is one at Manteo (10 miles north of range) and one at Edenton (10 miles from the northwest corner), and a third called Liverman (just east of Lake Mattamuskeet). These airports do not have any commercial traffic. They are too small to be covered in the FAA Air Traffic Activity Manual. The light aircraft operating out of these airports might have to deviate substantially in any point to point north/south flights in order to avoid R-5314 airspace. We have no information as to the number of such deviations, if any.

Military aircraft which proceed to and from Dare County come from the following locations:

- Seymour Johnson AFB, Goldsboro, N.C.
- Myrtle Beach, AFB, Myrtle Beach, N.C.
- Norfolk, Virginia
- Richmond, Virginia
- McGuire AFB, New Jersey
- Washington, D. C.

Each unit has one or more standard routes which is used to approach R-5314. The Navy (out of Norfolk) is unique in that it stays within Oceana Control; whereas all AF and ANG units require service from Washington Center. The high speed, low altitude route Raleigh Durham - 130 passes close to the eastern orbit point (of R-5314) and is used by several units occasionally as part of the inbound route.

In addition there is usually one military helicopter flight per week from SJAFB to the Range.

It is expected that the continued operation of the range will have any significant impact on aircraft as a result of military aircraft enroute to the range.

4.3.4 UTILITIES AND WASTE DISPOSAL

There is no existing impact of the Dare County Range on the utilities in the County. The only commercial utility serving the Range is the Norfolk and Carolina Telephone and Telegraph Company which supplies one telephone; otherwise the Range is self-sufficient.

5.0 IMPACT OF FUTURE OPERATIONS AT DARE ON THE ENVIRONMENT

5.1 DESCRIPTION OF PLANNED CHANGES IN RANGE OPERATIONS

Although it is not possible to predict exactly the future of the Dare County Range, some estimates of the planned activities are necessary to determine the future impact of the use of the Range.

5.1.1 RANGE UTILIZATION

Current plans call for the continuation of training activities at their current level by the 4th and 354th TFW, and the ANG units. Beginning in the fall of 1974, F-14 aircraft will be added to the Navy Oceana Base and will use the Dare County Range. It is estimated that by 1975 two additional squadrons of F-14's will be stationed at Oceana, and over a three year period this will increase to 7 squardrons. However, some of these aircraft will replace those currently in use, and the total increase in use of th Dare County Range by aircraft from Oceana NAS will be approximately the equivalent of only two squadrons. The aircraft using the Navy Dare Range will then be F4, A-6, and F-14. The mission of the F-14 will be principally that of a fighter aircraft but will also have a secondary attack mission similar to that of the A-6. No major change is anticipated in type of activities at the Navy Dare Range. It is estimated that for each two squadrons of F-14 added, the number of aircraft trips to the range will increase by 500 per year. Assuming 8.5 range sorties/trip, the estimated use of the Navy Dare Range is as shown below.

Navy Dare Range Use

	1973	1974	1975	1977
Range Sorties	24,825	23,280	26,468	26,468
Aircraft	2,599	3,017	3,392	3,392
Hours of Use	1,266	1,435	1,614	1,614

These estimates are based upon (1) assuming second half 1974 utilization equal to first half plus 125 more aircraft (F-14) at 8.5 range sorties; (2) 1975 utilization equal to twice the use (sorties and aircraft) during January-June 1974 plus 500 more aircraft (F-14) at 8.5 range sorties each; (3) 1977 utilization equal to 1975 utilization; (4) hours of use are proportionate to January-June 1974 hours (688 hours for total of 1446 aircraft) on the basis of total number of aircraft.

Utilization of the AF Dare Range is also expected to increase as a result of F-15 beddown at Langley Air Force Base.
Buildup of aircraft will be such that full strength will be achieved in 1977. When full strength is achieved, an additional 7272 aircraft uses of the Range will occur each year. At an estimated nine range sorties per aircraft use, the additional number of sorties per year

will be 24,948. Thus the future use of the AF Dare Range is estimated as below:

	1973 or 1974	1977
Range Sorties	36,741	67,689
Aircraft	3,562	6,334
Hours of Use	902	1,603

The range sorties and aircraft in 1977 are based on 1973-74 level plus F-15 addition. The use hours for 1977 are based upon 1973-74 hours in proportion to the number of aircraft. (The F-15 is estimated at 9 sorties/aircraft compared to the 12 sorties/aircraft currently using the AF Dare Range. However, because of scheduling, the use of the Range is probably dictated by aircraft rather than total number of sorties, i. e., 3-5 aircraft per half hour scheduled period will be the maximum use possible independent of whether 9 or 12 sorties are used.)

In order to meet the requirements for additional hours of operation and additional range sorties, it is anticipated that the Navy Dare Range will continue to be available for flight operations from 0800 hours to 2330 hours on Monday through Thursday and may extend Friday operations also. It is anticipated that the AF Dare Range will also extend its hours of operation from sunrise to sunset to accommodate more flights.

