DOE/EIS-0006

DOE/EIS-0006
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Final Environmental Impact Statement

WIND TURBINE GENERATOR SYSTEM

Block Island, Rhode Island

Responsible Official

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U.S. DEPARTMENT OF ENERGY
Washington, D.C. 20545

July 1978

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1. SUMMARY

1. SUMMARY

The U.S. Department of Energy (DOE) has conditionally selected a site on Block Island, Rhode Island as an installation site for the field testing of a MOD-OA wind turbine generator system developed by private industry under contract to NASA. The Block Island site was originally proposed by the Block Island Power Company, the Narragansett Electric Company and the Rhode Island Division of Public Utilities. Its selection is contingent upon the completion of detailed negotiations and environmental impact assessment procedures, of which this document is a part.

1.2 BACKGROUND

1.2.1 Introduction

The field test project is the second phase of a two-phase program to 1) take wind measurements at 17 candidate wind turbine sites, and 2) field test large experimental wind turbines. On Block Island, Phase I was begun in late 1976, and would continue throughout the Phase II test period to provide a data base for the operational assessment of the wind turbine.

1.2.2 Description of Proposed Action

An experimental wind turbine generator (WTG), designated MOD-OA, will be installed on a knoll in New Meadow Hill Swamp, electrically

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integrated with the adjacent Block Island Power Company power plant and operated to supply electricity to the existing utility network. The MOD-OA wind turbine is a horizontal-axis machine with a large two bladed propeller-type rotor and generator assembly mounted on a steel truss tower. The 200-kilowatt MOD-OA has a tower height of 100 feet, rotor diameter of 125 feet, and a total height of 165 feet. The machine will generate a maximum 200 kilowatts of alternating current at its "rated wind speed" of 19 miles per hour (at 30 feet) and above, up to 34 miles per hour. Above 34 mph the blades will be feathered and braked.

Once the site is prepared by the utility and the turbine is erected by a NASA contractor, the turbine will be operated in phase with the utility network for a two to four year field test period. After project completion, a decision will be made regarding disposition of the wind turbine. If the machine is not turned over to the utility, it will be removed and the site restored to its original state.

Associated with the proposed installation and operation of the wind turbine will be the installation and operation of a Cable TV network. This alternative has been identified as a means of mitigating the impact of turbine-induced television interference and is discussed in Sections 3.2.1, 5.4 and 9.2. Where a potential for measurable environmental effects exists, such effects will be monitored.

1.2.3 Anticipated Benefits

The field test program will 1) provide valuable data necessary for the further development of large wind turbines, and 2) demonstrate the feasibility of large, utility-based wind systems for providing significant amounts of electrical power. It will help determine the performance characteristics, operating and maintenance needs, and economics of a wind energy system interconnected with a conventional power plant and used to supply power through an existing utility network. Existing information on the environmental impact of large wind turbines will be verified.

1.2.4 Characteristics of Existing Environment

The WTG site is in the eastern central portion of the island on a grassy knoll in the New Meadow Hill Swamp. Land on which the site is located is owned by the Block Island Power Company. The site, as well as the adjacent power plant facility, is zoned "business." Seven diesel-generators, with a capacity of 3,615 kilowatts, supply power to the island's distribution system. The average power level generated ranges from 250 kilowatts in the winter to 1,500 kilowatts in the summer. Block Island, about 12 miles offshore mainland Rhode Island and about 16 miles east-northeast of Montauk Point, Long Island, is six miles long and three and one-half miles wide at its widest point. It is a popular summer resort; estimates of peak holiday weekends have run as high as 3,000 visitors. Summers on Block Island are mild, but winters are harsh and cold with northeasterly storms that raise the winter average wind speed to about 20 miles per hour, well above the summer average.

1.3 POTENTIAL ENVIRONMENTAL IMPACTS

1.3.1 Impact of Construction Activities

The effects of site preparation and construction activities on transportation, the local economy and the aesthetic character of the site are expected to be minor. The effect on ecological systems is also expected to be minor. No encroachment of equipment or personnel on the Meadow Hill Swamp is expected. Earth excavated for the tower foundation will remain at the site, where it will be used to level the knoll summit. Waste concrete will be disposed of on BIPC property in such a manner that it will not flow into or be deposited in the marsh. No new roads are needed to the site.

1.3.2 Impact of Wind Turbine Generator Structure and Operation

1.3.2.1 Human Environment

The potential impact on the aesthetic qualities of the area include visual impact, which is found to be difficult to assess and highly subjective, and wind turbine noise, which is not a significant factor. Social and economic effects of the addition of the generating unit to the local utility system and a possible increase in local tourism are assessed and found to be beneficial. Potential safety risks involve the possibility of tower failure, blade failure , and aircraft-turbine collisions. Actions taken to decrease risks are discussed, including 1) the maintenance of an exclusion area around the turbine, 2) automatic redundant machine shutdown and safety systems, 3) regular preventive maintenance, and 4) visitor control measures if needed. The effect of the turbine on electronic communications is assessed and television interference is found to be "unavoidable", if no corrective measures are taken. However, wind turbine-induced interference may be alleviated by the installation of Cable TV.

1.3.2.2 Biotic and Abiotic Systems*

A slight decrease in wind speed down-wind of the turbine may result from machine operation; however, this is not expected to effect nearby vegetation. Measures will be taken to prevent possible erosion resulting from the loss of ground cover near the base of the turbine due to the movement of vehicles and personnel.

Terrestrial animal life near the site may be disrupted due to activity associated with operation and maintenance. Competent observers have not identified the Block Island Meadow Vole in the site area.

Block Island lies along the Atlantic flyway, a major migratory route for birds. Assessment of the potential for bird kills at

*Reference letter of comment #1.

the wind turbine shows that the primary hazard is to nocturnal migrants which are flying considerably below their normal cruising altitude due to storm or overcast conditions or which are landing near the site to feed or rest. In addition, there is some hazard to low-flying diurnal migrants which cannot see the turbine due to fog.

1.4 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

The possibility of bird kills at the turbine cannot be ruled out. However, the risk of this occurrence is similar to that posed by other tall structures, such as radio towers and buildings. It can be expected that the potential for bird kills will increase at the height of seasonal migration.

Turbine-induced television interference is found to be "unavoidable" at this site if corrective measures are not taken. A cable television network would eliminate possibility of the interference. The Federal intention to install such a network is discussed as an "alternative" in Sections 5.4 and 9.2.

1.5 ALTERNATIVES

Possible alternative actions include discontinuation of the project, selection of another site from among the other 16 candidate sites and the alleviation of adverse effects. The first alternative would seriously delay the Federal effort to demonstrate the feasibility of economical, large-scale wind turbines to enable the early implementation of wind energy. The second alternative would delay the Federal effort and cause additional government expense, and may result in testing the turbine at an inferior site. The adverse effect of turbine-induced interference can be alleviated by the installation of Cable TV on the island.

1.6 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The use of the site for the field test period would not have a detrimental effect on the long-term productivity or future options of the region. Nor would such an effect occur if the wind turbine is transferred to the utility at the end of this period.

1.7 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS

Most of the approvals and/or permits necessary for turbine installation and operation were obtained by the proposers before submittal of their proposal for use of the Block Island site. Strong support for the WTG test project on Block Island has been voiced at both state and local levels (See Appendix B.). There are no apparent conflicts with land use plans, policies or controls.

1.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

There will be no significant irreversible or irretrievable commitments of resources.

1.9 ENVIRONMENTAL TRADE-OFF ANALYSIS

The environmental impacts, costs and benefits of the project are assessed in relation to possible alternatives (Section 1.5, above). It is stated that benefits gained from the WTG test project experience outweigh expense of transporting the turbine, equipment and personnel to the island. Since no significant environmental impacts are anticipated, these benefits also outweigh the environmental effects which will occur.

2. BACKGROUND

2. BACKGROUND

2.1 Introduction

The U.S. Department of Energy (DOE) is engaged in an effort to promote the rapid development and commercialization of wind power as a major source of inexhaustible, virtually pollution-free energy. One of the major goals of the program, carried out by the Wind Systems Branch, Division of Solar Technology, is the development of industry-built, utility-operated wind energy conversion systems (WECS). As part of this program, DOE has embarked on the second phase of a two-phase project to select wind turbine generator (WTG) sites for installation and field testing of three 200-kilowatt WTG's, designated MOD-OA, and one 2,000-kilowatt WTG designated MOD-1. Selection of 17 candidate sites, using available wind data from nearby locations, was made in June, 1976. Wind data have been collected at these sites, under Phase I of the project, since late 1976. From among these sites, a site on Block Island, Rhode Island, proposed to DOE by the Block Island Power Company, the Narragansett Electric Company and the Rhode Island Division of Public Utilities, has been tentatively selected for installation and field testing of a MOD-OA wind turbine generator. Final Phase II award is contingent upon completion of detailed negotiations and environmental impact assessment procedures.

Phase I of the project involves the installation, operation and monitoring of meteorological instrumentation (two anemometers,

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two wind direction sensors and a recorder) on a 160-foot (48.77 meter tower). Phase I was begun in late 1976. Wind measurements on Block Island will continue throughout Phase II to provide a data base for the wind turbine generator (WTG) field test project. Since the potential environmental impacts of the meteorological tower on Block Island have already been investigated and found to be insignificant in an Environmental Impact Assessment prepared prior to the announcement of the 17 candidate sites, (see reference 33) they will not be discussed further in this report.

The primary focus of Phase II is the actual field testing of a utility-operated WTG to provide information and data regarding the operation of large wind turbines in a user environment. In brief, the co-sponsors, particularly the Block Island Power Company (BIPC), will supply the site, operating personnel, and most interconnection equipment; DOE will provide the wind turbine, research equipment and additional support. This environmental impact analysis deals primarily with the implications of Phase II.

2.2 Description of Proposed Action

An experimental wind turbine generator (WTG), designated MOD-OA, will be installed on a knoll in New Meadow Hill Swamp, electrically integrated with the adjacent Block Island Power Company (BIPC) power plant and operated to supply up to 200 kilowatts of electricity to the existing utility network for a field-test period of two to four years. The test program will help determine performance characteristics, operating and maintenance needs, and economics of a wind energy system interconnected with a conventional power plant and used to supply power through existing utility lines.

The wind turbine will be the third 200-kilowatt machine built for DOE under the technical management of the National Aeronautics and Space Administration's (NASA) Lewis Research Center (LeRC) at Cleveland, Ohio. The 200-kilowatt model is an improved version of a 100 kilowatt experimental machine now being tested by NASA-LeRC near Sandusky, Ohio. Like its prototype, the machine will have a two-bladed propeller-type rotor with a span of 125 feet (38.10 meters) mounted on a 100-foot (30.48 meter) steel truss tower.

In conjunction with the proposed installation and operation of the MOD-OA wind turbine, is the installation and operation of a Cable TV network. This alternative measure has been identified as a means for mitigating the impact of wind turbine-induced television interference and is discussed in Sections 3.2.1, 5.4 and 9.2. In addition, environmental effects of the wind turbine will be monitored when the need for such monitoring is indicated.

2.2.1 The Wind Turbine Generator

External Appearance

The MOD-OA wind turbine generator installation consists of a 100-foot (30.48 meter) blue or light gray open-truss tower, similar to a large utility transmission tower, on which a white streamlined housing, known as a nacelle, and two rotor blades will be mounted. The blades, 125 feet (38.10 meters) in diameter, will be fitted to a hub at one end of the nacelle and will, in their vertical orientation, extend approximately 65 feet (19.81 meters) above the tower, giving the entire WTG structure a 165-foot (50.29 meter) maximum height above the knoll and a 190-foot (57.91 meter) height above New Meadow Hill Swamp. In operation, the nacelle will be rotated so that the blades are located downwind of the tower as they revolve at a maximum speed of 40 rpm. A photograph of a similar turbine is shown in Figure 1 and turbine specifications are provided in Table 1.

The Tower

The four-sided steel tower will be constructed of pipes, with 8-inch vertical members braced with horizontal and diagonal rods. All joints will be welded. The tower base will be firmly anchored to a 200-cubic yard (152.91 cubic meter) poured concrete slab buried 10 feet (3.05 meters) below grade. Access to the drive train assembly will be by a 1500-pound (.68 metric ton) capacity cable-hung hoist suspended in the center of the tower.

Figure 1 - MOD-O Series Wind Turbine Generator

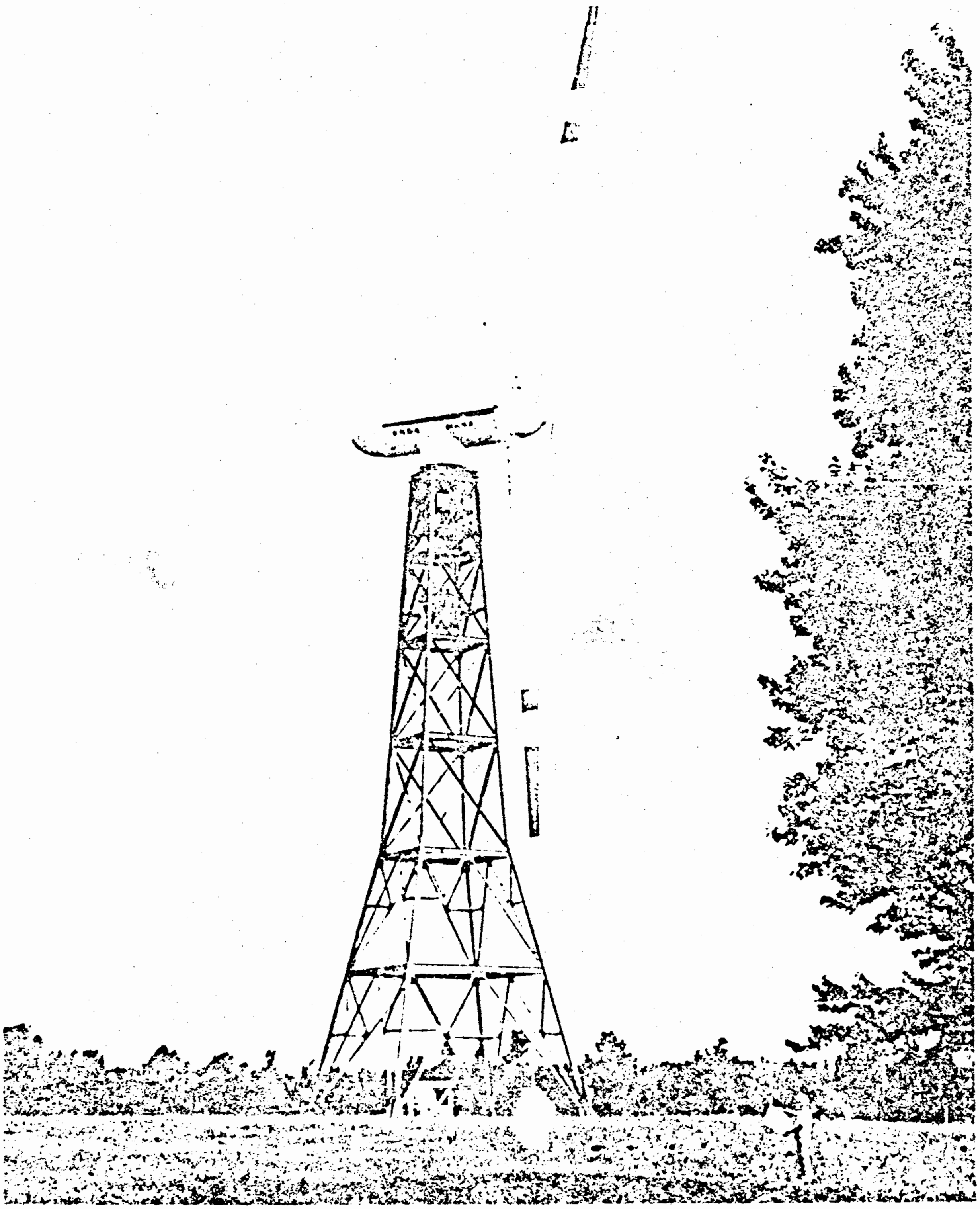


TABLE 1

SPECIFICATIONS OF THE

MOD-OA

WIND TURBINE

	MOD-OA
Power	200 kilowatts
Total Height	165 ft. (50.29 m.)
Total Weight	91,000 lbs. (41.27 metric tons)
Tower:	
Type	steel truss
Height	100 ft. (30.48 m.)
Base	30 x 30 ft. (9.14 x 9.14 m.)
Peak	7 x 7 ft. (2.13 x 2.13 m)
Weight*	47,000 lbs. (21.32 metric tons)
Foundation	200 cu. yds. (152.91 cu. m.) concrete slab
Rotor:	
Number of Blades	2
Type	aluminum
Rotor Diameter	125 ft. (38.10 m.)
Swept Area	12,265 sq. ft. (1139.46 sq. m.)
Rotor Weight	7,200 lbs. (3.26 metric tons)
Power System:	
Generator Type	Synchronous A.C.
Rating	250 KVA
Power Factor	0.8
Voltage	480 V

*Does not include foundation.

Turbine and Rotor Assembly

The turbine will be equipped with two aerodynamically tapered blades, each 62.5 feet (19.05 meters) long and weighing 2,300 lbs. (1.05 metric tons), designed to rotate at a constant speed of 40 rpm in a counterclockwise direction (looking upwind). The MOD-OA's blades are constructed of aluminum. They will be affixed to a hub and swept downwind at a fixed cone angle of 7 degrees from the vertical. Blade pitch will be automatically controlled by a hydraulic pump which drives a rack and pinion actuator and gears which swivel the blades, increasing or decreasing their exposure to the wind (lift) to maintain constant rpm. During periods of low wind (under 8-10 mph) or wind which exceeds the designed blade operation load (over 34 mph), the blades will be feathered. In a feathered position, the blades are designed to withstand wind velocities of 150 mph.

Drive Train Assembly and Housing

The blades will be attached to a high torque, low speed drive shaft, which transfers rotation through a high speed gearbox (1800 rpm). Torque is then transmitted to a synchronous generator by means of a belt and pulley drive. The entire assembly will be mounted on a bed-plate and enclosed in a 30-foot (9.14 meter) long cylindrical fiberglass streamlined nacelle for protection from the elements.