5.1.2 STAFFING

The Air Force plans to shift from military to civilian personnel for operation of the Range in 1975. All military personnel (with the exception of the Range Control Officer), and will be replaced by civilian employees in 1975.

5.1.3 ORDNANCE

In order to reduce the potential fire hazard which results from the use of the MK-4 spotting charge, alternative spotting charges are under development. Practice bomb spotting charges, "cold smoke" identified as CXU-1/B and CXU-2/B containing titanium tetrachloride have been tested on the range. They require additional test, development, and evaluation before they will be acceptable for routine use on the Range. Cold smoke has the advantage that a smokeless powder charge is not used, and the smoke is formed by vaporization of the $TiCl_4$ and its oxidation to TiO_2. The potential for starting fires is thereby significantly reduced.

Present plans call for the use of cold smoke as a spotting munition by 1975 during the peak fire hazard season, at least on the AF Dare Range, provided operational test and evaluation is satisfactory. MK-4 spotting

charges will be used during low fire hazard periods. The cold smoke is considerably more expensive than the conventional MK-4 charge. The cold smoke will not be suitable for night use because it does not give a visible flash. This will affect the Navy Dare Range operations more than those of the AF Dare Range because of the greater night use of the Navy Dare Range; the cold smoke may therefore not be used on the Navy Dare Range.

5.2 PHYSICAL ENVIRONMENT

5.2.1 FUTURE AIR QUALITY IMPACT

Future aircraft operations at the Dare County Range will involve an increase in the number of operations conducted annually and changes in the types of aircraft using it. Each of these factors will affect the magnitude of the impact of the operations at the Range on air quality.

The number of operations per year at the Air Force Dare Range is expected to increase by a factor of approximately 1.8. Annual average concentrations of pollutants at the Range can be expected to increase proportionately as a result of this factor. However, short term pollutant concentrations will not be affected by an increase in Range usage since the short-term frequency of flight operations cannot be increased significantly over the frequencies which occur at the present time during periods of intensive use.

The principal change in aircraft type will be the introduction of the F-15 aircraft. Except for NO_x, this aircraft will emit pollutants at rates similar to or less than those for the F-4 aircraft which is representative of aircraft currently using the Range. The NO_x emission rate for the F-15 is approximately 5 times the rate for the F-4.

The overall effect of these changes will be increases in annual average CO, HC, SO_x and SP concentrations by a factor of 1.8 or less, and an increase in annual average NO_x concentrations by a factor of approximately 9 (assuming conservatively that all Air Force operations are flown by F-15 aircraft). Since annual average pollutant concentrations at the Range resulting from current operations are estimated to be below the federal air quality standards by factors of 700 or greater, future operations are not expected to result in an adverse impact on air quality at the Range.

5.2.2 FUTURE NOISE IMPACT

5.2.2.1 Noise Related to Future Aircraft Operations

As indicated in Section 2.3, the proposed future use of the Range, circa 1977, will include additional Air Force operations using the F-15 aircraft to be bedded down at Langley AFB, and additional Navy Operations using the F-14 aircraft to be bedded down at Oceana NAS. The operational activities of each of these aircraft will likely include similar patterns as those currently in use, and the distribution of the sorties into the different types of Range activities is expected to be similar also. On this basis, the additional noise impact due to these increases in operations has been assessed for each of the sites of interest in the vicinity of the Dare County Range.

5.2.2.2 F-15 and F-14 Operational Data

It is estimated that by 1977 the F-15 operations at the Range will total approximately 100 sorties per day, distributed as follows: fifteen nuclear runs, 30 strafing patterns, 25 low angle bombing patterns, and 30 dive bombing patterns per day.

The F-14 operations will be about 8500 sorties per year or 34 per day. These will not be completely additional to present operations, as the total number of sorties is expected to increase by only about 6000 per year or about 24 per day, as some of the present operations are phased out. The net change in operations, therefore, will be distributed as follows: about 21 straight path west entry runs, and about 3 dive bomb runs. The additional use of the north entry to the Navy Dare Range should be negligible.

5.2.2.3 Aircraft Noise Data

The flyBY noise levels of the F-15 and F-14 have been given in Table 4.1.2-E. As indicated in that table, both of these aircraft are significantly less noisy than the F-4, A-6, and A-105 aircraft.

5.2.2.4 Noise Exposure Values at Sites of Interest

The principal sites affected by the additional F-15 and F-14 operations in the 1977 time period will be the Alligator River sites, and the Route 264 - South entry to the AF Dare Range.

In general, it should be noted that although the number of fly-bys at any one of these locations will increase significantly (by 75% for those sites mainly affected by Air Force, by 60% of those affected by AF and ANG operations, and by 25% by those affected by Navy operations), the total noise exposure level, which is an energy summation measure, will not change appreciably.

The total noise exposure level at the Alligator River - South site will increase from 47 dB to 48 dB as a result of the F-15 operations. The Route 264 - South entry point will also increase by one dB unit to 42 dB, while the downwind-leg sites will increase by one dB, from 32 to 33 dB.

The Alligator River - North site similarly will increase by one dB to 42 dB due to F-14 flyby operations. The Noise Exposure Level at the Oregon Inlet, due to the existing Navy Aircraft will increase by one dB. Noise levels at Stumpy Point and at Pettigrew State Park will also increase by some small amount due to the likely increased use of holding time as the number of aircraft using the Range increases.

The land areas within the NEF 30 and 40 contours shown on Figure 4.1.2-C would also be expected to increase slightly consistent with the increased values of NEF at the principal sites of interest. The overall effect of these increases would be slight, however.

5.2.2.5 Noise Exposure Impact

Because of the relatively minor increases expected in the Noise Exposure Forecast values due to the increases in the number of operations, there should not be any change in the impact due to noise to the inhabitants and to the compatible land use patterns of the surrounding area. Thus, except in the entry corridors to the Range, essentially any type of land use would be permissible according to the NEF methodology.

5.3 FUTURE IMPACT ON BIOTIC ENVIRONMENT

Two of the anticipated changes in the operation of the Range are the partial use of cold smoke spotting charges and increased use of the Range. The effect of these changes on vegetation and wildlife is expected to be as follows.

5.3.1 THE USE OF COLD SMOKE CHARGES

The non-incendiary discharges will contain titanium tetrachloride ($TiCl_4$) as discussed previously. This oxidizes in air to form titanium dioxide (TiO_2) and chlorine gas (Cl_2). Titanium dioxide is a stable compound that does not react significantly with water. It is commonly used as white pigment for paint. Some unoxidized $TiCl_4$ may fall into and react with water to form titanium dioxide plus hydrochloric acid. It is not expected that the small quantities of $TiCl_4$ used (25 cubic centimeters per charge), or its reaction products, will have any significant affect on the vegetation or wildlife on the Range since the impacts will be localized at the target areas.

The use of cold smoke spotting charges will also reduce the number of fires which occur in the target area and the potential for fires in the adjacent uncleared areas. This can prevent large areas of wildlife habitat from being destroyed. Reduction of fires in the small target area is of lesser importance since these have no significant effect on habitat.

5.3.2 INCREASED USE OF THE RANGE

Noise and air pollution will increase somewhat when the use of the Range increases. Increases in air pollution are not expected to cause any harm to wildlife or vegetation. Increased noise levels may increase possible impacts mentioned previously, i. e., hearing reduction, masking of auditory signals, or behavioral changes, but the increase in noise exposure is not expected to be large enough to cause significant changes in present wildlife conditions.

5.4 FUTURE IMPACT ON THE HUMAN ENVIRONMENT

5.4.1 CONVERSION OF THE AF DARE RANGE TO CIVILIAN PERSONNEL

The Air Force plans to replace the military personnel operating the AF Dare Range with civilian personnel except for the Range Safety Officer, who by Air Force regulations must be a military officer. Therefore, a total of 13 positions will be converted. At present, since the Range Supervisor is already a civilian, a total of 14 civilians and 1 military will staff the Range. The schedule for conversion will depend on the results of the recruiting; however, it is expected to start in September 1974 and be completed by January 1975.

The impact of the conversion will be mainly an economic one. It will result in 13 new full-time jobs in the area.

Dare County Range falls in the highest civil service wage area in North Carolina. The proposed salary for the range foreman is $5.93 per hour and for skilled crafts--carpenter, plumber, electrician, vehicle maintenance, and senior communications personnel--is $5.02/hour to $5.30/hour. Two vehicle operators, weather and communications personnel will be hired at about $4.73 per hour as well as a clerk typist at $6408 per year and a medic at $8000 per year. Therefore, the conversion of 13 positions to civilian will result in an increase of about $130,000 in the civilian payroll of the Range.

This will be offset by loss in income from the housing contract and TDY food allowance for the 13 military personnel being replaced. This loss is estimated to be approximately $40,850 per year.

5.4.2 LAND USE

The major impact of continued use of the Dare County Range is the preclusion of other possible uses, particularly agricultural uses, although the feasibility of such uses has not been definitively established in this study.

5.4.3 UTILITIES

Since the Dare County Range is self-sufficient and no increased demand for utilities is expected after acquisition, there is no impact of the continued use of the Range on utilities.

5.4.4 AIR TRAFFIC

Dare County (R-5314) is already fairly tightly scheduled on a 5-day week, 8-hour day basis. Based on a forecast increase in the number of users, it will be necessary to increase range utilization (ratio of used to available time) which currently runs at about 65% for the Air Force side. In the period 1 October 1972 through 30 September 1973 some 3560 aircraft used the AF Dare Range. Since all flights using the AF Dare

Range require Washington Center following twice per round trip, it is estimated that a total of 1780 "overs" or contacts were associated with this traffic (based on flights of 4 aircrafts each). In calendar 1973 Washington Center handled 324,252 overs. Thus the Dare traffic represents about one-half of 1% of the total. Should an additional tactical fighter wing (72 aircraft) be stationed at Langley AFB and all other factors remain the same, the percent of workload would increase to .6%. In paragraph 4.3.3 it was concluded that the existing impact of the Dare County Range on air traffic is insignificant as far as commercial traffic is concerned and unknown but probably insignificant as far as light aircraft are concerned. The estimated future increase in traffic load handled by Washington Center and attributable to traffic to and from Dare County is relatively significant (i. e., $\approx$500 "overs") but that increase is very small compared to total Washington Center traffic.