Yaw Controls

Orientation of the rotor into the wind will be controlled by an automatic yaw mechanism installed in the upper section of the tower just beneath the nacelle. The entire nacelle and blade assembly will rotate, at a rate of 1/6 rpm, on top of the tower in response to changes in wind direction.

Other Structures and Equipment

Service Stand -- A small 8-foot (2.44 meter) high service stand will be installed on the knoll near the tower base to support the drive train and blade assembly during initial assembly, testing and subsequent maintenance operations.

Cabling and Transformers -- Power from the wind turbine will be fed directly to the power plant load bus through underground power cables. A step-up transformer, protective relays and solid-state governors on the power plant diesel generators will be required to interface the WTG with the utility network.

Electrical Control and Monitoring Equipment -- The operation of the wind turbine will be automatically controlled and monitored from the present Block Island Power Company plant. A NASA instrumentation van will be at the site during the initial testing stages and will return periodically for system checkout and maintenance.

Electrical Output of the Wind Turbine

The Mod-OA will produce 200 kilowatts of 60 Hz a.c. power at its rated wind speed of 19 mph (at 30 feet). The MOD-OA electrical system consists of a 480-volt, 200 kilowatt synchronous generator; an electrically operated generator breaker; a station auxiliary transformer; and a 480-volt to 2400-volt step-up transformer with a primary breaker. The generator and system have adequate protection, instrumentation and controls. The generator is furnished with a brushless exciter, a solid-state voltage regulator, and automatic synchronizing equipment.

2.2.2 Construction Activities

Site Preparation

Preparation of the site to accept the wind turbine and erection equipment will require grading and leveling of the knoll summit to yield an area approximately 150 feet by 150 feet, excavation and pouring of the tower foundation, spreading and rolling of crushed stone on the graded surface, the installation of underground cables between the site and the power plant, and the installation of control equipment in the diesel generator plant. Soil borings made in August 1976 indicate that the subsoil is adequate to bear the foundation (See Section 2.4.4).

Wind Turbine Installation

The wind turbine will be installed by a private contractor selected by the NASA-Lewis Research Center. Wind turbine components will be assembled on the 8-foot (2.44 meter) service stand at the site. On-site construction of the tower will involve the welding of pipe sections and erection by crane (see below). Once completed, the entire machine assembly will then be lifted by crane and installed at the top of the tower. Construction will take from seven to nine months.

Construction Equipment

A soil test rig, a road grader and dump truck, a concrete mixer, a welding rig, and several transport and trailer trucks will be required for site preparation and wind turbine installation. A large 85-ton-capacity conventional crane with a 150-foot (45.72 meter) boom will be required to install the rotor and the drive assembly and generator on the top of the tower.

The 85-ton crane necessary to lift the wind machine will weigh approximately 85 tons (77.1 metric tons). The tower will weigh approximately 24 tons (21.77 metric tons) and in all likelihood will be shipped in two pieces of 12 tons (10.88 metric tons) each, approximately 50 feet (15.24 meters) long. The crane and the tower will require transportation by seagoing tug and barge at different times. Three round-trips will be required-two for the crane and one for the tower. It is also possible that two round-trips will be necessary to transport a smaller crane for the tower erection; although a 35-ton crane is now on the island, its presence or availability at the time needed is open to question.

The ferry boat is available for rental during the off season and is capable of three trips a day; its capacity is 35 tons (31.75 metric tons). The ferry will handle loads like the 70 foot (21.34 meter) long rotor blade trailer, the wind turbine machine, and the mobile data van.

Technical and Construction Personnel

Preparation of the site will require a limited number of workers to operate grading equipment, pour the foundation, and install underground cables. Site preparation and wind turbine construction will require one government inspector for six months and a six-man contractor crew for nine months. Short visits by personnel from the various utilities cooperating with BIPC and by supervisory personnel from DOE and NASA-LeRC will also be required during the installation process.

2.2.3 Environmental Monitoring

Monitoring of environmental impacts of the wind turbine will be carried out intermittently when information is desired, conditions warrant, or the severity of an anticipated impact indicates monitoring is necessary. For example, verification of the effect of the wind turbine on television reception could be accomplished by brief preannounced periods of Cable TV system shutdown. BIPC personnel will be required to inform DOE of any significant, unanticipated impact (such as a large bird kill) which develops. In addition, DOE and NASA personnel will make periodic visits to the site and will be receptive to information or comments offered by island residents.

2.2.4 Restoration of the Site

At the termination of the project and if ownership of the wind turbine is not transferred to the utility, all government-installed facilities and installations (such as the wind turbine tower and service stand) will be dismantled, removed from the site, and disposed of in a manner which will not adversely affect the site or the Block Island environment. The knoll will be restored or allowed to revert to its natural state, as required by the New Shoreham Town Council and Planning Board.

Such restoration may include removal of the tower foundation, refilling of excavations with earth, planting of grass or other vegetation, or other actions needed to satisfy local government requirements and/or sound environmental practices. In addition, within the limits of its jurisdiction over restoration activities, DOE will ensure that its action will maintain the integrity of New Meadow Hill Swamp as a wetland environment and will not pose hazards to human safety.

2.2.5 Installation and Operation of Cable TV

As revealed in Section 3.2.1, Cable TV is the most effective means of alleviating turbine-induced television interference. Therefore, DOE proposes to install a Cable TV network on the island and maintain service for the duration of the WTG test project. Documents which would transfer ownership of the wind turbine to the utility would specify that operation of Cable TV must be maintained to alleviate potential TV interference. Discussion pertaining to the installation and impact of such a system may be found in Sections 5.4 and 9.2.

2.3 Site Selection and Anticipated Benefits

The Block Island site, selected for the WTG test program, has been judged to best satisfy established technical and programmatic criteria. Individual site evaluations are based on factors such as the availability of wind energy at estimated turbine hub height, the reliability of wind data, and climatological and topographical hazards. Each of the 17 selected sites, valued for its uniqueness, was carefully chosen to ensure that the sites selected for the field tests would represent a broad range of topographic types, climatic regions, sizes of power distribution network, and major power sources.

The Block Island site was selected on the basis of its high historical average-annual wind speed of 16.6 mph, the high reliability of the available wind data and the low percentage of time when the wind would be below the 8 mph required for machine operation. (See Section 2.4.8 below.) In addition, Block Island is heavily dependent upon expensive imported fossil fuels and, thus, represents the type of isolated, small utility system where wind power may be cost-competitive with conventional power services in the near future. Data collected and experience gained on Block Island would have near-term relevance to the federal program objective of accelerating the commercialization of wind systems.

It is expected that this installation and field testing of a MOD-OA will provide valuable experience and data regarding wind turbine design features, the durability of machine components, wind characteristics, and electrical stability and control requirements of a WTG-utility interface. Monitoring at the site will also enable further identification and verification of the environmental, legal and social issues associated with large wind turbines.

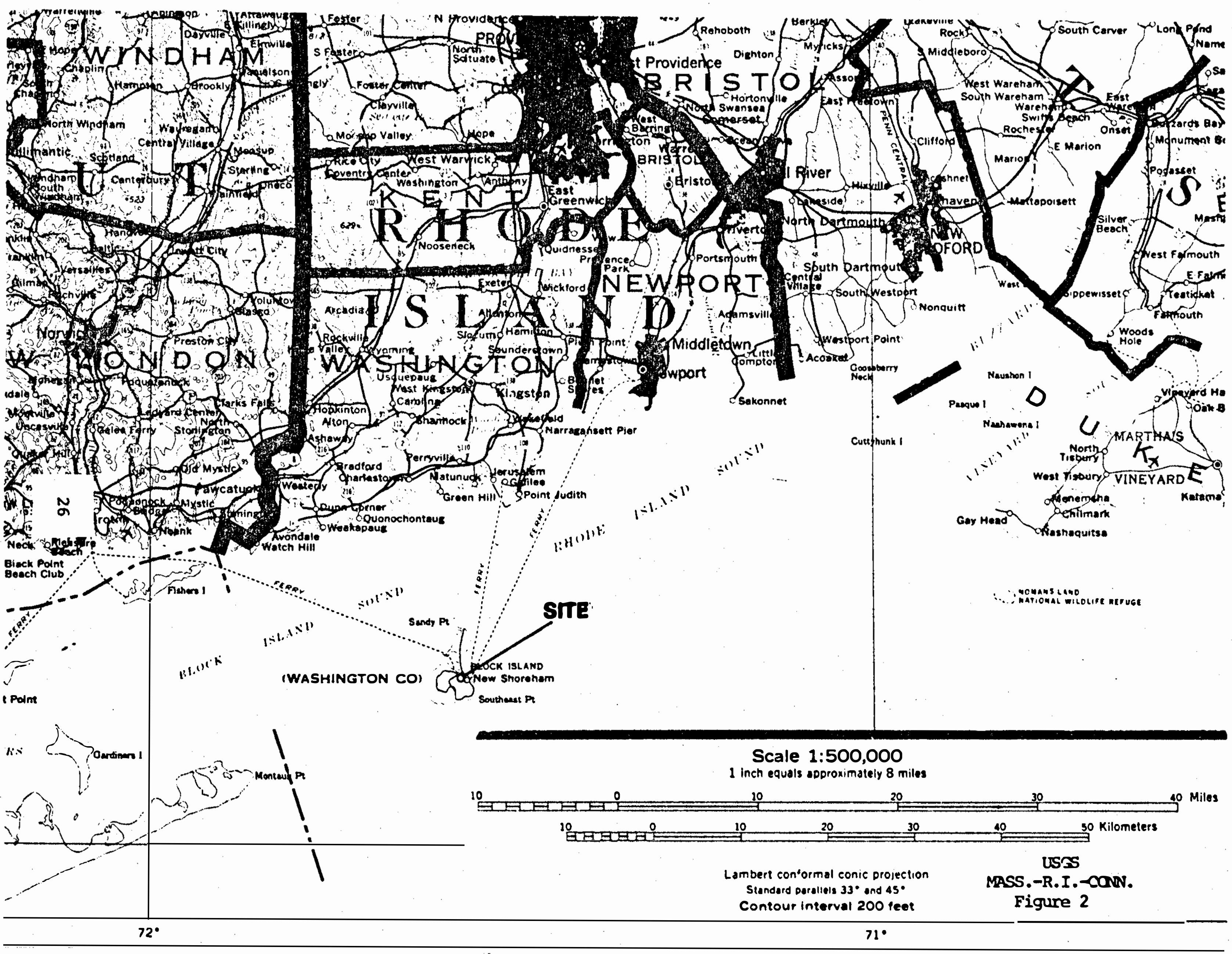
The test program will help determine performance characteristics, operating and maintenance needs, and economics of a wind energy system which is interconnected with a conventional power plant and used to supply power through existing utility lines. The field-test program will help demonstrate that wind-generated utility-based power is technically feasible and, in regions with high winds, is a potentially cost-effective means of reducing the use of high-cost, polluting fossil fuels. Block Island is representative of the type of small isolated community where wind power may offer immediate advantages.

2.4 Characteristics of Existing Environment

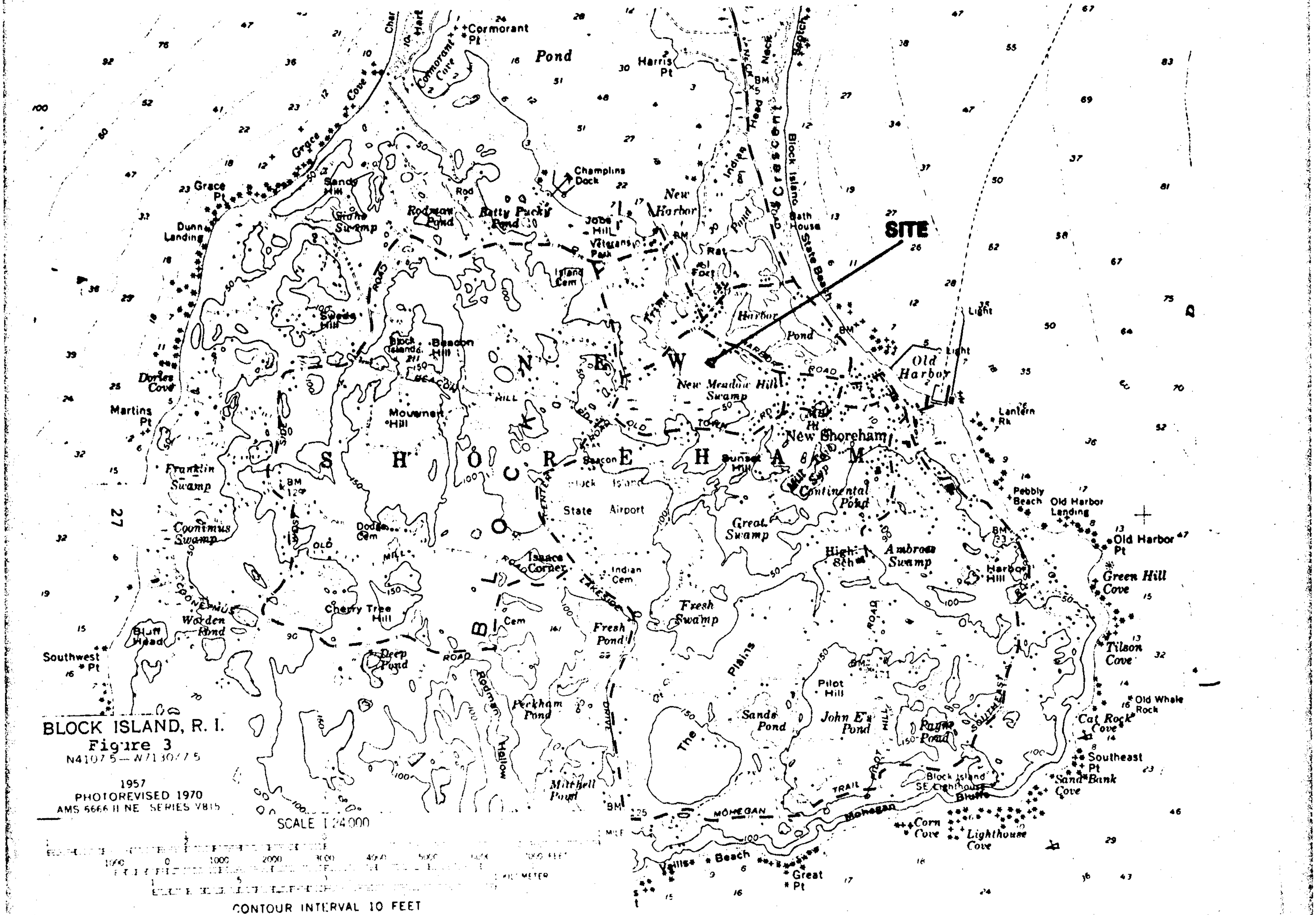
2.4.1 Location and Topography

Block Island is the popular name for the town of New Shoreham, Washington County, Rhode Island. Located near the termini of the Block Island Sound, the Rhode Island Sound and the Atlantic Ocean, it is about 12 miles off the south coast of mainland Rhode Island and about 16 miles east-northeast of Montauk Point, Long Island, New York (see Figure 2). The island lies between latitudes $41^{\circ}08'$ and $41^{\circ}14'$N and longitudes $71^{\circ}32'$ and $71^{\circ}37'$W. Total land area is approximately nine and one-half square miles. The island, described as pear-shaped, is six miles long and three and one-half miles wide at its widest point. It is included on the U.S. Geological Survey (USGS) Block Island seven and one-half minute topographic quadrangle map, revised in 1957 and published at a scale of 1:24,000 with a contour interval of ten feet. Figures 2, 3, 4 and 5 show the island and the portion of the island where the site is located.

Block Island consists of two irregular, hilly areas connected by a sandy lowland. The WTG site is in the eastern central portion



USGS
MASS.-R.I.-CONN.
Figure 2



BLOCK ISLAND, R. I.
Figure 3
N4107.5—W7130/7.5
1957
PHOTOREVISED 1970
AMS 6666 II NE SERIES V815
SCALE 1:24 000

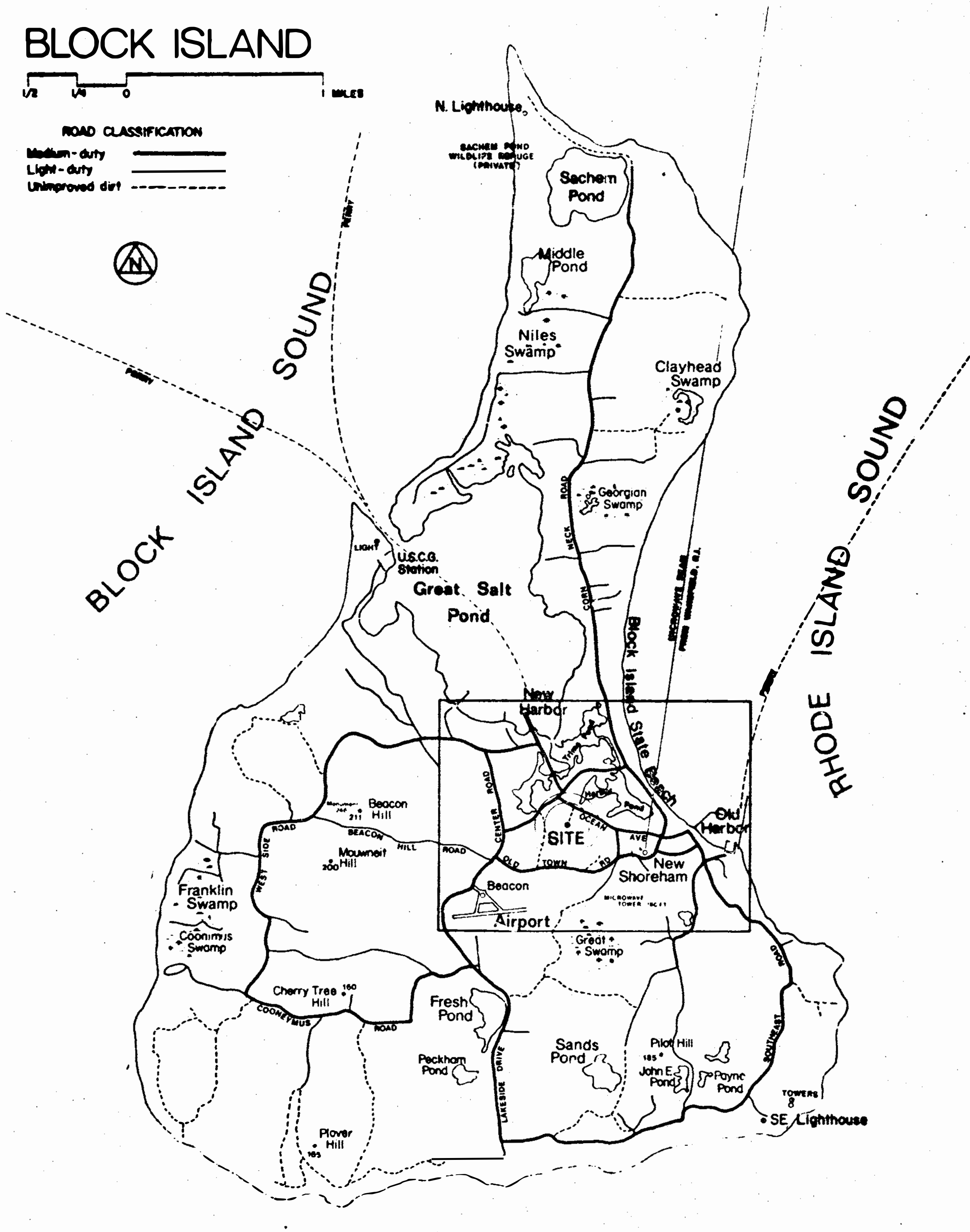


Figure 4 Block Island

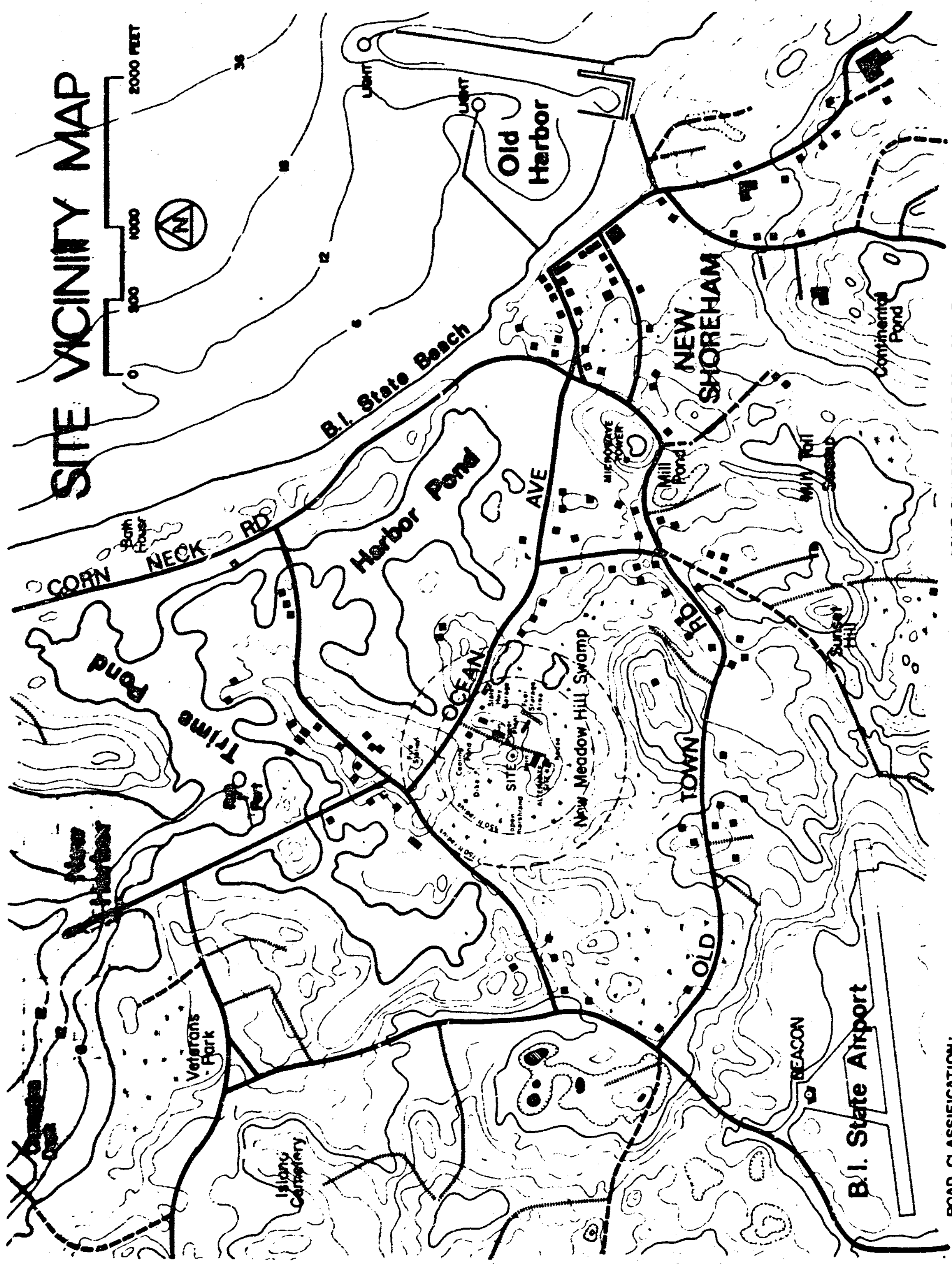


Figure 5 Site Vicinity Map

of the island, on a grassy knoll in a small freshwater wetland known as New Meadow Hill Swamp, one-half miles from the sea. The area near the site is generally low and rolling, with low-lying areas five to ten feet above sea level. The site itself is 30 feet above sea level and 20 to 25 feet above New Meadow Hill Swamp, which surrounds the knoll to the west, south and east. The meteorological tower utilized in Phase I is located on another knoll 250 feet southwest of the primary site.

2.4.2 Local Demography

Population and economic activity reached its peak shortly after the turn of the century. The island prospered as a resort area with flourishing summer hotels, a fishing industry and over 1,400 year-round residents until the 1920's. A decline in the summer trade was attributed to the increased popularity of the automobile for vacation. Some attribute the lessened emphasis on fishing and agriculture to the occurrence of the 1938 hurricane which destroyed the fishing fleet, and the increasingly harder to justify distance from land markets as mainland transportation improved.

The permanent residential population, as shown in Table 2, steadily decreased to 496 by 1960 and has since then remained relatively stable. Demographic calculations predict that the island's population will remain near its current level through the year 2,000. The population increases by approximately 1,200 summer residents, 1,000 overnight visitors, and 1,000 day visitors on an average day during the 100-day summer season. Estimates of peak holiday week-ends have run as high as 3,000 visitors.

Table 2 - Population

Year	Population
1915	1,414
1930	1,029
1960	496
1970	501
2000	500

Source: U.S. Census of Population 1960 and 1970, Rhode Island, Land Use Analysis, Rhode Island Department of Community Affairs, 1968.

With few employment opportunities, the proportion of the population in the productive age brackets has declined sharply. Young people have been leaving the island to seek employment, educational and cultural opportunities. Many who have come to live there have been older retirees. As illustrated in Figure 6, in 1970 nearly 43 percent of the population was 55 years old or older; 60 percent over 45, and only 20 percent was under 18.

Since the first half of the century, the island's resident labor force has dwindled to approximately 180 persons. The majority are in professional, managerial, craft and service occupations (including construction and maintenance personnel and sales clerks) as shown in Table 3. Indicative of the highly seasonal economy, 85 percent of all retail sales are made between May and October. The 1969 median family income of 8,289 dollars was substantially below the Rhode Island median of 9,733 dollars.

POPULATION CHARACTERISTICS
NEW SHOREHAM, R.I., 1970

Figure 6

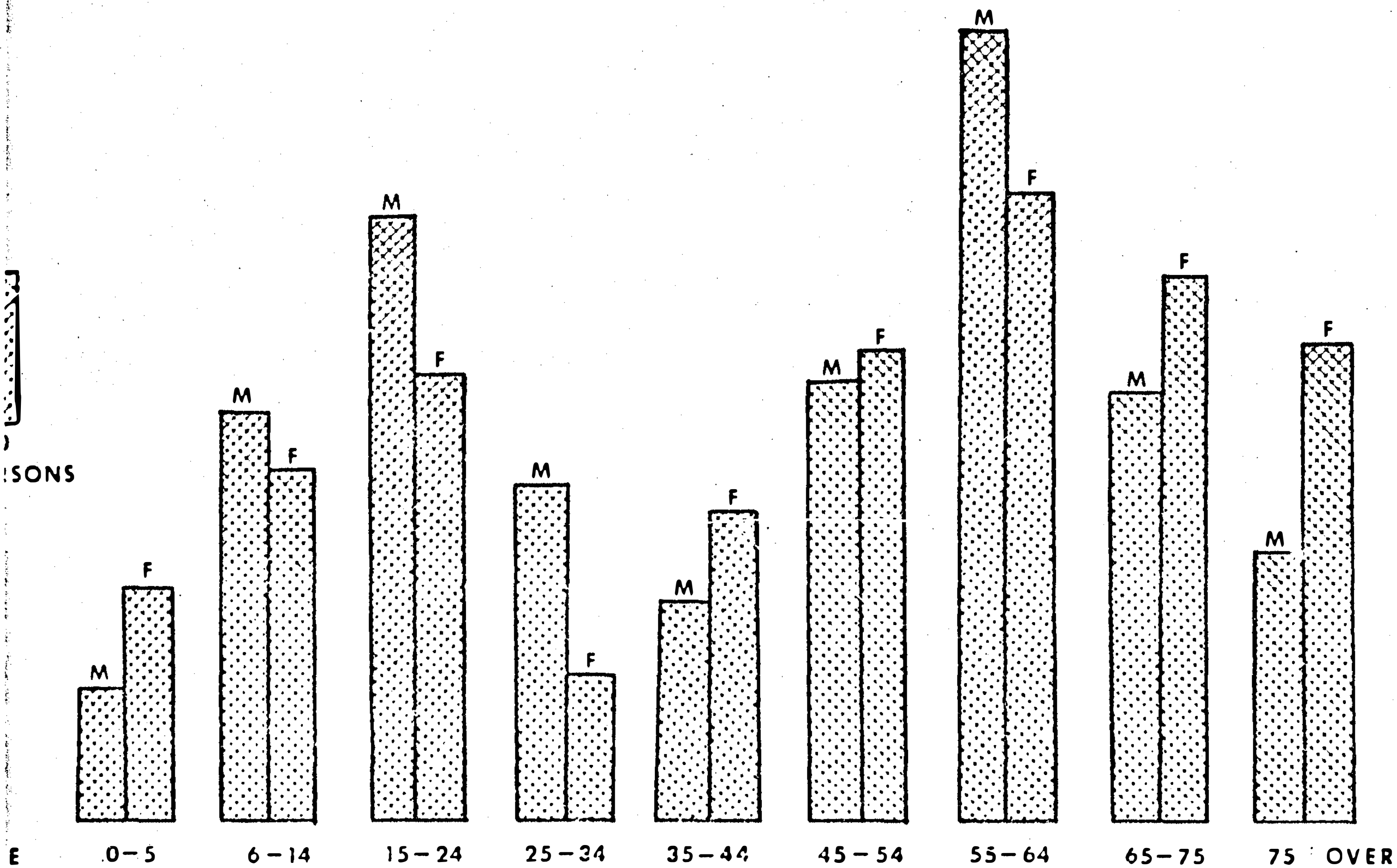


Table 3 - Labor Force

Occupation	Labor Force 1960	Labor Force 1970
Professional & Managerial	53	37
Craftsmen	33	44
Laborers	32	11
Operatives & Service Workers	23	34
Clerical	12	11
Sales	8	--
Not Reported & Other	15	15
Total Employed	176	152
Unemployed	19	28
Total Labor Force	195	180

Source: U.S. Census of Population, 1960, 1970.

Based on data from both the 1960 and 1970 census, it is estimated that about 48 percent of the housing units (365) were constructed prior to 1939. From 1940 to 1960, only 74 new housing units were constructed on the island, but between 1960 and 1970, there was a net increase of 314 new dwelling units. Of these, 301 were built by summer residents as seasonal homes, an average of 30 units per year. Table 4 summarizes housing trends between 1960 and 1970. From 1970 to 1974, 125 building permits were issued for new dwelling units. There has been very little multiple unit construction on the island since 1960. Thus, following several decades of overall decline, there is an upswing in the construction of new summer homes, but not as yet in restoration of the former hotel capacity and businesses serving tourists.

The number of hotel and other overnight tourist accommodations has, in fact, declined in the past decade, despite some rental cottage construction. For example, three hotels totaling over 400 rooms closed. The Block Island Chamber of Commerce (1972, Land Use Analysis) estimates that the existing overnight capacity of approximately 1,500 to 1,800 persons is not adequate to sustain the island's tourist economy.

Table 4 - Housing Characteristics

Occupancy	Number of Units 1960	1967*	1970
Year-round	195	173	208
Owner-occupied	149	-	153
Renter-occupied	46	-	55
Seasonal (or vacant)	243	486	544
Total - all units	438	659	752

*Year-round and seasonal single family homes, single family seasonal units in cluster colonies, and 7 housing units in mixed use structures, but not seasonal rooms.

Source: U.S. Census of Housing, 1960 and 1970, and 1967 Inventory of Housing in Land Use Analysis, Rhode Island Department of Community Affairs, 1968.

Development on the island is concentrated in Old Harbor, the village center, as shown on Figure 3. Old hotels, inns, rooming houses, restaurants and shops cluster along the harbor front. Homes and a few scattered inns line the five streets radiating into the countryside, especially to the south and to the southwest toward the airport.

The USGS topographic map (1957, revised 1970) indicates sixteen structures, several of which may be interpreted as homes, within a 1000-foot radius around the site. An August, 1976 site visit indicated that some of the structures shown on the map no longer exist. Two structures, at the end of the access road, are an old barn and farmhouse which are used for storage by BIPC and are presently unoccupied.

Along Ocean Avenue from its intersection with Beach Avenue to the southwest are: the New Shoreham Fire Station at the intersection of the two roads; two one-story buildings which house the seven diesel generators of BIPC; the state highway garage; and, southeast of the garage, a small pond, a gasoline service station and several houses. There are no residences within 550 feet of the site (the theoretical maximum throw distance in the event of blade failure, see reference 16), although a 400 foot portion of Ocean Avenue passes within this radius.

2.4.3 Land Use

State and Local Land Use Plans

Public and privately sponsored plans for the island all emphasize the need to preserve the island's unique natural environment and charm in the face of development pressures. At the same time, they recognize the need to strengthen the economy. These plans do not explicitly forecast population and economic activity, nor do they present any optimum levels for designing future public facilities.

The Land Use Analysis (LUA) prepared for Block Island in 1968 by the Rhode Island Department of Community Affairs, assumes 500 year-round residents to be the minimum to sustain basic economic life, and projects this minimum as the population through the year 2000.

The New Shoreham Comprehensive Community Plan (CCP) (see reference 23) attempts to outline community objectives; to plan for community facilities, recreation, conservation and land use; and to recommend implementation action. The CCP was prepared in consultation with the Town Council and Planning Board by the Rhode Island Department of Community Affairs, and was adopted by the Town Council in April, 1972.

A major stated goal of the CCP is "... to ensure that development will occur in an orderly fashion and will be in keeping with the present character of the community...".

Recognizing the recent trends in construction of new homes throughout the island, the plan emphasizes that many types of development would diminish the island's "unspoiled, rural character," a strongly held value of the year-round residents and a major attraction to tourists and seasonal residents. "Therefore, (the CCP states) the major planning concern in New Shoreham is to prevent indiscriminate, undesirable development."

At the same time, the CCP provides for additional development to strengthen the hotel/tourist business base, lengthening the season and attracting more visitors. Statements in the CCP about the development potential of the Old and New Harbor areas and the contiguous, presently sparsely settled areas assume moderate growth.

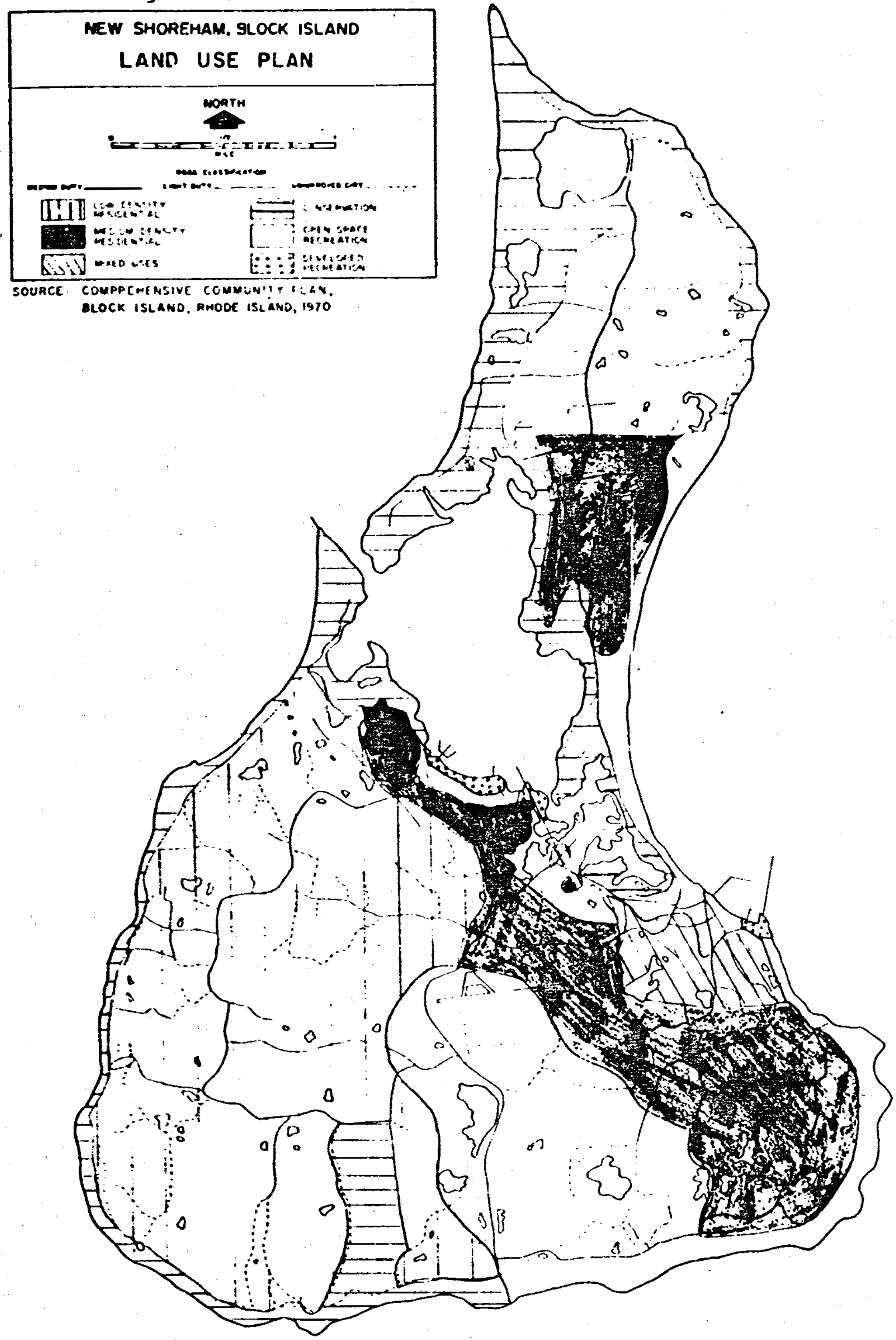
Figure 7 outlines future land uses proposed in the Comprehensive Community Plan (CCP). These proposed uses take into account both environmental and socioeconomic objectives, present land use patterns, soils, flood areas, elevations, ground water, public utilities, development trends and community goals.