6.0 ALTERNATIVES TO PROPOSED ACTION

6.1 GENERAL

Air Force training ranges are required so that aircrews can maintain proficiency in bombing and gunnery events. Required standards are minimums that must be met, and these standards are reviewed annually and established in Air Force and Tactical Air Command directives. The events in which aircrews must maintain proficiency are varied but include low angle strafing, dive bombing, and radar or visual nuclear bombing practice. The minimum proficiency criteria established is based on aircrew experience, the mission of the unit, the type of aircraft and take into account the ability of existing simulators to provide realistic training.

6.2 CRITERIA

Dare County was selected for the Range because it met several criteria for establishing a range:

(1) Isolated area for less impact on civilian population.

(2) Accessibility (nearness) to the using agency.

(3) Minimum conflict with other land uses.

(4) Sufficient land area available to provide maximum safety for ground personnel.

(5) Sufficient airspace available to preclude conflict with federal airways.

(6) Sufficient land area available to provide a complete target complex, i.e., strafing, dive bombing, and nuclear targets.

To provide sufficient buffer zones around a target area for the safety of the civilian population and also the aircrews by not requiring hazardous flight patterns, Air Force directives require a 7 x 10 nautical mile area as the minimum for a composite nuclear and conventional range.

6.3 ALTERNATIVE EAST COAST SITES

Since the prime user of Dare County Range is the 4th Tactical Fighter Wing (4TFW) at Seymour Johnson AFB in North Carolina, a training range is required on the East Coast to fulfill its requirement. Three such ranges are Warren Grove Air National Guard (ANG) Range northeast of Atlantic City, N.J., Marine Corps Range at Cherry Point, North Carolina, and Pointsett Range at Shaw AFB, South Carolina.

Warren Grove Range does not currently meet the requirements of a composite (i.e., nuclear and conventional) range. Its size is only 3.1 x 2 square miles. Due to size limitations, its strafe target cannot be used by the F-4 aircraft of the 4TFW and it has no nuclear target. It is located in a populated region making future land acquisition doubtful. Aircraft flight patterns are outside the physical range boundaries for a portion of the bombing maneuver, with resultant disruption of the civilian community. Also, it is in a heavy air traffic region, very near McGuire AFB. Also, it is 300 nautical miles from Seymour Johnson AFB, 3 times as far as is Dare County and beyond the combat radius of the 4TFW aircraft without air-to-air refueling.

Pointsett Range is also size limited, being about 4 x 5.5 miles in a trapazoid shape. It does not have a nuclear target due to insufficient land area and is located in a heavy air traffic area adjacent to Shaw AFB, home of the 363 Tactical Reconnaissance Wing. Also, it is 50 percent further from Seymour Johnson AFB than is Dare County Range. Its small size results in some disruption in the lives of the civilian community, chiefly due to noise.

The Marine Corps Range at Cherry Point does meet the requirements of a range; however, it would reach its saturation point after accommodating 1400 of the 3200 range sorties required by the 4TFW every six months. This still leaves approximately 1800 sorties of the 4TFW, 3000 sorties by Navy units using Dare County Range, and 1000 sorties of ANG units which must look elsewhere for a gunnery range. Even if the other two ranges had the targets available, and they do not, their current use is such that they could not support all the sorties required. As stated previously, these required sorties are minimums essential to keep a unit combat ready. The range sortie requirements will be increased with the new F-15 wing at Langley AFB, but will be somewhat less than the 4TFW requirements.

Dare County Range meets the airspace requirement of 7 x 10 miles as it is 7.0 x 10.7 miles in area. This allows for a separate range to be operated in the same locale, and this is operated by the Navy. It is in an isolated area of very low population density and is of sufficient size to contain the aircraft patterns to prevent disruption of the small civilian population. There is little conflict at present with current land use as it is on a wooded area, and areas have been cleared only to allow for the actual target areas and required lead-in lines. Dare County is also centrally located as it is 100 miles from Seymour Johnson, 75 miles from Langley, and about 60 miles from the Navy's major using unit at Oceana NAS in Virginia.