The draft report, State Land Use Policies and Plan, sets forth the state, environmental, social and economic goals; development and conservation policies; and recommendations for state-local implementation. These are similar to those which the CCP outlined somewhat more specifically for the island.

General Land Use

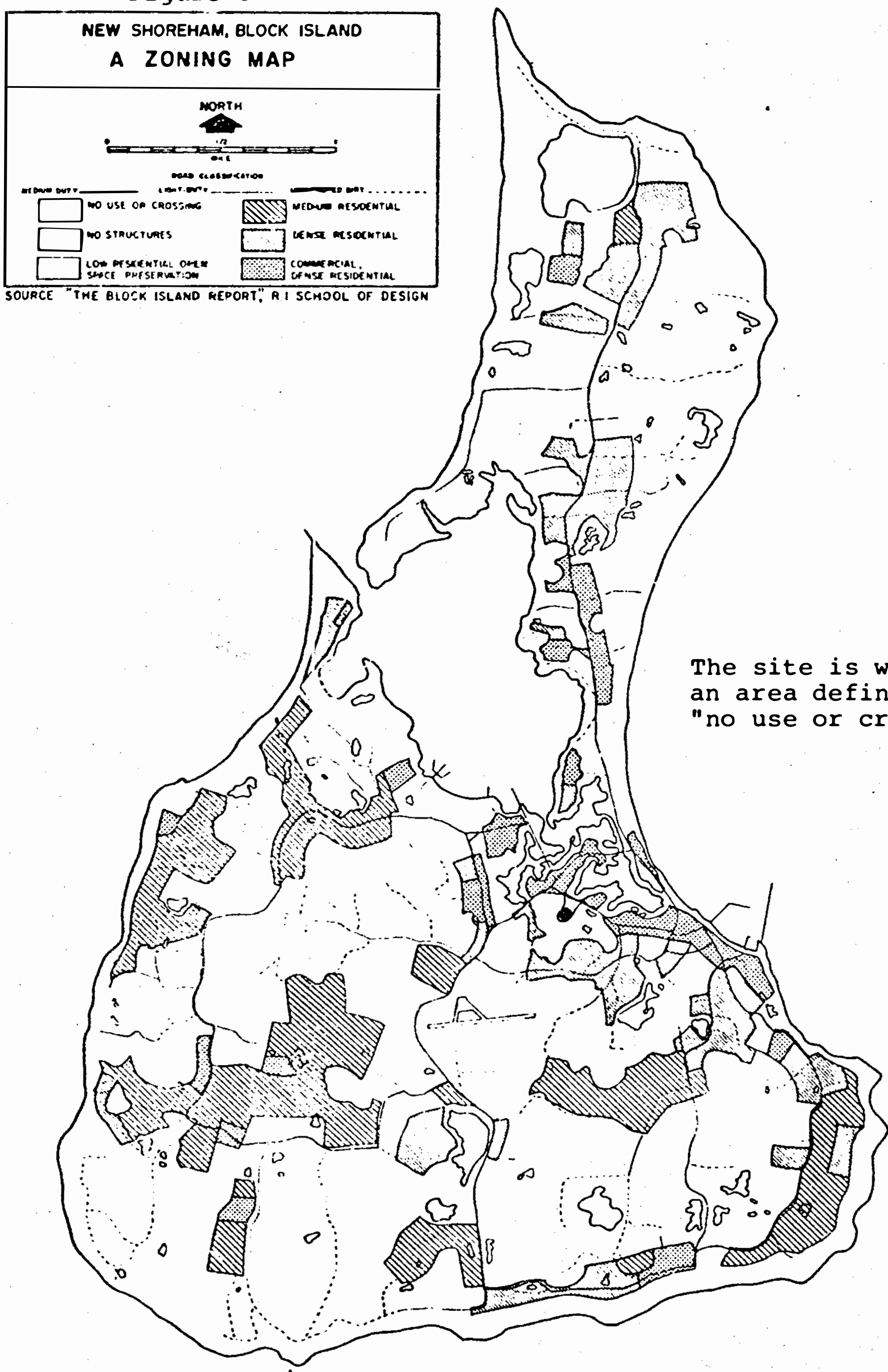
Despite its relative popularity as a vacation spot, Block Island has not experienced the rapid growth of other resort areas on the Atlantic coast. As a result, only 10 percent of the island's 6,500 acres have been developed. The tourist industry is moderately prosperous, but no new hotels or other major developments

Figure 7



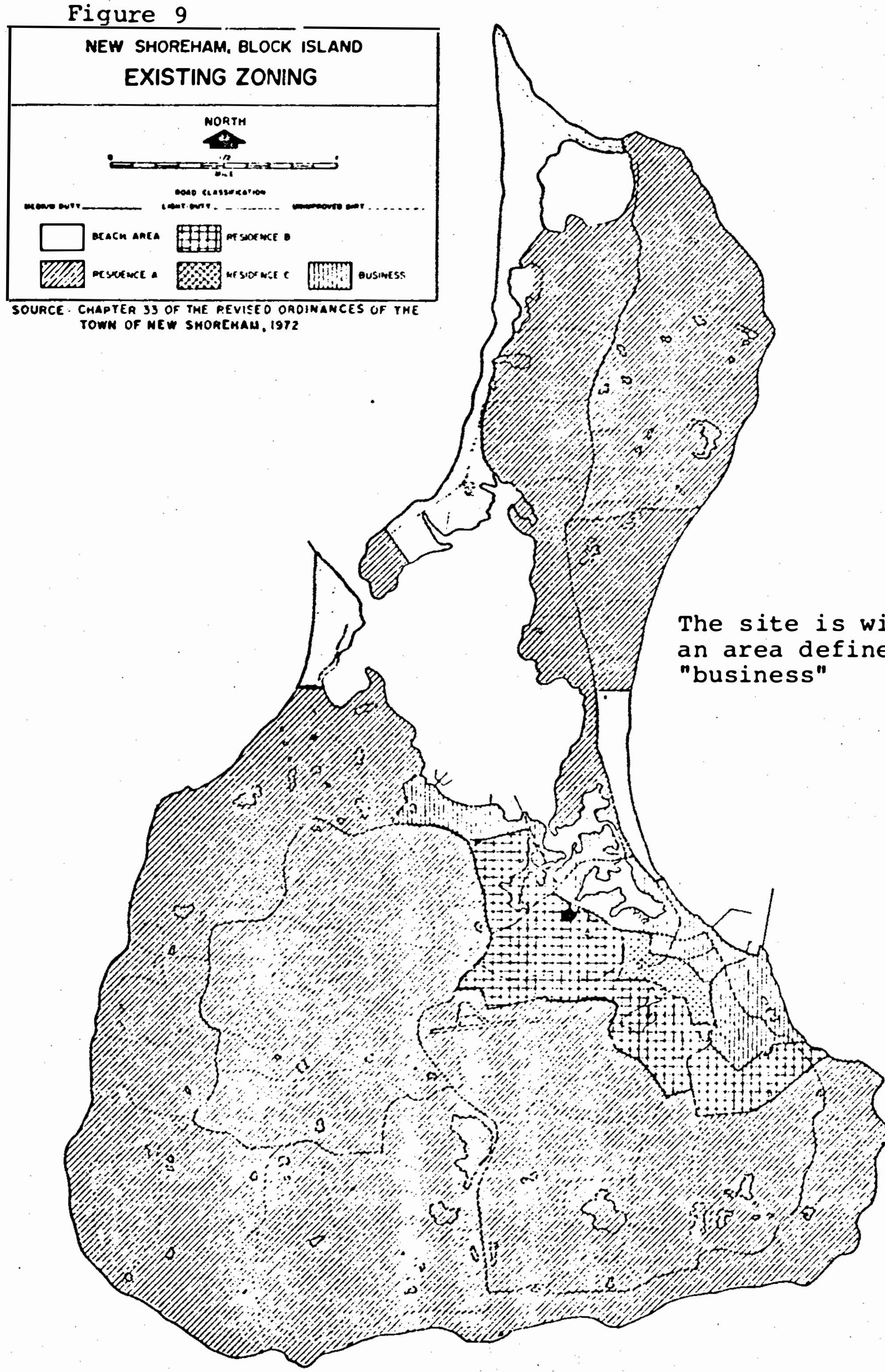
SOURCE: COMPPEHENSIVE COMMUNITY PLAN, BLOCK ISLAND, RHODE ISLAND, 1970

Figure 8



The site is within
an area defined as
"no use or crossing"

Figure 9



The site is within an area defined as "business" (such as condominiums) have been built in recent years, and the island has largely maintained its rustic character.

Agriculture on the island is limited to dairy farming and the raising of early vegetables and potatoes. The major agricultural area is Corn Neck to the north. There is now no major farming activity within one-half mile of the site, although the BIPC property was a farm at one time, as evidenced by the abandoned barn and farmhouse near the knoll.

The major land-use features within one mile of the site are the Block Island State Airport, 2,500 feet to the southwest, at higher elevation (100 feet); New Harbor, the prime pleasure boat harbor on the island, 3,000 feet to the north-northeast; Old Harbor, the old commercial fishing dock, 4,000 feet to the east-southeast; and the village center of New Shoreham, one-half mile to the south.

Land Use Near the Site

The property on which the site is located is owned by the Block Island Power Company and is well within the major sphere of development on the island. The BIPC property is bounded by Ocean Avenue to the north and Beach Avenue to the west. At present, most of the area within the 550 foot exclusion radius (See Section 3.2.1, "Potential Safety Risks") is devoted to power plant activities. Man-made features within the exclusion area include two buildings housing BIPS's diesel generators (200-300 feet northeast of the site), a 400 foot portion of Ocean Avenue, a state highway garage along Ocean Avenue, an oil and gasoline depot (about 500 feet east-southeast of the site) and an abandoned barn and farmhouse (100 and 200 feet southeast of the site). No residences are located within the exclusion area. Outside the exclusion area, the New Shoreham Fire Department is housed in a building northwest of the Ocean and Beach Avenue intersection. Besides the 600-foot access road leading to the site from Ocean Avenue, a narrow dike and road has been constructed by BIPC across the northwest corner of New Meadow Hill Swamp which is used as a cooling pond.

Accessibility

The site vicinity is bounded by Ocean Avenue (formerly Harbor Road) on the northeast, Old Town Road on the south and Beach Avenue on the northwest. A gravel service road extends from Ocean Avenue to the site.

Year-round ferry service is operated from Galilee on the Rhode Island mainland to Old Harbor, about a mile from the site. Over 100,000 passengers are carried to the island annually. The ferry is stern-loading and has a capacity of 35 tons. Barge and ferry boat operators serving Block Island indicate that, based on past experience, trips to Block Island during the winter period (November through April) are made on the average of four out of five days per week. In the summer additional passenger ferries are in service to New Harbor. There is also hydrofoil service from Galilee in the summer months.

Regularly scheduled passenger flights are available daily, year-around from the State Airport at Westerly, Rhode Island to the Block Island Airport and additional flights are made from the state's principal airport, Theodore Francis Green, in Warwick, Rhode Island.

Communications

Theoretical analyses and preliminary experiments now being sponsored by DOE indicate that large wind turbine blades may interfere with FM radio, TV and microwave signals. Reception of these and other signals on Block Island is described below and potential effects are assessed in Section 3.

FM Radio -- Present FM radio reception is adequate.

Television -- The island is a fringe area for television reception. While individual antennas receive the nine VHF channels and five UHF channels listed in Table 5 reception quality is generally poor. Some signals are received from New York, but these are very weak and are generally not viewed on the island.

Table 5 - Television Channels

Channel	Origin	Distance (km)
2	Boston, Mass.	129
3	Hartford, Conn.	105
4	Boston	129
5	Boston	129
6	New Bedford, Mass.	156
7	Boston	129
8	New Haven, Conn.	105
10	Providence, R.I.	64
12	Providence	64
27	Worcester, Mass.	105
36	Providence	64
38	Boston	129
53	Norwich, Conn.	56
56	Boston	129

Microwave -- A microwave beam carrying telephone transmission from Point Judith, Rhode Island is received at a 160-foot tower near Mill Pond, one-quarter mile to the southeast of the WTG site.

Aircraft Navigation -- The Block Island Airport (41°10'N-71°35'W) has one 100-foot by 2,500-foot runway (REIL Rwy 28, MIRL Rwy 10-28). It has a landing approach of 128° at a 2,000-foot altitude to the DORY intersection, which is 5.8 nautical miles from the runway. The charted characterization of obstructions is "below 1,000 feet AGL."

The nearest Low Altitude Federal Airway, V-46, runs approximately 11.6 nautical miles (20 kilometers) from the airport between East Hampton, New York and Nantucket, Massachusetts. VOR (Very High Frequency Omnidirectional Range) beacons are located about 23.5

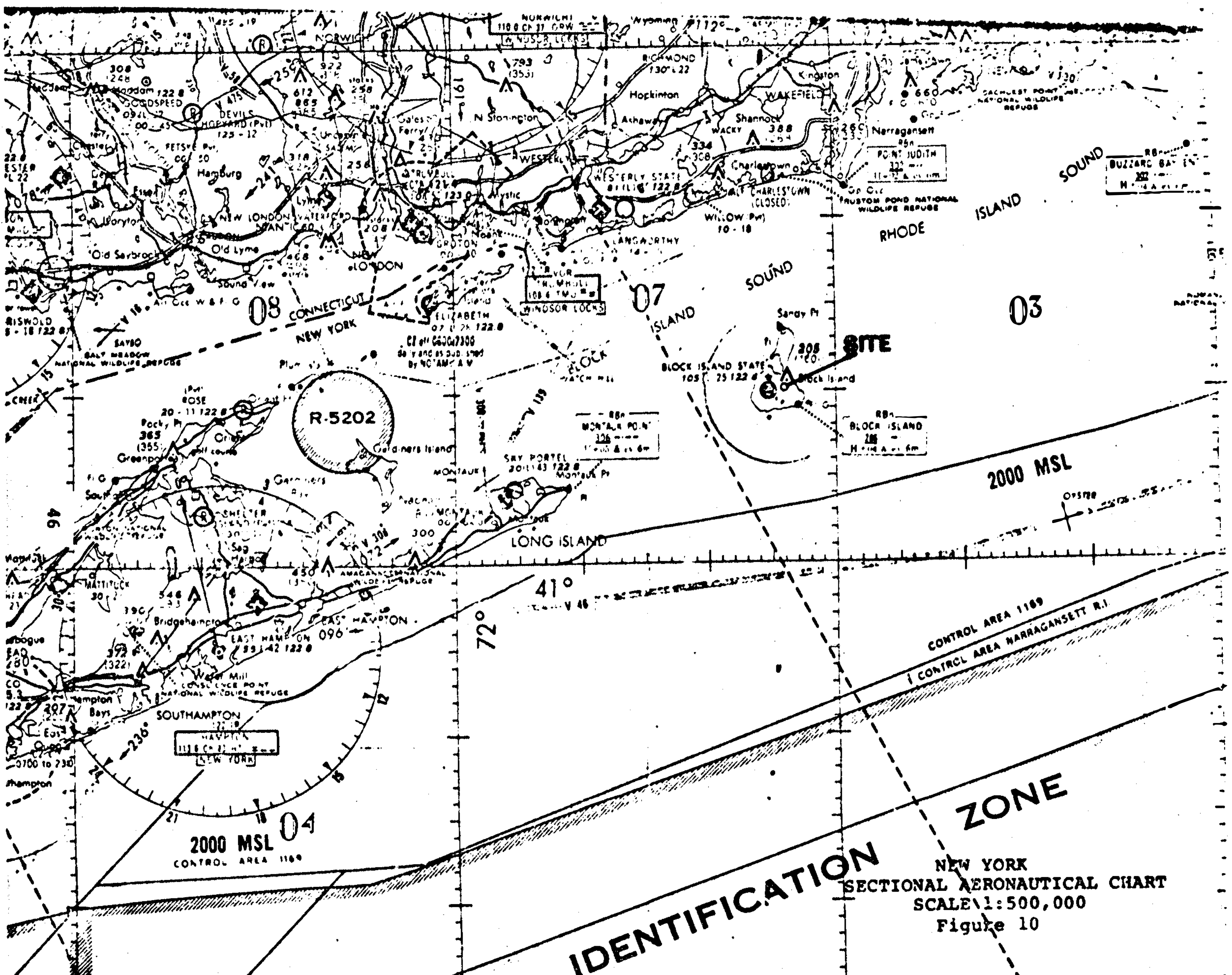
nautical miles northeast at Trumball (108.4 MHz), about 30 nautical miles at Norwich (110.0 MHz, Channel 37), about 34.5 nautical miles north-northeast at Providence (115.6 MHz, Channel 103), and about 36 nautical miles west-southwest at Hampton (113.6 MHz, Channel 83). Figure 10, taken from the New York Sectional Aeronautical Chart, presents aeronautical characteristics of the Block Island area.

Ship Navigation -- Three marine lights project from the island. The Block Island North Lighthouse is located on the northern tip of the island at Sandy Point. The Block Island Southeast Lighthouse, located on the southeastern shore is coupled with a marine radiobeacon (286 kHz). A beacon-light is also located at Old Harbor.

Existing Electrical Power Network and Rate Structure

In January of 1976, the Block Island Power Company retail residential price for electricity was 21 cents per kilowatt-hour (kWh) for the first 100 kWh and 7.5 cents per kWh over an initial 100 kWh each month. The minimum charge was 19 dollars per month.

The alternative "all electric" rate was seven cents per kWh for the first 800 kWh and 5.5 cents per kWh over 800 kWh per month. The minimum charge was 40 dollars per month. Average revenue collected by BIPC on residential rates on the island is about three times more than the mainland average revenue collected by the Narragansett Electric Company. Fuel costs, to the power company,



NEW YORK
SECTIONAL AERONAUTICAL CHART
SCALE 1:500,000
Figure 10

between the island and the mainland show a similar contrast. The bus bar cost of electricity to BIPC is approximately three times higher than that to Narragansett Electric.

Seven diesel-generators, ranging in size from 150 to 1,000 kilowatts, supply power to the Block Island Power Company network. Total generating capacity is 3,615 kilowatts or 4,500 kilovoltampere. In the summer, the average power level generated is 1,500 kilowatts maximum and 500 kilowatts minimum. The winter average power level generated is 500 kilowatts maximum and 250 kilowatts minimum. Power is supplied through three banks of isolating transformers having a total capacity of 2,250 kilovoltampere. These transformers serve five radial 2,400-volt distribution lines that supply electric power to the whole island.

Each generator has a switchboard-type manually-operated oil circuit breaker and its own individual exciter controlled by an automatic voltage regulator of the electromagnetic type having a sensitivity of ± 1.5 percent. Frequency control is provided by electric governors that vary the speed of the diesel units. Frequency varies to ± four seconds a day. A 0.3 percent variation in frequency, resulting from a 10 percent load change, is restored to normal within seven seconds.

The Block Island Power Company generating plant and distribution system terminal are about 200 feet from the WTG site within the exclusion area. The distribution line to which the WTG would be connected has a 1,500 kilowatt capacity and handles a maximum peak load of 1,400 kilowatts and a minimum load of 225 kilowatts. This load is estimated to be 40 percent residential and 60 percent commercial during the summer and 70 percent residential and 30 percent commercial during the winter. The proposed point at which the wind turbine will be connected has a voltage of 2,500 volts or less. Step up transformers tie this section to the 2,500-volt system.

2.4.4 Geology

Block Island was affected by two or more periods of Pleistocene glaciation. The substrate of the island is composed of unconsolidated glacial deposits (about 50 feet above to 500 feet below sea level) of Pleistocene age resting on semiconsolidated material (about 500 to 1,000 feet below sea level) of Triassic or Cretaceous age. These, in turn overlie crystalline bedrock of the Paleozoic era. Most of the glacial deposits are part of the terminal moraine, consisting of till and sorted drift, that extends northeastward from the Ronkonkoma moraine of Long Island to Nantucket.

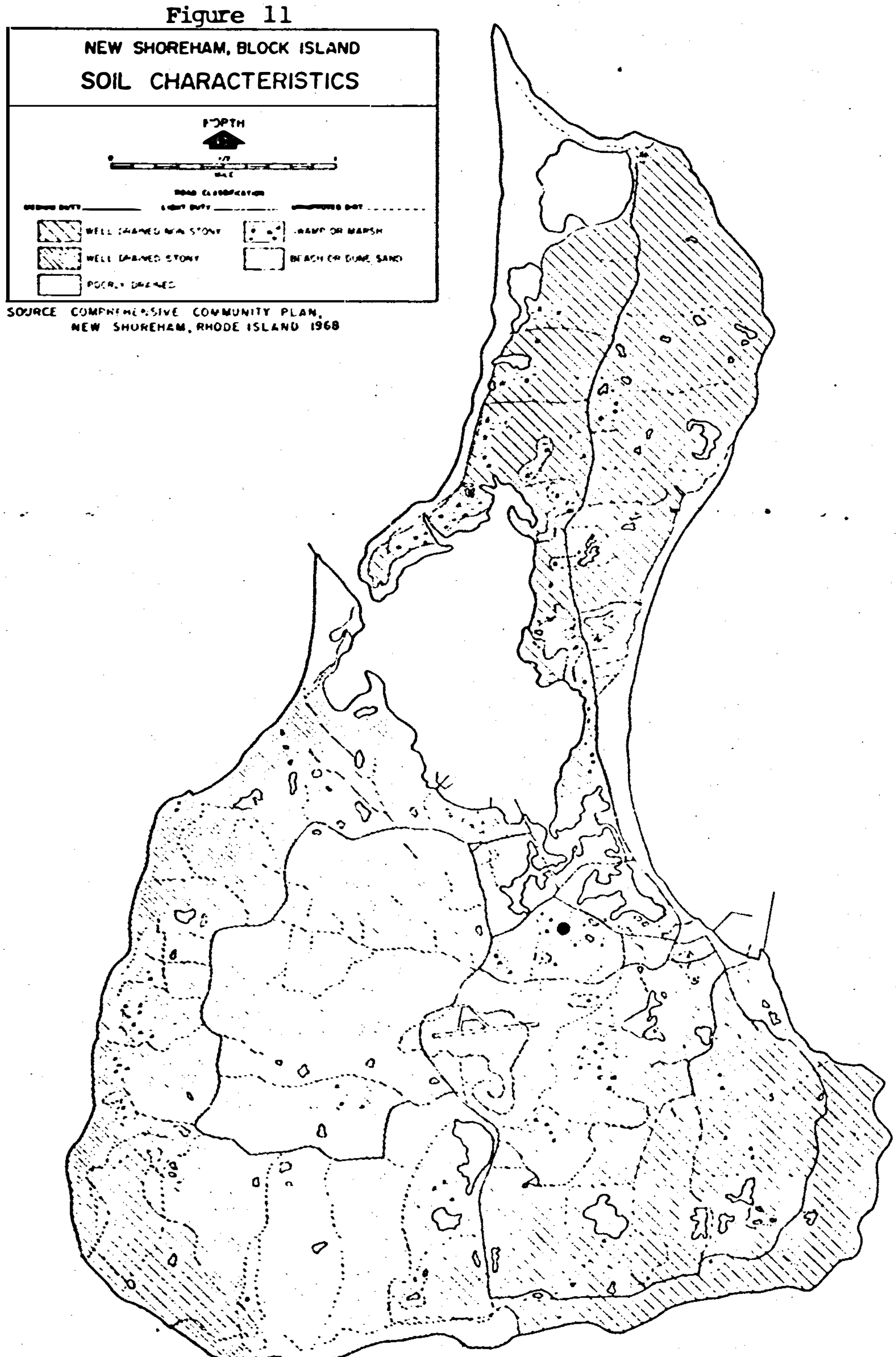
Block Island is characterized by low rolling hills; salt water and brackish ponds; freshwater ponds occupying glacial kettleholes; and freshwater marshes such as the New Meadow Hill Swamp. The island's soil is classified as Inceptisol, having a weakly differentiated horizon, and being prone to leaching due to relatively heavy rains on the island (an average 40 inches per year). General soil characteristics for Block Island and the site area are outlined in Figure 11.

Most of the island is overlaid by two types of fairly permeable soil: Narragansett Fine Sandy Loam, a well drained non-stony soil, and Gloucester Stoney Fine Sandy Loam, a well drained stony soil. A third type of soil, Whitman Silty Clay Loam, is poorly drained and occurs only in a few small bodies which occupy small depressions or pot holes and are practically stone free.

The rock-strewn soil on the site knoll is Gloucester Stoney Fine Sandy Loam formed on sorted drift and relatively permeable loose sandy till. Natural drainage through this soil (which covers the southwestern part of the island, at an average thickness of about two feet), is good to excessive.

New Meadow Hill Swamp is close to the water table as indicated by year round surface water. However, the site is located 20 to 25 feet above the marsh and, given the soil's good drainage characteristics, should not be subject to inundation or settling. Soil borings taken in August, 1976 indicate that the soil is stable. (See reference 8.) No significant inundation or erosion was recorded during the hurricane of 1938 or after heavy rains associated with Hurricane Carol in 1954.

Figure 11



SOURCE COMPREHENSIVE COMMUNITY PLAN,
NEW SHOREHAM, RHODE ISLAND 1968

2.4.5 Hydrology

The fresh ground-water reservoir of Block Island is contained in the unsolidated deposits and consists of (1) numerous small "upper perched water bodies" that are present in the higher parts of the island, (2) a large northern and southern "lower perched water zone" that lies beneath the upper perched water bodies and is above (but to some extent interconnected with) the main zone of saturation, and (3) the main zone of saturation. The chief and best potential source of fresh ground water is the lower perched water zone located in the southern section of the island. It yields about 40,000 gpd (gallons per day) for public supply from the large well field on the island. Recharge to the lower perched water zone is about 20 times the estimated near-future water needs (about 100,000 gpd) of the island. The main zone of saturation can probably yield a maximum of a few gallons per minute to individual wells without inducing salt-water encroachment; 1962 withdrawals were small.

Precipitation falling on the island is the sole source of ground-water recharge; average recharge is estimated to be about 2 mgd (million gallons per day). Most of the precipitation is derived from the water vapor furnished to the atmosphere by evaporation from the ocean. Cooling causes the atmospheric water vapor to condense on minute particles of matter such as dust, salt spray, and smoke. Condensation commonly occurs on minute salt (sodium chloride) crystals derived from the ocean. Thus, the precipitation falling on Block Island can be expected to contain more salt than precipitation that falls on most mainland areas. (The wind turbine has been designed and coated to ensure resistance to salt corrosion.) The availability of ground water is illustrated in Figure 12.

Total water consumption was about 80,000 gpd in 1962. Water on Block Island is high in iron (median 1.0 parts per million) and is relatively corrosive (median pH 6.2). The low lying sections of the coastline are subject to storm flooding and sea-water contamination (see Figure 13).

2.4.6 Noise Levels and Air Quality

Noise Levels

Ambient noise level measurements, approximately one mile from the WTG site were conducted by the Environmental Protection Agency (EPA) in January of 1975.

Recorded levels were indicative of a very quiet noise climate. On the basis of the above data, a crude estimate of the daytime equivalent sound level (Leq) was 40 decibels (dBA); the estimated nighttime Leq was about 27 dBA. These values were combined to obtain an estimated day-night average sound level (Ldn) of 39 dBA. This estimate was probably only valid during the winter season and it

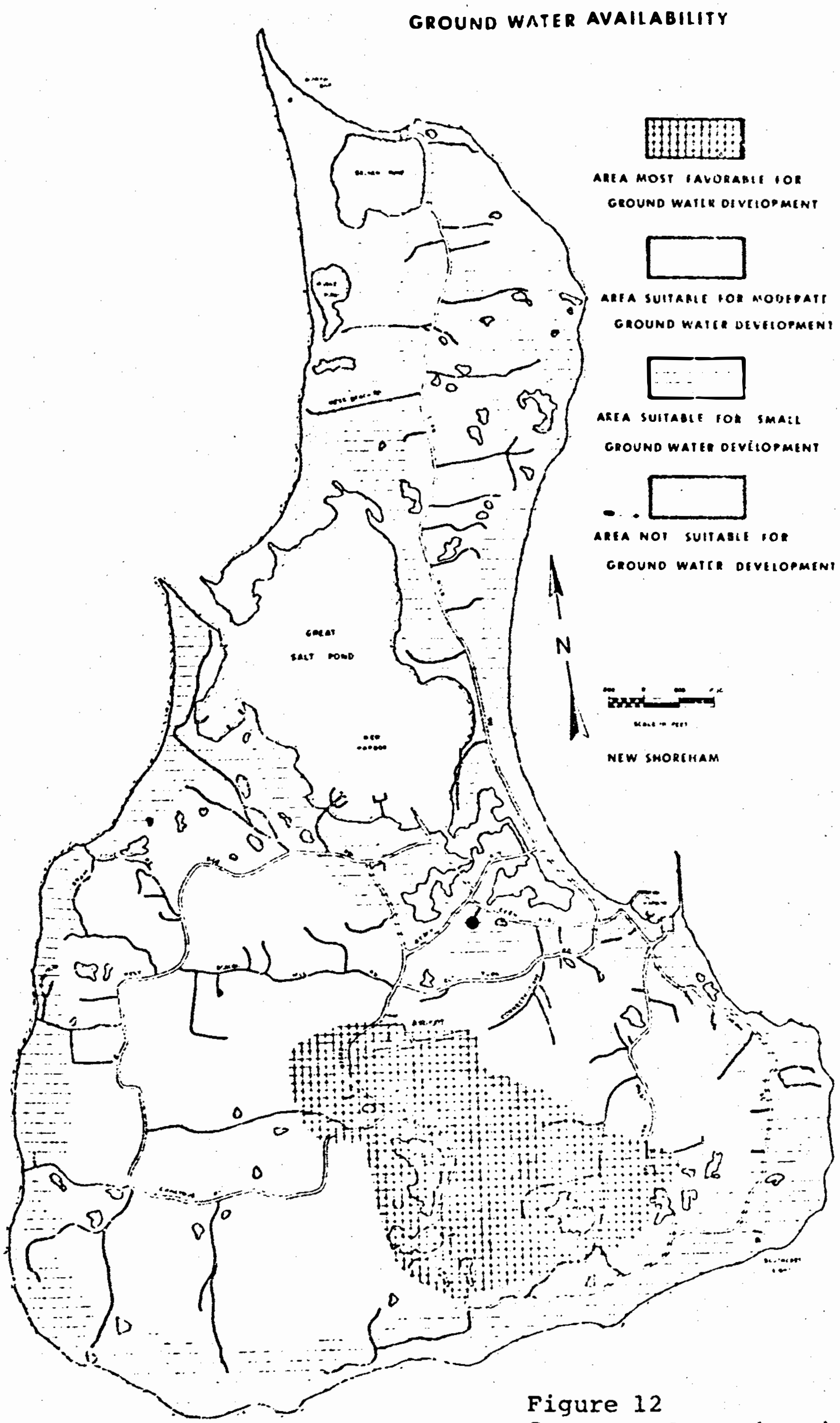


Figure 12
Source: Comprehensive Community Plan

FLOOD DANGER AREAS

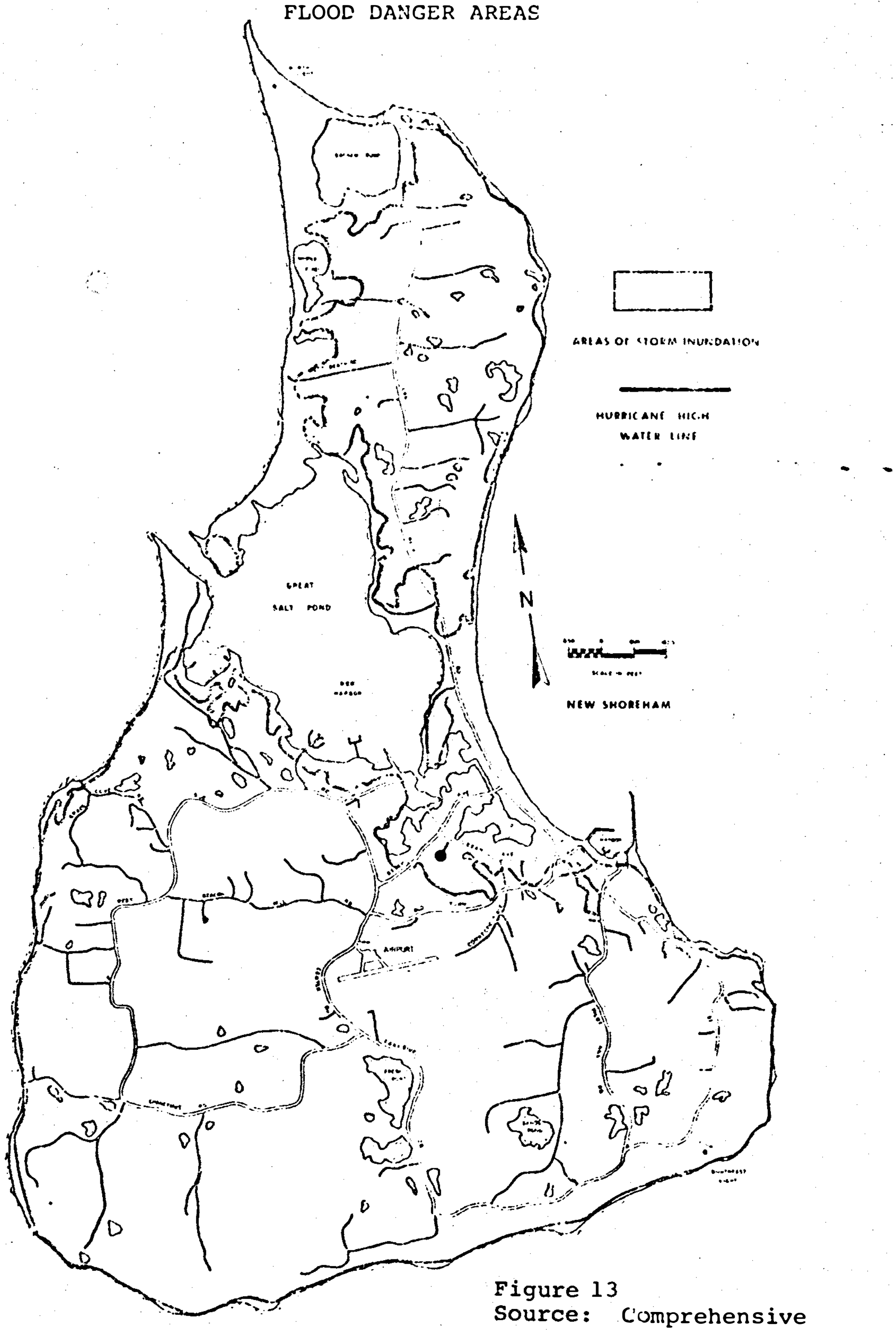


Figure 13
Source: Comprehensive
Community Plan

expected that the noise levels would have increased somewhat during the summer months due to the seasonal increase in population.