6.4 OTHER ALTERNATIVE SITES

Alternatives available to the using units if Dare County Range should not be available fall into 2 categories.

a. Permanent movement of the users to available bases and ranges in other parts of the country. This is not a

viable alternative for military and political reasons. Also, economics are an important factor as the cost of moving a unit the size of the 4TFW has been calculated at approximtely $4 million. Also to be considered is the distribution of some 4000 military personnel and their families and the cost of additional facilities to support the added men and aircraft. This alternative would also be unacceptable to the Navy as the same military, political, and economic reasons are valid. Permanent movement is not a possibility for the ANG units using the Dare County Range because the ANG units belong to the state until federalized for a national emergency. ANG units with fighter aircraft on the East Coast could exchange aircraft with units with non-fighter aircraft that do not require a weapons range. This exchange would not be feasible because of the following reasons:

a. Cost of the exchange would be approximately the same as moving an activie Air Force squadron.

b. Retraining of ANG personnel and/or acquiring of new skills for the new weapons system would be required. This is more difficult for ANG than for active duty Air Force.

c. Temporary deployment of the using units is another possible alternative available but is also an expensive one. This deployment would involve moving aircraft and men to a temporary location for about 11-14 weeks each six months to obtain the required training for the aircrews. This would be attempted at a base which has available facilities and a bombing range to provide the training. This cost has been computed as $4 million for Air Force units and about $2 million for Navy units as they already have some deployed operations. These costs could be further increased by the necessity for construction of adequate maintenance and personnel support facilities for the expanded operation. The Air National Guard already deploys during a two-week encampment period annually; however, any continuing deployment to obtain bombing and gunnery training would be impossible as their pilots are normally available for 1/2 day flying periods at various times throughout the week and on one weekend per month.

The training requirement is established in directives. Due to budgetary limitation, the level of training is set at what is considered minimum essential to maintain a unit in combat ready status. We can, therefore, assume the training must be done and by not accomplishing it in one geographical area, we merely shift the environmental impact it has to another location in the United States.

There are no other ranges in the Eastern United States which are more isolated than Dare County Range and as such, the flying activity has much less impact on the local population. Since the required land for the Range is already cleared and future expansion is not programmed, environmental impact is therefore limited to exhaust emission and noise. This would seem to have less impact on flora and fauna than would development of this land for agriculture, residential, or industrial use.

6.5 NO PROJECT ALTERNATIVE

This alternative implies that the Government would not acquire the Dare County Range by fee acquisition. The land would then revert to whatever use the owner selected. Possible uses would include agriculture (timbering, crops, pasture), or to leave the land unimproved, in which case it could serve as a wildlife preserve or hunting and fishing area. However, due to the need for training of aircrews, the abandonment of the Dare County Range would not eliminate this aspect of the action at some other location.

7.0 ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

The fee acquisition of the Dare County Range by the Air Force will mean its continued use as a practice range by aircraft of the Air Force, Navy, Marines, and Air National Guard. The adverse impacts which cannot be avoided relate to air and noise pollution, potential destruction of vegetation as a result of controlled burning and accidental fires, loss of taxable land in Dare County, and preclusion of other land uses which might otherwise occur.

While these impacts can be classified as being adverse, they are not of a large magnitude. Furthermore, they would probably apply to an equal extent if the training operations were shifted to an alternative East Coast site. The loss of taxes could be avoided by payments made in lieu of taxes; however, this cannot be readily accomplished within the existing legal and regulatory system. The loss to the County will be partially offset by jobs, service contracts, and payments such as aid to school systems attributable to children of employees at federal installations. The tax loss could also be avoided by a continuation of the lease; however, this would be contingent on agreement between the owners and the Air Force on an equitable rate on a long-term basis.

Potential impacts due to the use of herbicides on the Range has not been quantified. There is relatively little scientific evidence concerning such impacts. Research is currently being conducted on the national level to learn more about the impacts of such use. In the event that such use proved detrimental, it would be possible to substitute mechanical methods for brush control, although it would incur substantially higher maintenance costs.

The potential adverse impacts due to accidental fires have been minimized by the program of controlled burning, the contract for forest fire protection service, and the proposed use of cold spotting charges. Adverse impacts to wildlife as a result of aircraft noise have been minimized by restricting aircraft operations at wild fowl locations and during migratory seasons.

8.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The continued operation of the Dare County Range will involve no significant irreversible or irretrievable commitment of resources. The resources to be considered include land form, water, minerals, biotic species, and human resources such as labor, historic sites, or areas of archeological interest.

If the operation of the Range were discontinued at some future time, the land would soon revert to its original condition (assuming no other use were applied). The drainage canals could readily be dammed to restore the ground water table to its original level (1-2 feet higher than at present in the vicinity of the canals). The buildings, spotting towers, and targets could be removed. The only potential residue would be spent target ammunition which had been buried in the peat. This would eventually corrode, adding a minor amount of iron to the groundwaters.

9.0 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The purpose of this section is to examine the proposed project under the proposition that the people living today must act as custodians of the environment for their future generations. Thus, the question is: will the proposed undertaking benefit us in the short-term sense but result in a long-term cost with respect to potential environmental impacts?

The short-term use of the Dare County Range will benefit us now in maintaining the United States air defenses. Its fee acquisition will assure that this resource is available as long as needed; however, it does involve commitment of a large area of land (in a currently undeveloped area) to this purpose.

The use of the Range does not result in many discernable long-range environmental costs. In fact, most of the area is being preserved in its natural state for future generations. The only activity associated with the Range which may have a long-term impact is the use of herbicides. The long-term effects of these herbicides on the environment has not yet been determined.