Air Quality

No major sources of air pollution presently exist on the island. From 1969 through 1972, the State of Rhode Island Department of Health maintained an air quality monitoring station at the New Shoreham Airport on Block Island (approximately 3,000 feet southwest of the proposed WTG site). Data obtained from this station are shown in Table 6. It can be seen from Table 7 that none of the air quality data measured during this period even approached violations of National Ambient Air Quality Standards or Rhode Island Ambient Air Standards; and therefore, the state discontinued the operation of the site.

Table 6 - 1970 Air Sampling Data
Block Island Airport*

	Pollutants		
	Particulates	Sulfur-Dioxide	Nitrogen-Dioxide
Number of Readings	13	12	12
Maximum 24-hours	66.7	15.7	86.5
Minimum 24-hours	19.2	7.9	5.6
Arithmetic Mean	36.8	8.7	12.4
Geometric Mean	34.2	-	-
Standard Deviation	1.45	1.23	2.20

*latest complete data available

Source: State of Rhode Island Department of Health

Table 7
Comparison of National Primary and Secondary Standards and Rhode Island Air Quality Standards

Pollutant	National Primary Standard	National Secondary Standard	State of R.I. 1973 Goal	State of R.I. 1975 Goal
Particulates	75 ug/M^3 (annual geometric mean)	60 ug/M^3 (annual geometric mean)	60 ug/M^3* (annual geometric mean)	50 ug/M^3* (annual geometric mean)
	260 ug/M^3 (24-hr maximum)	150 ug/M^3 (24-hr maximum)	168 ug/M^3* (24-hr maximum)	130 ug/M^3* (24-hr maximum)
Sulfur Dioxide	80 ug/M^3 (annual arithmetic mean)	60 ug/M^3 (annual arithmetic mean)	72 ug/M^3* (annual geometric mean)	57 ug/M^3* (annual geometric mean)
		1300 ug/M^3 (3-hr maximum)	858 ug/M^3* (1-hr maximum)	687 ug/M^3* (1-hr maximum)
	365 ug/M^3 (24-hr maximum)	260 ug/M^3 (24-hr maximum)	358 ug/M^3* (24-hr maximum)	286 ug/M^3* (24-hr maximum)
Nitrogen Dioxide	100 ug/M^3 (annual arithmetic mean)	100 ug/M^3 (annual arithmetic mean)	NONE	NONE
Carbon Monoxide	10 mg/M^3 (8-hr max. average)	10 mg/M3 (8-hr max. average)	9.2 mg/M^3* (8-hr max. average	NONE
	40 mg/M^3 (1-hr max. average)	40 mg/M^3 (1-hr max. average)		
Total Oxidants	160 ug/M^3 (1-hr max. average)	160 ug/M^3 (1-hr max. average)	118 ug/M^3* (1-hr max. average)	NONE
Hydrocarbons	160 ug/M^3 (3-hr max. average)	160 ug/M^3 (3-hr max. average)	118 ug/M^3* (3-hr max. average)	NONE

*Standard conditions for measurements are established at 25°C, 1 atm pressure.
Source: State of Rhode Island, Department of Health

2.4.7 Ecology

Vegetation

There are said to be more ponds than trees on Block Island. Very few trees of the original forest, which once covered the island, remain. Presumably, early settlers used almost all the available wood for fuel and lumber. The principal cover now consists of grasses, thickets of low-growing shrubs which have overrun abandoned farmlands, and old apple orchards.

No vegetation higher than 10 to 15 feet is located near the site. The grass covered knoll is surrounded on three sides by the fresh water marsh grasses and mud flats of the New Meadow Hill Swamp. Vegetation in the site area is comprised primarily of thistles, grasses, wildflower, and low to medium height bushes such as bayberry, rusugo rose, sumac and chokeberry.

Environmentally Sensitive Areas

An environmentally sensitive area is defined by the U.S. Environmental Protection Agency (EPA) to be any area which is intolerant to major changes by man. It has been expressed that exploitation of such regions could result in irreparable and irretrievable damage. Specific land types which fall under this category are: fresh and salt water ponds, marshes and wetlands, coastal zones, areas with impermeable soils, areas which have a slope greater than 15 percent, areas with high ground water tables which generally includes any area on Block Island which is below the ten foot elevation, areas favorable for ground water supply, and dunes and bluffs. The island's environmentally sensitive areas have been outlined in Figure 14. The site-knoll is 30 feet above sea level. Although adjacent areas, such as the New Meadow Hill Swamp, would be considered environmentally sensitive to inundation due to their low elevation, the site itself appears stable.

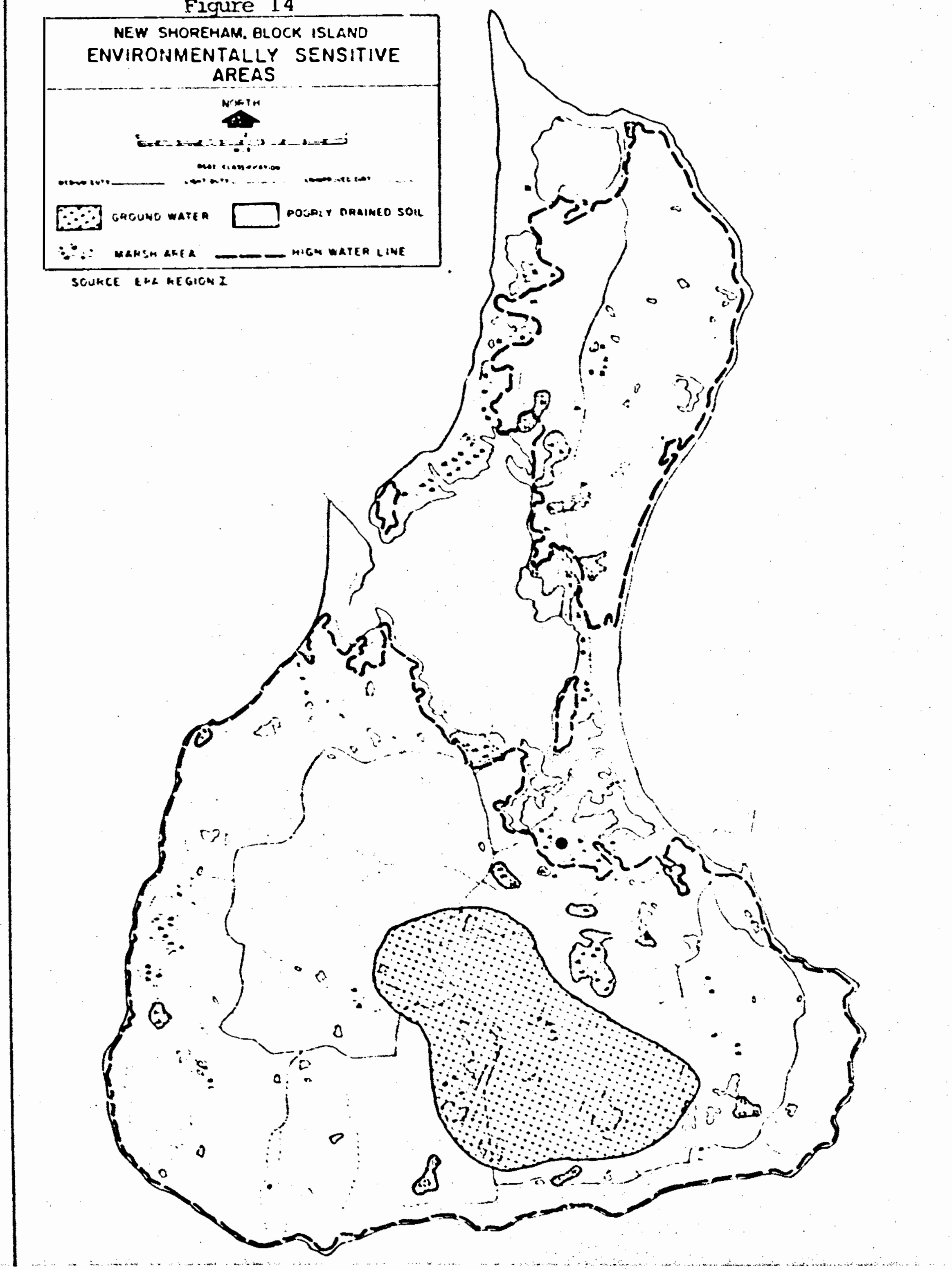
Mammals and Reptiles

Native animals include muskrat, field mice, deer, and several species of turtle and frog. Wetland areas are popular habitats and the presence of these animals in the New Meadow Hill Swamp area is likely.

Threatened or Endangered Mammals* -- The Block Island meadow vole (Microtus pennsylvanicus provectus), a field mouse which inhabits Block Island's beach grass, has been the subject of concern related to the wind turbine construction. The Fish and Wildlife Service of the U.S. Department of Interior does not include the Block Island meadow vole on its current list of endangered and threatened wildlife, but fears have been expressed by conservationists that unharnessed development of the island will endanger the meadow vole or result in its extinction.

*Reference letter of comment #1 and #6.

Figure 14


NEW SHOREHAM, BLOCK ISLAND
ENVIRONMENTALLY SENSITIVE AREAS
NORTH
GROUND WATER
POORLY DRAINED SOIL
MARSH AREA
HIGH WATER LINE
SOURCE EPA REGION I

A recent scientific observation of the Block Island meadow vole was made by Yale University students; and a Yale zoologist informs DOE that the Block Island meadow vole can be found in abundance on the island and that its habitat of preference is the coastal area near Sachem Pond at the northern tip of the island, quite distant from the wind turbine site. A resident naturalist tried specifically to locate the meadow vole at the turbine site and reports that no voles could be observed. The construction site in fact currently serves as a storage site for the Block Island Power Company and is subject to daily activity and traffic.

Given these circumstances, DOE anticipates that the wind turbine system will have no environmental impact on the Block Island meadow vole population or its natural habitat.

Insects

Data regarding the size and distribution of insect populations on Block Island could not be readily obtained.

Birds

Migrating Bird Species -- North American birds, particularly waterfowl, are believed by some to sort themselves in migration into particular corridors of flight or flyways. Four major flyways are defined by the U.S. Fish and Wildlife Service. Block Island lies along what is termed the Atlantic flyway. Its numerous fresh and salt water ponds and solitary location at sea, midway between two major wildlife refuges (Monomoy on Cape Cod and Morton on Long Island) make it a convenient shelter or resting place for migrating birds. Species which migrate over Block Island include Snow and Canada Geese; 22 species of duck; American Brant; several shorebird species, including plover; birds of prey, such as the Peregrine Falcon; and numerous songbird species. A bird banding station, licensed by the U.S. Fish and Wildlife Service, is operated at the Sachem Pond Wildlife Refuge at the extreme north end of the island. Species that winter at the island include the Double-crested (Great) Cormorant.

It is not uncommon for some birds to use different migration routes in the spring and fall. At different times of the year birds to be found include: from late November through early March, Red-throated Loons, Holboell's Grebes, Gannets, Black Ducks, White-winged Scoters, Surf Scoters, American Scoters, Red-breasted Mergansers, Great Black-backed Gulls, Herring Gulls, Ring-billed Gulls, Bonaparte's Gulls, Purple Sandpipers (occasionally, an Iceland Gull, Kittiwake or Dovekie); in March and from late October through early November, Canada Geese and other transient waterfowl; from March through April and from late September through early November, many transient fringillids, such as Slate-colored Juncos, and White-throated Sparrows; in May and during the middle of September, numerous warblers; in May and from late August through September, transient shorebirds.

Threatened or Endangered Bird Species -- Block Island is located within the range of two threatened or endangered bird species: the American Peregrine Falcon, (Falcon columbarius) which migrates along the Atlantic flyway, and the Ipswich Sparrow (Passerculus princeps) which winters along a 1,000 mile section of the Atlantic coast from Massachusetts to Cumberland Island in South Georgia. The small populations of these species--there were 58 Ipswich Sparrows in the 1962 count--, while increasing their danger of extinction, also lessens the possibility of their presence on Block Island. Block Island does not appear to be a uniquely vital habitat for either species.

Bird Activity Near the Site -- During the past year a pair of Mute Swans have constructed a nest between the BIPC access road and Beach Avenue. This is the only sign of breeding by large birds at New Meadow Hill Swamp. Throughout the year, small flocks of gulls fly above and land in the marsh. Visible diurnal migrant activity consists of occasionally large flocks of songbirds in the fall. However, no large groups of waterfowl have been seen at the marsh in recent years. While it would seem likely that the wetland would occasionally be frequented by herons or small groups of waterfowl, no such activity is reported by Block Island Power Company officials.

2.4.8 Meteorology

Climate

Block Island possesses a typical maritime offshore climate, but is close enough to the mainland to be affected by temperature extremes over land. Seasonal temperature extremes are not as great as those on the mainland, but the average temperature (50.1°F) is the same as at Providence, Rhode Island. The growing season extends from April to November and is about 220 days long.

Summers are usually dry with maximum temperatures averaging 74 degrees in July and August. The island is too small to build up cumulonimbus clouds, and local thunderstorms are infrequent. Fog occurs on one out of four days in early summer when the ocean temperatures are relatively cold.

Winters are distinguished for their comparative mildness with temperature maxima averaging 4 to 10 degrees above freezing and minima averaging 25 degrees in February. Surface winds are usually from the east. When snow begins, it soon changes to rain or melts rapidly if it does accumulate.

The ocean has a dampening effect on hot winds in the summer and an accelerating effect on cold winds from the mainland in the winter. Sea winds (Katabatic winds from Narragansett Bay and Long Island) reach 40 mph under certain conditions in the winter with the average for that season about 20 mph. The highest sustained wind speed recorded on the island was 91 mph, in September of 1938. Wind velocities over the entire island average 17 mph yearly.

Wind Measurements -- During the period of 1880 to 1950 U.S. Weather Station wind data was collected at different times from four locations, all less than one-half mile from the WTG site. Over the 69-year period of record, mean hourly wind speeds were above 18 mph in five months (January, February, March, November and December) of each year with a high in December of 20.2 mph. Hourly means well above 16 mph were recorded in seven months of each year. Annual hourly mean was 16.6 mph. Wind data recorded for the Block Island airport for the 12 months of 1975 showed an average of 12.04 mph. The ratio between the 69-year mean and the airport 12-month average was 1.38. Wind measurements obtained during Phase I of the project indicate that the values obtained from the 69-year data more nearly represent those of the WTG site than the airport data.

Relevant data collected include the following:

Mean Velocity[1]	7.7 m/s (17 mph)
Historical Mean Velocity[2] (9.1m)	7.0 m/s (16 mph)
Percent Time below cut-in[1] (8 mph)	29%
Turbulent Intensity[1] (45.7m)	0.16[3]
Turbulent Intensity[1] (9.1m)	0.21[3]
Maximum Velocity Recorded[1]	30.4 m/s (67.5 mph)

[1]Based on ERDA/NASA Meteorological Measurements for data period 12/76-6/77.

[2]Based on 68 years of Block Island National Weather Service data.

[3]A relative measurement which takes into account gustiness, flow reversals and boundary layer effects. Turbulent intensity in the 0.20-0.25 range is considered high but acceptable for a large horizontal-axis wind turbine. (Data obtained from Battelle-Pacific Northwest Laboratories)

Precipitation -- The average annual precipitation, based upon the period of 1878 to 1961, is 40.8 inches. Monthly averages range from 2.6 inches in June to 3.9 inches in March. The driest decade on record, 1916 to 1925, averaged about 35 inches.

Climatological Hazards

In the early fall, the island is affected by most of the tropical storms moving up the coast. During these storms, and other periods of high wind, flooding occurs along the island's shores. The extent of this flooding, the hurricane high water line, is indicated in Figure 12 in Section 2.4.7.

Only five hurricanes have struck with significant force during the past 45 years, none within the past 16 years. Damage was apparently minor. High winds, associated with northeast gales, commonly reach 75 mph during the winter months. Wind gusts of 135 miles per hour were experienced during Hurricane Carol in 1954; but such gusts would be well within the 150 mph design wind speeds of a MOD-OA wind turbine. Historically, New England hurricanes move rapidly; buffeting by extremely high winds is of short duration. Again, the island is too small to build up cumulonimbus clouds and local thunderstorms rarely occur. No tornadoes have been recorded. It is also noted here, along with other potential hazardous conditions, that there has been no history of earthquake activity on or near the island.

2.4.9 Local Historic, Scenic, Cultural and Natural Landmarks

Historical Background*

Originally, Block Island was called by its Indian inhabitants, "Monisses," the "Isle of the Little God." Adrien Block, in 1614, was the first white man to land on the island, but it was not until 1661 that the first white settlement consisting of sixteen families arrived on the island. In 1672, it was incorporated as "New Shoreham, otherwise Block Island."

During the next 100 years, the vulnerable island was repeatedly besieged by pirates. When the War of Independence broke out, there were nearly eight hundred whites, fifty Indians, and forty negroes living on the island and the prosperous little community was considered quite a temptation to the British fleet.

After the war and through much of the 19th century, the islanders supported themselves by fishing and piloting vessels through the hazardous waters between the island and the mainland. In 1870, the construction of the first of two breakwaters was started with Federal funds. It was the construction of the harbors that signaled the growth of the island as a vacation resort. In 1879, New Shoreham's official name was changed to Block Island, yet delighted

* Insert adapted from the Environmental Impact Statement-Wastewater Collection and Treatment Facilities, New Shoreham, Rhode Island.

visitors called it "The Bermuda of the North." By the turn of the century, steamers arrived daily from New York, Boston, Providence, Newport, New London and Montauk.

The First World War, however, abruptly ended this prosperous era. The Depression and subsequent Second World War further curtailed the island's tourist trade and many hotels closed. Fortunately, the island was still self-supporting through this period by fishing and farming. In the postwar decades, Block Island was rediscovered as a family resort. Private yachting and flying grew more and more popular and a new generation of tourists once again visited the island. What they found was a lovely, wind-swept place, with old fashioned inns and simple cottages. Many bought abandoned farmlands overrun by shrubs and bayberry, but dotted with ponds. They fixed up the old homes bit by bit, doing most of the work themselves.