APPENDIX A

Real Estate Leaseholds

The Air Force and Navy Range complex encompasses 46,341.06 acres located in Dare County, and 302 acres overlapping into Hyde County, North Carolina.

On February 1, 1964, West Virginia Pulp and Paper Company leased to the United States of America 45,145.27 acres of land, more or less, in Dare County, North Carolina, to be used as a joint Air Force and Naval Weapons and Gunnery Range and Buffer Zone for the term beginning February 1, 1964 through June 30, 1964, provided that unless and until the United States gives notice of termination, the lease will remain in force from year to year until June 30, 1974. [59] The initial lease was for $135,000.00 per year, with a clause providing for a renegotiation of the leasehold value prior to July 1, 1969. Under clauses six and seven, title to all trees and growth cut pursuant to the lease vests in the Government, but the Lessor is entitled to reimbursement for the value of the merchantable timber and young growth cut. It was agreed by the parties in clause ten that material damage to the leased property which directly results from fires caused by the operation of the Weapons Range will be paid for by the Government through settlements in Supplemental Agreements. Clause thirteen allocates the responsibility to the Government to take all reasonable precautionary measures and controls to prevent forest fires.

In Supplemental Agreement No. 1 made April 28, 1967 between West Virginia Pulp and Paper Company and the United States of America, the Lessor agreed to accept payment in the amount of $33,472.50 as the value of timber cleared or to be cleared pursuant to the provisions of paragraphs 5(b) and 5(d) of the original lease agreement, $780 for the value of the timber cleared or to be cleared from a road right of way, and $80,747.50 for the timber destroyed or damaged as a result of the forest fire of April 11-14, 1966.

In Supplemental Agreement No. 2, entered into June 30, 1969, the Lessor, WESTVACO (formerly West Virginia Pulp and Paper Company) achieved, pursuant to paragraph five of the original lease, an adjustment of rental value to $205,000 per year until June 30, 1974.

On September 15, 1971, the original lease was amended by Supplemental Agreement No. 3 to effect payment of $275,500 to the Lessor for timber damaged and destroyed on March 22, 1971 to March 25, 1971, by forest fire caused by reason of the Government's operation of the Weapons Range.

Supplemental Agreement No. 4 was made on August 23, 1973 between WESTVACO, M. P. McLean, and the United States of America. In this agreement all three parties ratified the replacement of WESTVACO by the new fee owner, M. P. McLean, in the initial lease.

A second lease for 1,200.31 acres at an annual cost of $7,200 per year is in effect with Mr. John J. Taylor, Jr. [60] This tract is a 150 foot wide road right of way that leads from Beechland Road to the northwest corner of the Navy Range.

Another area of land contained within the Range lies just north of U.S. 264 in the extreme northeast corner of Hyde County. It contains 302.00 acres and is leased from Pamlico, Inc. at an annual cost of $1,916.

APPENDIX B

Herbicides Used on the Range

As discussed in Sections 2.3.3 and 4.2.3, four chemicals are used in the herbicide program. The following is a discussion of some of the chemical and environmental characteristics of each of those four chemicals:

Dalapon: The chemical name for Dalapon is 2,2-dichloropropionic acid. [50]

Its chemical structure is $CH_3 - \overset{Cl}{\underset{Cl}{C}} - \overset{O}{\overset{\|}{C}} - OH$. Other names include Ded-weed, Dowpon, Gramevin, Radapon, and Unipon. It is used alone on switch cane areas at the rate of 20 gallons per acre (with a formulation of 1875 lbs of dry chemicals to 1875 gallons of water plus a wetting agent). It is also mixed with either 2,4,5T (or Silvex) and used on areas of switch cane intermixed with brush areas. In this latter application the mixture (960 lbs of Picloram is mixed with 600 gallons of water, plus 16 gallons of either 2,4,5T (or Silvex), is applied at the rate of 20 gallons per acre. [3]

The toxicities of Dalapon for various organisms are shown in Table B-1. Dalapon is considered relatively non-toxic to mammals and birds, although one study showed a depression of reproduction in ducks having a high concentration of Dalapon in their diet (<1250 ppm).

Dalapon is also considered relatively non-toxic to fish and arthropods. The effect on soil nematodes is unclear; in one study 94% reduction in soil nematodes occurred after field application, while in another study, earthworms (one type of nematodes) were not affected at all. [51]

Dalapon is very soluble (45 g 100 mg) and therefore readily enters the surface water system. Because of the slow drainage much of the herbicide may degrade before reaching the canals if a wide buffer zone is left. Dalapon is considered relatively non-persistent. In one study, Dalapon applied at a rate of 5 to 40 lbs per acre persisted for only 10 to 60 days with little or no leaching (moist-loam soil). [51] No information is readily available on the breakdown products and their toxicities and solubilities, etc.

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*Other factors, such as tolerance of acidic soil also are likely to the success of pond pine in the area.