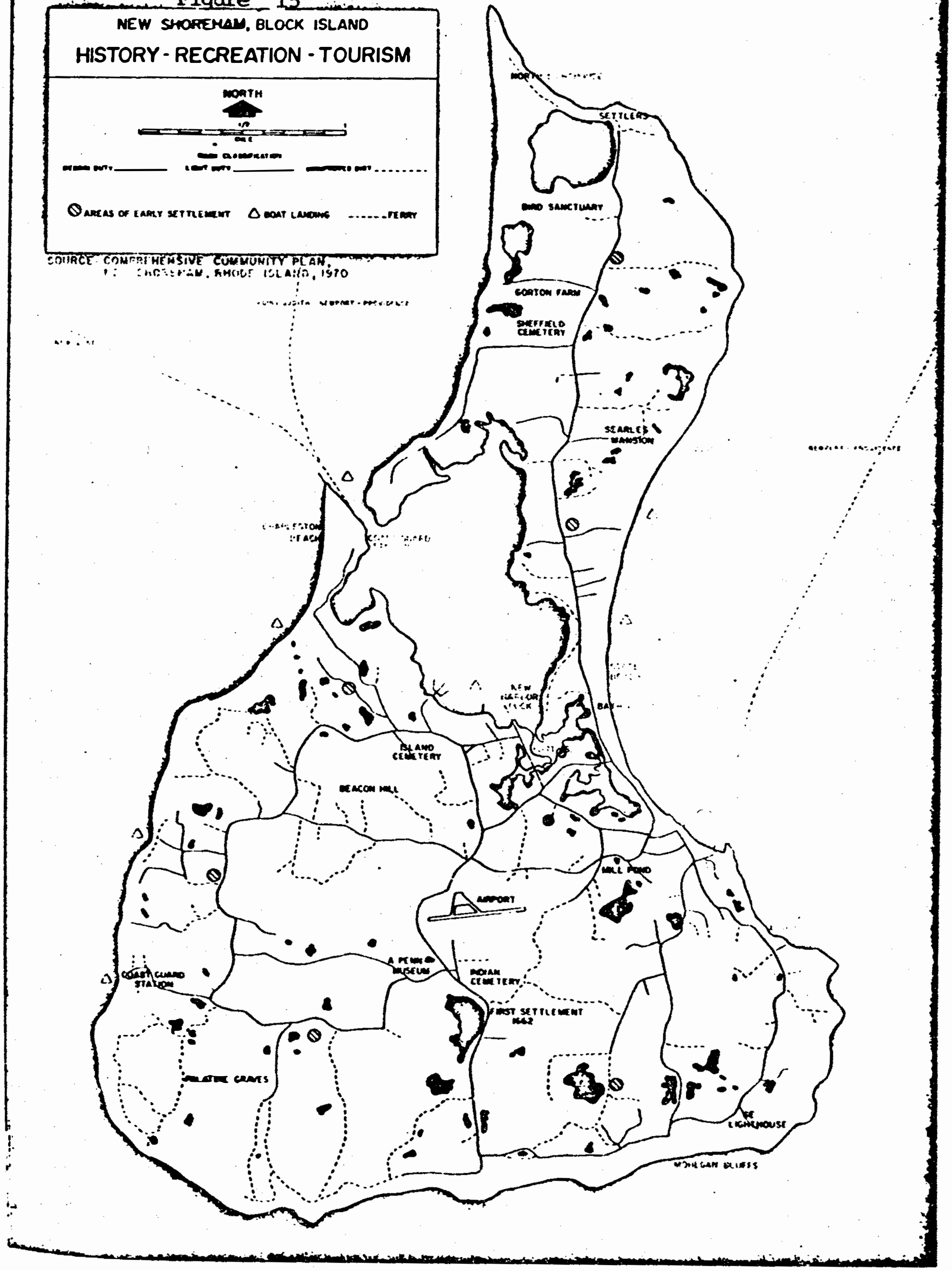
Today, "New Shoreham, otherwise Block Island," is governed directly by a five member Town Council. In 1970, its people defeated a bill to establish legalized gambling on the island. It is interesting that oppostion to this bill was so intense that even the possibility of secession from the state was explored as an alternative to the island becoming "The Las Vegas of the East." It is now the concensus of those who visit or reside on the island that preservation of the existing rural character and pristine environment is of utmost importance and they are determined to achieve a sensible balance between conservation and development before it is too late.

Places of Interest

There are two historic properties in New Shoreham which are listed on the National Register of Historic Places. The Block Island North Light is situated on the north end of the island. The Old Harbor Historic District was designated a landmark on May 8, 1974. No impact on these properties will result from the project other than the fact that the turbine will be visible from portions of the Old Harbor. A preliminary survey by the Rhode Island Historical Preservation Commission indicates that several other districts could be identified as eligible for the Register and possibly the whole island could be considered a district, as has been done at Nantucket.

Monuments on the island include the Tercentenary Monument on Ocean Avenue about one-half mile from the WTG site. The Block Island State Beach is one-half mile to the west. A privately owned tract of land along the island's north coast between Sachem Pond and the Block Island Sound, about four miles north of New Meadow Hill Swamp functions as a wildlife refuge. Many of the local landmarks are designated in Figures 15 and 16.

Figure 15



NEW SHOREHAM, BLOCK ISLAND
HISTORY - RECREATION - TOURISM
NORTH
AREAS OF EARLY SETTLEMENT
BOAT LANDING
FERRY
SOURCE: COMPREHENSIVE COMMUNITY PLAN,
SETTLERS
BIRD SANCTUARY
GORTON FARM
SHEFFIELD CEMETERY
SEARLES MANSION
ISLAND CEMETERY
BEACON HILL
MILL POND
AIRPORT
COAST GUARD STATION
MUSEUM
INDIAN CEMETERY
FIRST SETTLEMENT 1662
PALATINE GRAVES
SE LIGHTHOUSE
MOHEGAN BLUFFS

RECREATION AND TOURIST ATTRACTIONS.

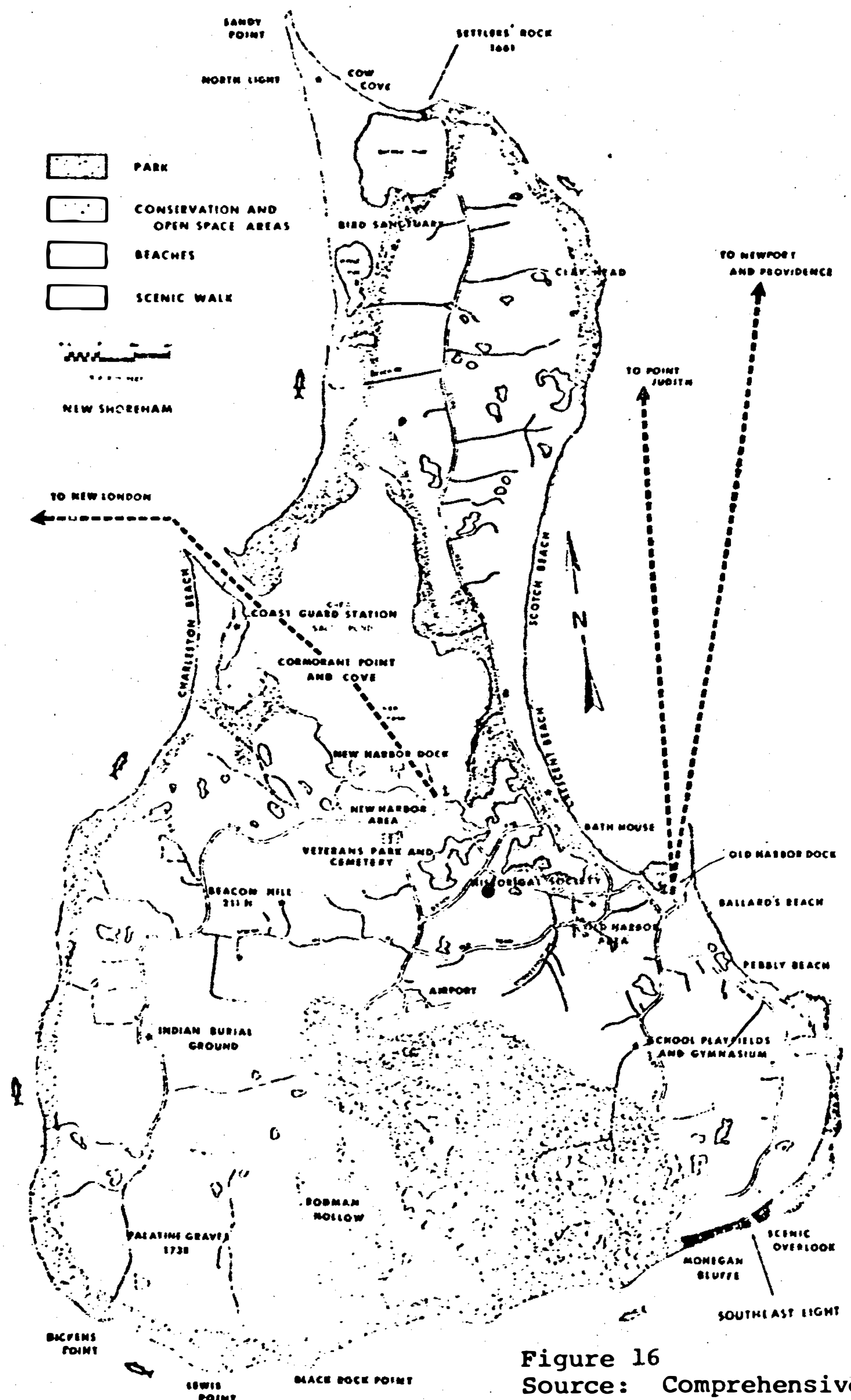


Figure 16
Source: Comprehensive Community Plan

3. POTENTIAL ENVIRONMENTAL IMPACTS

3. POTENTIAL ENVIRONMENTAL IMPACTS

3.1 Impact of Construction Activities

3.1.1 Human Environment

Transportation

The major form of transportation to the island is boat. Cost implications associated with transporting the blade trailer, wind-turbine machine, mobile data van, equipment, and personnel are discussed in Section 9.2. Suitable dock facilities, adequate for unloading heavy construction equipment, wind turbine components, and related supplies, are available.

Due to the island's defined land area and relatively few roadways, particular attention must be given to maintaining an efficient circulation pattern. Some minor and brief inconveniences will be experienced by motorists due to the movement of heavy equipment and trucks between the docks at Old Harbor and the site. The impacted area will be a one-mile route along Water Street and Ocean Avenue. These inconveniences will be experienced during movement of the 70-foot blade trailer, the 85-ton crane, and possibly the 35-ton crane, each of which will make two trips to and from the site (once for installation and once for removal). Because of the limited number of vehicle trips along this route, the slow

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speeds involved, and the ability of the existing roads to accommodate heavy equipment, modification of these medium-duty roads will not be required.

Economy

There will not be more than 10 project-related construction, technical and supervisory personnel staying in New Shoreham at any time during the nine-month construction period. Skilled construction labor is available on the Rhode Island mainland. Typically, crews take the ferry Monday morning and Friday afternoon. Adequate week-day accommodations for the required work force already exist in the area. While many Block Island hotels operate on a seasonal basis, the island is geared to extreme seasonal population fluctuations and the limited number of personnel involved should not greatly affect local revenues nor cause a marked increased demand for services.

The purchase of various construction materials and the rental of equipment will have a short-term beneficial effect on the local economy. The wind turbine foundation is estimated to require 200 cubic yards of concrete which will most likely be obtained from a portable concrete batch plant presently operating on the island.

Aesthetics and Human Interest

Some disruption of the area surrounding New Meadow Hill Swamp will result due to the visual impact of construction activities and noise associated with the movement of equipment and trucks at the construction site. However, this disruption is expected to be limited and of short duration. The site is located southwest of Ocean Avenue in an area devoted to power plant activities. The visual impact and sound levels related to construction activities should not be a striking contrast to present functions.

3.1.2 Ecological Systems

Knoll and Surrounding Marsh

Adequate space exists on the knoll and immediately adjacent high ground to contain all construction activities; no encroachment of equipment or personnel on the New Meadow Hill Swamp is expected. Draining or "reclamation" of the marsh is neither necessary nor planned.

Excavation and pouring of the foundation and grading of the site will result in the modification of the surface soil structure and destruction of some bushes and freshwater marsh grasses. Measures will be taken at the end of construction to prevent soil erosion due to the loss of ground cover. The base of the turbine covers 900 square feet. A 90 by 90-foot area must be graded. Earth excavated for the tower foundation will remain at the site where it will be used to level the knoll summit.

After the concrete foundation has been poured and back-filled, crushed stone will be spread over the ground surface area under and immediately surrounding the tower base to provide a firm footing for erection equipment and vehicles used in the course of tower and machine assembly. Waste concrete will be disposed of on BIPC property in such a manner that it will not flow into or be deposited in the marsh.

Wildlife

There is no evidence that the knoll itself is presently inhabited by any mammal, reptile or bird species. It is possible, however, that construction activities may temporarily drive off some of the wildlife inhabiting the marsh.

3.2 Impact of Wind Turbine Generator Structure and Operation

3.2.1 Human Environment

Aesthetics

Due to the location of the proposed site for the WTG, the low topography of Block Island as well as a lack of trees in the vicinity, the wind turbine tower and blades will be visible over a wide area of the island. Based on line of site calculations, the proposed turbine, which would rise to 190 feet above sea level, will be a conspicuous feature from most vantage points around the island. The WTG will be at least partially visible from almost all open locations on the island, with the exception of the sparsely populated southwest coast where it will be blocked from view by hills. The WTG blade will be visible (in the vertical position) fifteen and one-half miles at sea with the tower structure visible for ten and one-half miles. Residents and visitors to the island will be able to view the structure from New Shoreham, Old and New Harbor; Beacon and Mouwneit Hills, the Block Island State Beach, and from the Providence-Newport ferry.

Little is known of the public's probable reaction to the physical presence of large wind turbines. Thus, the acceptance of the proposed WTG has not been fully determined. However, a recent study completed by the University of Illinois (U. of I.), (see reference 19) has found that wind turbine installations are considered more aesthetically acceptable to the general public than power line towers. The study, a survey of a total of 1,800 people located in eastern Washington, southeastern Wyoming, western Michigan, eastern Rhode Island, Chicago, and the Gateway National Recreation area in New Jersey (the location of a small wind turbine at Sandy Hook), concluded that a majority "did not seem to have any objections ... to locating windmills in scenic areas, on the shores of lakes or oceans, or, for that matter even close to their homes."

In the past, windmills have been considered picturesque features, but this reaction is generally restricted to the rustic quality of older windmill structures. A portion of the U. of I. study addressed six types of WTGs in terms of structure aesthetics.

The study found that there was indeed a preference for the class cal "old Dutch" structures. Columnar tower structures were rate second with a lattice tower, the type proposed for Block Island, third. There was no particular aversion to any of the basic design concepts. The WTG test program on Block Island should provide additional information on the public's reaction to the aesthetics of wind turbines. The additional data provided by this study, the survey by U. of I. and other related studies currentl sponsored by DOE will allow for development of more conclusive evidence concerning the general public's feelings towards these structures.

As noted, the most highly visible component, and that which is most likely to be aesthetically displeasing, will be the open-truss tower. This portion of the structure will be painted ligh blue or grey to blend with its background. The tower appears similar to many high voltage electric transmission towers. The fact that it does not comprise the total height of the WTG struc ture and is merely a support for the potentially more attractive component, (the cylindrical housing and blades) should somewhat diminish its negative impact. It should be recognized that measures recently suggested (National Academy of Engineering, 1972) to screen or decrease the visual impact of similarly constructed towers -- such as vegetative screening or siting on the down-si of a ridge rather than the peak -- are impractical for use with wind turbines at most locations, not only because of climatic limitations but also because of the need to obtain maximum performance per unit cost, which requires the maintenance of maximum blade exposure to high winds and the siting of wind turbines in prominent locations. Planting vegetation to screen the turbine from nearby vantage points would decrease wind velocity (through friction with the earth's surface) and might, in some locations, cause wind shears which would place abnormal loads on the turbine blades. The cylindrical housing and blades, which will be visible from greater distances and from partially shielded locations near the site, should have less negative impact due to their light color and tapered configuration. The visibility of blade rotation will depend upon the colors selected and the incidental orientation to the wind. Written accounts of the 175-foot, 1250-kilowatt Smith-Putnam wind turbine, which was located on a Vermont mountain peak, indicate that the rotation and reflection of its longer, bulkier, polished stainless steel blades were visible for 25 miles (Putnam, 1948). Light reflection from the aluminum MOD-OA blades should be reduced by their coating of paint.

While the wind turbine will be highly visible from a distance on clear days, it is not known whether its visual impact will be adverse or positive. The recent resurgence of public interest in wind energy technology may mean that reactions would be favorable.

Wind Turbine Noise

Noise levels associated with wind turbines are difficult to measure due to their low level and interference from ambient wind noise. Noise measurements made by NASA at the MOD-O wind turbin in Plum Brook, Ohio on September 15, 1976 indicate that the sligh gear noise and the sound of wind passing over the blades during operation cannot be perceived over ambient wind sounds at distances greater than 50 feet from the turbine. Even at the base of the tower, the measured noise level was only 64 dba; below maximum acceptable levels specified for residential areas or work places.

The turbine is within the BIPC property and will be several hundred feet from Ocean Avenue, the nearest publicly accessible are Noise caused by the operation of a wind turbine of this size -- even in high winds -- is considerably less than that caused by diesel generators of the type used by BIPC.

Economic and Social Effects

The possible social and economic effects of the operation of a wind turbine on Block Island are associated with 1) the addition of a power generation unit to the island's utility system, and 2) a possible increase in tourist activity on the island due to the presence of a large operational wind turbine.

Addition of Power Generation Unit -- The current peak capacity of the Block Island Power Company is 3,615 kilowatts. If the 200-kilowatt MOD-OA output were added to this figure, a theoretical increase of 5.5 percent in the utility's generating capacity would result. Since adequate reserve power must be maintained to back up the WTG in the event that the wind drops below WTG cut-off velocity (8-10 mph), an effective increase in the utility's peak capacity will probably not be realized in practice, although BIPC's ability to operate near peak loads may be enhanced.

BIPC's seven diesel generators operate at peak load capacity only during the summer months, when the island's population is swelled by tourists. The lower power level supplied by the utility is 300-kilowatts, during the winter season, from 1:30 a.m. to 6:30 a.m. Since this period is also characterized by the highest wind velocities experienced on the island, the highest percentage of output from the WTG will be realized during that time. Theoretically, the MOD-OA could produce 66 percent of the utility's output during the early morning hours of the winter months.