Table B-1

Dalapon Toxicity

Mammals LD_{50}	(mg/kg)	Birds LC_{50}	(ppb)	Fish LC_{50}	(ppb)
Rat	7570 to 9330	Mallards	> 5000*	Bluegills	115
Mouse	> 4600	Pheasants	> 5000	Fathead minnow	440
Rabbit	3860	Coturnix	> 5000	Rainbow trout	> 500
Guinea pig	3860			Harlequin fish	> 500

Anthropods, Nematodes, and Annelids	LC_{50} (ppb)
Waterfleas: *Daphnia magna*	6.0
Brown shrimp	approx. 1.0

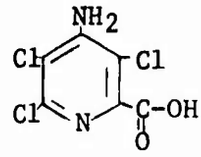
*Dalapon was found to depress reproduction in mallard ducks when fed at levels of less than 25% of those which produced mortality.

Note: LD_{50} is the dosage at which 50% of the organisms were killed as is referred to as the lethal dosage.

LC_{50} is the concentration (in feed, in surrounding water) at which 50% of the organisms were killed (lethal concentrations).

Therefore, high numbers indicate low toxicities.

Picloram: The chemical name for Picloram is 4-amino-3,4,6-trichloropicolinic acid. Its chemical structure is:



Other names for the herbicide include Tordon and Borolin. [52] Picloram is mixed with Silvex and is applied to brush areas at a rate of 15 gallons per acre (with a formulation of 188 gallons of Picloram mixed with 18 gallons of Silvex, in 2,405 gallons of water). [3]

Picloram toxicities for various organisms are given in Table B-2. Picloram is considered relatively non-toxic to mammals and birds. Picloram is also considered non-toxic to fish, especially in warm weather climates since the tolerances of most fish increase with increases in water temperature. Oysters may be unaffected by low dosages although more study is needed to verify this. Picloram does not appear to harm soil fungi or bacteria and does not reduce nitrification. [51]

Picloram is soluble in water and caution should be taken to avoid the canal drainage system in application. This is expecially important because of the very high persistence of the herbicide. In one test Picloram applied at 5 lbs per acre was still there after 19 months. Another study found that crops were affected when planted in an area treated with Picloram 9 months previously. Other studies show persistence up to three to four years. High persistence means that picloram which may penetrate into other areas, including farmland, may accumulate to levels which affect plant life. [51]

Silvex: The chemical name for Silvex is 2-(2,4,5-trichlorophenoxy) propionic acid. Its chemical structure is:

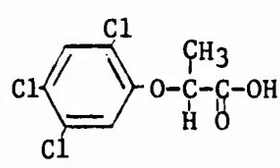


Table B-2

Picloram Toxicity [51]

Mammals LD_{50}	(mg/kg)
Rat	8200
Mouse	2000 to 4000
Rabbit	2000
Guinea pig	3000

Birds LC_{50}	(mg/kg)
Chicks	6000
Mallards	> 2000
Pheasants	> 2000

Fish* LC_{50}	(ppm)
Fathead minnow	135
Rainbow trout	150
Green sunfish	150
Brown trout	230
Brook trout	240

Arthropods LC_{50}	(ppm)
Stonefly nymphs	120
Daphna	> 380

*Tolerances of most fish increase with increases in temperatures.

Note: LD_{50} is the dosage at which 50% of the organisms were killed as is referred to as the lethal dosage.

LC_{50} is the concentration (in feed, in surrounding water) at which 50% of the organisms were killed (lethal concentrations).

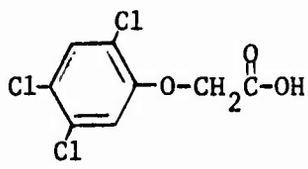
Therefore, high numbers indicate low toxicities.

Other names for Silvex are Fenoprop, Garlon, 2,4,5,TP, Juron, Jurosal, and Esteron. [51] On the Range Silvex is mixed with Picloram and Dalapon (in formulations described earlier) and used on areas of brush and switch cane mixed with brush.

Silvex toxicities for various organisms are given in Table B-3. Silvex is considered slightly toxic to mammals, relatively non-toxic to birds. It is only slightly toxic to fish except when the ester formulation is used (as is the case on the Range). When an ester formulation is used toxicity levels as low as 0.36 ppm (LC_{50}, 48 hr.) has been found, apparently due to the fact that ester formulations more effectively penetrate the body of the fish. [51] Furthermore, esters of Silvex were found to accumulate in bluegills after exposure to sub-lethal concentration on both laboratory and field tests. More study needs to be done to determine the sensitivity of fish to these formulations.

Oysters and shrimp may also be sensitive to the ester formulation of Silvex. The exposure of oysters to 1.0 ppm of Silvex (ester) for 96 hours causes a 23% decrease in shell growth. The exposure of brown shrimp to 0.24 ppm of Silvex (ester) for 48 hours resulted in a 50 percent mortality or paralysis. It is doubtful however that sufficient concentrations would ever reach nearby shrimp and oyster populations since Silvex is only slightly soluble in water and relatively non persistent. [51]

2,4,5-T: The chemical name for 2,4,5-trichlorophenoxyacetic acid. Its chemical structure is:



Other names for the chemical are Esteron 245 Concentrate, Ded-Weed Brush Killer, Fence Rider, Inverton 245, Line Rider, and Reddon. [52] Mixed with Dalapon (in the formulation described earlier), 2,4,5-T is used to control switch cane mixed with brush areas. [3]

The toxicities of 2,4,5-T to various organisms is given in Table B-4. The chemical is toxic to mammals. The chemical is relatively non-toxic to birds although one study showed that egg yields were reduced when chickens were fed sub-lethal dosages. In fish, test results vary with formulations used, but the ester formulations of 2,4,5-T appear to be toxic to fish. Oysters and shrimp are not adversely affected. [51]

Since it is insoluble in water, 2,4,5-T may remain in the application area and not move as rapidly into the surface water system as the other chemicals used. The chemical persists in most soil conditions for 2 weeks to about 3 months. [51]

Table B-3

Silvex Toxicity [24]

Mammals	LD_{50} mg/kg
Rat	1070
Mouse	2140
Rabbit	850
Guinea pig	850

Birds	LC_{50} (ppm)
Pheasants	3000-5000
Coturnex	>5000

Fish*	LC_{50} (ppm)
Bluegills	2.9
Fathead minnows	8.9
Rainbow trout	23.0
Harlequin fish	48.0

Amphibians	(ppm)
Toad tadpoles	22
Chorus frog tadpoles	20

Arthropods	LC_{50} (ppm)
Brown shrimp	0.24
Stonefly nymphs	5.2
Daphnia pulex	2.0

*The ester formulation, used on the Range, is more toxic to fish than the formulations used in these tests.

Note: LD_{50} is the dosage at which 50% of the organisms were killed as is referred to as the lethal dosage.

LC_{50} is the concentration (in feed, in surrounding water) at which 50% of the organisms were killed (lethal concentrations).

Therefore, high numbers indicate low toxicities.

Table B-4

2,4,5-T Toxicity

Mammals LD_{50}	(mg/kg)
Rat	300
Dog	100

Birds* LC_{50}	(ppm)
Mallards	> 5000
Pheasants	1250 to 2500
Coturnix	> 5000

Fish LC_{50}	(24 hr) (ppm)
Harlequin fish	1.0 (Butyl Ester)
Bluegill	1.8 (Isopropyl Ester)

Arthropods LD_{25}	(ppm)
Daphnia	1.5
Eucypris	0.5
Hyallella	0.7
Palaemonetea	1.2
Amphiagrion	7.5
Pachydipla	8.0
Tramea	8.0
Chironomous	6.0

*Chickens exposed to 2,4,5-T showed a reduction in egg production. There was no change in the fertility or hatchability of the eggs.

Note: LD_{50} is the dosage at which 50% of the organisms were killed as is referred to as the lethal dosage.

LC_{50} is the concentration (in feed, in surrounding water) at which 50% of the organisms were killed (lethal concentrations).

Therefore, high numbers indicate low toxicities.

A comparison of the various toxicities of the herbicides to various organisms is given in Table B-5. The toxicity of DDT is included for comparative purposes. Silvex and 2,4,5-T may be considered slightly toxic or toxic to some mammals and fish, although they are relatively non-toxic to birds. These chemicals do not dissolve in water readily and it is likely that they degrade within or near the area of application. Their metabolites should be determined and monitored in the surface water system for movement and for toxicity to fish.

Table B-5

Comparison of Herbicide Toxicities to Toxicity of DDT

Mammals LD_{50} (mg/kg)

	Rats	Mouse	Rabbit	Guinea pig	Dog
Dalapon	7570 to 9330	> 4600	3860	3860	
Picloram	8200	2000 to 4000	2000	3000	
Silvex	1070	2140	850	850	
2, 4, 5-T	300				100
DDT	420 to 800	200	250 to 400	400	60 to 75

Birds LC_{50} (ppm)

	Mallards	Pheasants	Coturnix
Dalapon	> 5000	> 5000	> 5000
Picloram	> 2000	> 2000	
Silvex		3000 to 5000	> 5000
2, 4, 5-T	> 5000	1250 to 2500	> 5000
DDT	850 to 1200	300 to 700	400 to 600

Table B-5 (Continued)

Comparison of Herbicide Toxicities to Toxicity of DDT

Fish LC_{50}	(ppm)	(24 hr, except DDT: 96 hr)	
	Rainbow trout	Bluegills	Fathead minnows
Dalapon	> 500	115	440
Picloram	150		135
Silvex	23	2.9	8.9
2, 4, 5-T		1.8	
DDT	0.007	0.008	0.019

Arthropods LC_{50}

	Daphnia
Dalapon	6.0
Picloran	> 380
Silvex	2.0
2, 4, 5-%	1.5
DDT	0.002

Note: LD_{50} is the dosage at which 50% of the organisms were killed as is referred to as the lethal dosage.

LC_{50} is the concentration (in feed, in surrounding water) at which 50% of the organisms were killed (lethal concentrations).

Therefore, high numbers indicate low toxicities.

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