Increased Tourist Activity* -- The MOD-OA turbine is likely to attract visitors from among the resident and tourist population on Block Island. Of course it is impossible to predict with accuracy how tourism will be affected by any new development. However, due to past experiences with other wind turbine projects and due to this offshore location, DOE does not anticipate a marked increase in tourist traffic to the island; nor does DOE

*Reference letter of comment #1.

turbine. The volume of viewers presently anticipated at the turbine site would not warrant construction of a visitor accommodation area. Nor is it expected that any visitor traffic will affect water supplies or sanitation systems. In the event, however, that far more traffic is generated than is expected, DOE will reconsider construction of a suitable visitor accommodation area.

Since the project will be of relatively short duration (two to four years) and any initial attraction of the wind turbine will gradually decrease during that time, no increase in the rate of island development due to increased tourism should occur. Such development would require a sustained, dramatic increase in tourist activity over a period of several years. Community planning goals are based upon only a moderate growth assumption of a 15 to 25 percent increase in summer residents and visitors.

A certain effect of increased tourism -- however slight -- would be an increase in local revenues on the island. If, as anticipated, such increases are moderate, the overall effect of this factor on the island's economy could only be beneficial.

The new wind turbine may be an attraction to people who visit the island, whether or not the tourist population increases, and a moderate increase in tourist activity near the site may be experienced. One effect of this will be a small increase in vehicular and pedestrian traffic on Beach Avenue, Old Town Road and Ocean Avenue -- particularly on weekends during the summer months. If congestion results, special traffic control procedures may be required.

Potential Safety Risks

Although wind turbine components have been designed to withstand winds of 150 mph, there is a remote danger that a wind turbine blade might fail or that the tower might collapse due to severe wind loading or other extreme environmental conditions. To minimize the risk of blade or tower failure, a variety of safety features have been engineered into the MOD-OA wind turbine. In addition, strict safety precautions and procedures will be instituted, as described below.

General Safety Precautions and Procedures -- The tower structure and blades will be inspected at regular intervals by the utility and the NASA contractor to identify and repair potential structural defects. The turbine will also be inspected immediately following severe wind or storm conditions, and after other unusual conditions, such as earthquakes, nearby landslides or flooding.

A limited-use 550-foot radius exclusion area similar to a power line right-of-way will be maintained around the MOD-OA turbine. Visitor access to this area will be restricted by procedures detailed in a visitor control plan to be developed by BIPC and approved by NASA and DOE. A 6'-7' exclusion fence will be erected around the base of the wind turbine.

Technical personnel will be thoroughly trained to follow safe operating procedures and will be fully informed of risks associated with the wind turbine's electrical equipment, rotating machinery, and cable-hung hoist. The wind turbine has been designed to fully incorporate OSHA safety regulations and specifications.

Categories of Risk -- Four categories of risk have been identified for a large, horizontal-axis wind turbine: 1) tower collapse or component blow-off; 2) blade failure; 3) injury due to unauthorized access; and 4) collision by low-flying aircraft.

1) Tower Collapse or Component Blow-off -- In the event of tower collapse or component blow-off, the wind turbine or one of its components may fall in any direction. Since the rotor would be feathered and braked before w d speeds exceeded tower design limits, blade throw is not expected to accompany tower collapse. If the rotor does not break, maximum horizontal extension of the turbine would be 165-feet. However, if the rotor breaks due to striking the tower or the ground, the area of impact may increase, depending upon the orientation of the rotor and the attitude of tower collapse.

   Even during periods of extreme wind, tower collapse is highly unlikely. Since no tornadoes have been reported on the islan freak gusts which far exceed those experienced on the island to date are the only conditions viewed as potentially hazardous. Other possible causes of tower collapse include undermining of the foundation due to flooding, ground settling or a sudden geologic calamity such as an earthquake. Foundation undermining would be a relatively gradual process, noted and corrected during regular maintenance and inspection activities. Ground acceleration forces associated with a nearby earthquake of up to 7 on the Richter scale are less than those associated with high wind loading and are not a significant danger with structures of this type. However, such a risk cannot be totally discounted.

There is little risk to technical personnel or visitors in the event of tower collapse or component blow-off because it is unlikely that people would be in exposed areas near the turbine during periods when winds approached or exceeded 150 mph or during a tornado "warning" period. During an earthquake, the turbine would pose less risk than many other structures due to its high structural integrity, relatively low mass, and the absence of loosely attached overhangs or facades.

2) Blade Failure -- Computations performed by the NASA-Lewis Research Center indicate that an unrestrained MOD-OA wind turbine blade could be propelled up to 550 feet from the tower base if it broke away from the hub at 40 rpm at an optimum blade throw angle. Pieces of the blade in the tip area could travel even further than this. Blade throw distance would be significantly reduced if shedding occurred

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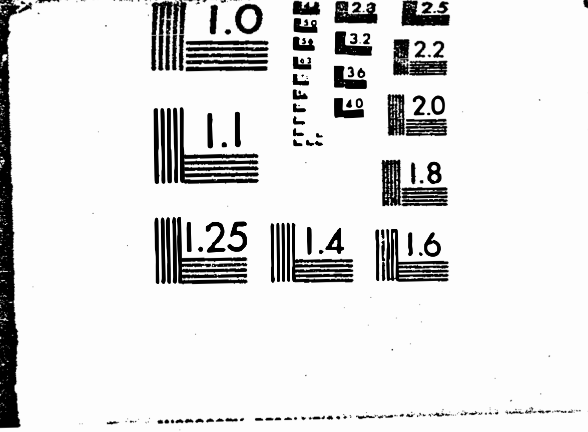


at less than optimum angle (see reference 16). The existing powerplant, a fuel tank storage area, a state highway garage, and a section of public highway (Ocean Avenue) all lie within 500-feet of the proposed wind turbine location. However this condition creates only a minimal operational safety hazard which has been carefully assessed by a NASA-Lewis Area Safety Committee which was assigned to provide safety review and approval of the MOD-OA project in accordance with standard Lewis Research Center safety policy and procedures. The MOD-OA incorporates several design features which make it structural safer than the MOD-O prototype. For example, blade loading has been significantly reduced by modification of the tower design and increased torsional stiffness of the yaw drive system. In addition, the design of the blades, spindle and hub has been modified to eliminate stress and provide additional strength. Safety features and precautions designed to identify structural problems and decrease the risk of blade failure include: a) automatic monitoring of the turbine's operational and structural dynamics; b) automatic shutdown by one of several automatic brake systems or blade feathering with manual re-start if a structural imbalance becomes evident; and c) regular inspections and maintenance. As an additional precaution and to protect the machine structure, the blades will be feathered and braked within several seconds when the ambient wind speed or a gust exceeds 34 mph. The rotor has been designed to withstand wind speeds of 150 mph in a feathered position.

To minimize the risk of blade failure, automatically monitored sensors will be installed on the wind turbine tower. A structural problem which develops during turbine operation or an unusual load (such as that caused by heavy icing) will be signalled by excessive vibrations or a dynamic imbalance in the turbine. The machine will automatically shut down before the problem becomes severe. Remote or automatic restart is not possible. The wind turbine can only be restarted by resetting the system at the site.

Given the safety and design features incorporated into the MOD-OA wind turbine, blade failure is highly unlikely. Because the turbine will not be rotating when wind speeds exceed 34 mph and people are not likely to be in exposed areas within or near the exclusion radius during high wind or storm conditions, the potential for injury to people is limited.

3) Injury Due to Unauthorized Access -- Safety risks associated with unauthorized access to the wind turbine include falls from the tower and injury caused by coming into contact with power equipment near the turbine. To discourage climbing of the tower, footholds which allow it to be scaled easily will be eliminated. The cable-hung hoist will be inaccessible from the ground and all hoist controls will be securely sealed to prevent tampering. In addition, all ground level electrical equipment will be shielded and/or caged in compliance with OSHA specifications and regulations.

4) Low-Flying Aircraft -- The wind turbine site is within two miles of the Block Island State Airport, but also is within the navigational "shadow" of a taller meteorological tower, a few hundred feet away. Since the meteorological tower has FAA visibility features such as lighting and paint, the FAA places no such requirements on the turbine tower or blades. Low-flying aircraft will be alerted by the meteorological tower.

Effect on Electronic Communications.

Large horizontal-axis wind turbine rotors can cause interference with high frequency radio waves in some locations (see reference 39). The signals which may be affected are in television and microwave frequencies at reception points where geometries favorable for interference occur among the wind turbine, transmitter, and receiver. The wind turbine will reflect electromagnetic radiation which is incident upon it. If the reflected radiation interacts with the original signal, the two signals are said to interfere. The interference will affect the amplitude and/or intensity of the signal. An assessment of interference at receivers near the site is presented below.

Microwave -- The primary criterion for determining the potential for a microwave communications interference problem is the ratio of the voltage of the interference signal reflected from the wind turbine rotor (V int) to the voltage of the primary signal received at the microwave antenna (V in). Voltage received is regulated by two factors: 1) the strength of the signal; and 2) the character of the antenna. Where $\frac{Vint}{Vin}$ = 1%, no serious interference problem will occur. Where $\frac{Vint}{Vin}$ = 1% - 5%, the potential for a problem exists. When the voltage of the interference signal is more than 5 percent of the voltage received, noticeable interference is probable. The characteristics of the antenna produce a highly directional narrow beam. To achieve high levels of interference, the interfering signal must be within the direction beam. The nearest approach of a microwave beam to the Block Island site is that received at a tower .25 miles to the east. Analysis of this type of interference indicates that, since the site is at right angles to the highly directional microwave beam, $\frac{Vint}{Vin}$ will be well below 1 percent, indicating that no problem will be experienced.

<u>Television</u> -- A wind turbine illuminated by a direct (primary) signal will result in a secondary signal being scattered off the blades. Because of the rotation of the blades, the net field picked up by a receiver in the vicinity of the wind turbine will be amplitude modulated. If the modulation is sufficiently strong, it will produce distortion in the receiver. For any given frequency, there is a region around the windmill where this distortion can occur. Within this region, interference will increase as the rotor orients itself in such a way that direct signals which

illuminate the blades are reflected directly toward the receiver antenna. Interference will decrease as the rotor turns away from the reception point. Therefore, at any given moment, reception quality will depend on the orientation of the wind turbine.

The severity of interference is regulated by the distance of the wind turbine from the transmitter, the frequency (wave length) of the signal, the geometry of the receiver with respect to the wind turbine and transmitter, and the quality of the receiving antenna and radio or television set. Signals in fringe reception areas and of high frequency will be most affected. The roughly circular area of interference around the wind turbine will be greater as frequencies increase. Receivers with low signal-to-noise ratios will exhibit the greatest degree of image distortion and will be affected at greater distances from the turbine.

Since the video portion of a TV signal is in the form of amplitude modulation and the audio portion is frequency modulated, the amplitude modulated interfering signal has a noticeable effect on the quality of the TV picture, but little effect on the audio.

When the modulated interference signal reaches or exceeds a threshold percent ($m \geq .10$) of the signal received, noticeable distortion of the image projected on the television screen occurs. This is characterized, at the outer edge of the interference radius, by the appearance of dark horizontal bars moving vertically on the screen and the beginning of a snow effect.

As the percentage of received interference increases (either by re-orientation of the rotor or a decrease in the distance between the rotor and the receiver) the picture break-up increases, with the appearance of a worsening "snow" effect.

Television reception on Block Island is by individual antennas. There is no existing cable TV network (which would offer an easy resolution of a predicted interference problem).

Interference radii have been calculated for each of the nine (9) VHF and six (6) UHF television channels commonly received on Block Island (see Table 8). Potential reception points within these radii have been identified using the most recent USGS map and (for areas near the site) recent photographs and observations during a site visit in July 1976. It has been found that a maximum of 111 reception points are with the radius of the most severely affected VHF channel, and 536 reception points lie within the 3.64 km radius for channel 56 - the most severely affected UHF station. These reception points are primarily in the village of New Shoreham, where there is a high concentration of permanently inhabited home-sites. While the figures include many vacation homes and several hotels where regular viewing would occur only during the summer months, the possibility that reception would be interfered with at these sites for only three or four months out of the year cannot be said to decrease the severity of the impact. For example, unacceptable television reception could have a negative impact on Block Island's tourist industry.

Table 8

POTENTIAL INTERFERENCE WITH TELEVISION RECEPTION ON BLOCK ISLAND (MOD-OA WTG)

Channel	Origin	Distance (km)	Interference Radius in Km	Reception Points in Radius	Adverse Impact[+]	Cumulative Impact[a]
2	Boston, Mass.	129	0.09	0	0	
3	Hartford, Conn.	105	0.15	2	0	
4	Boston	129	0.15	2	0	
5	Boston	129	0.21	2	0	
6	New Bedford, Mass.	156	0.26	6	0	
7	Boston	129	0.62	86	8	
8	New Haven, Conn.	105	0.62	86	15	
10	Providence, RI	64	0.69	105	6	
12	Providence	64	0.77	111	6	24
27	Worchester, Mass.	105	1.91	297	46 (15)[o]	
36	Providence	64	2.81	454	42 (14)	
38	Boston	129	2.81	454	36 (12)	
53	Norwich, Conn.	56	2.77	433	115 (38)	
56	Boston	129	3.64	536	40 (13)	80

\+ Assumes directional receiving antennas to be ineffective within a 40 degree cone behind the wind turbine (with respect to the transmitter) and that antennas will be 100% effective outside this cone

o Approximately 1/3 of resident population receives UHF on regular basis

a Number of homes which will be impacted by interference on at least one channel

Reference: USGS Block Island Quadrangle (1970)

While the number of reception points within the larger radii comprises almost all of the island's homes and vacation homes, approximately one-third of the island's residences are equipped with directional antennas. Such antennas are predicted to be effective for alleviating wind turbine-induced interference where the angle formed by the lines of sight from the reception point to the wind turbine and the transmitter is greater than 20 degrees (see Figure 17). Using this criterion, directional antennas will be ineffective within a 40-degree shadow cone behind the wind turbine (with respect to the transmitter). Therefore, the actual interference which will be experienced on the island without corrective action is roughly 66 percent of the total number of reception points within the radii -- the number of homes which do not have directional antennas. With the installation of directional antennas at all reception points on the island, the impact may be reduced even further. However, due to the 40 degree shadow cone (which covers different areas surrounding the site for channels originating from the west, northwest, north, and northeast) the installation of directional antennas will not eliminate the interference problem.

Table 8 shows the number of reception points within the 40 degree shadow cone for each channel, as well as the cumulative impact -- the total number of reception points (80) for which directional antennas will be ineffective on at least one channel. At many of these reception points, reception of two or more channels will be interfered with. For example, at least five homes near the site will experience interference on all six (6) channels transmitted from Providence and Boston.

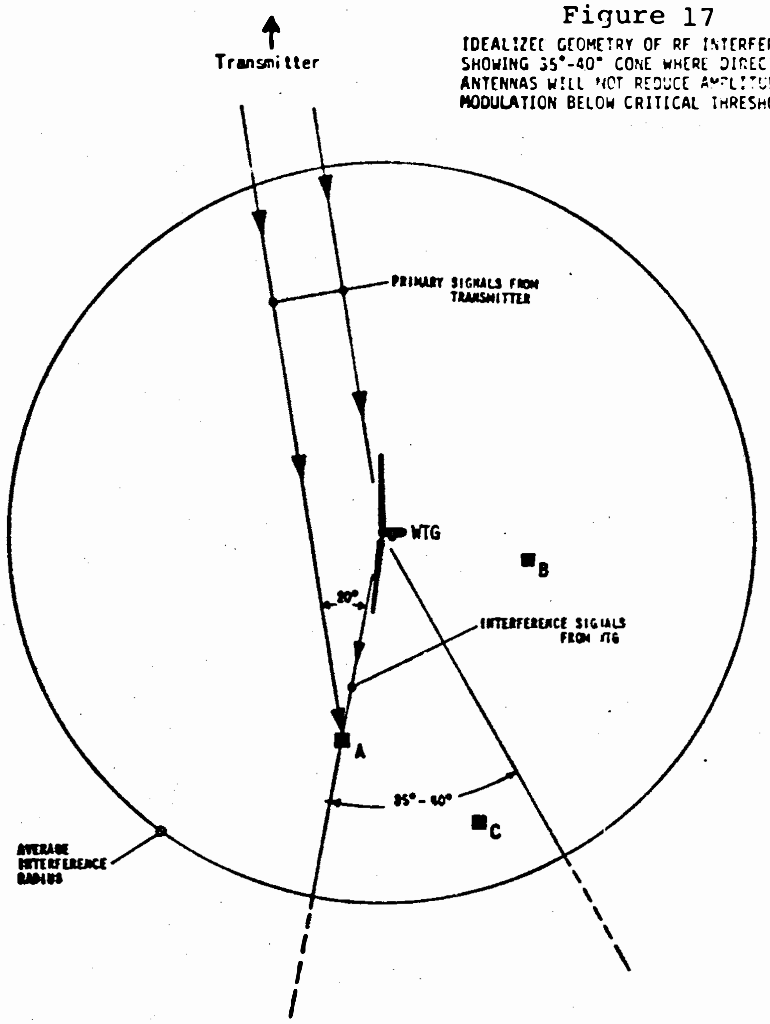


Figure 17

IDEALIZED GEOMETRY OF RF INTERFERENCE SHOWING 35°-40° CONE WHERE DIRECTIONAL ANTENNAS WILL NOT REDUCE AMPLITUDE MODULATION BELOW CRITICAL THRESHOLD

Reception Points:
- A - Receiver at critical 20 degree angle with respect to transmitter and WTG
- B - Directional antenna may eliminate interference
- C - Directional antennas will not eliminate interference

It should be recognized that the installation of directional antennas on Block Island would not only improve television reception in general (at these homes outside the 40 degree shadow cone) but would enable those residents and vacationers whose dwellings are not now equipped with such antennas to receive UHF broadcasts for the first time. Assuming that unimpeded television reception is a positive factor, this improved and expanded reception capability would constitute a positive effect on the human environment. The extent of this effect can only be estimated, but the installation of 350 directional antennas at reception points not now equipped in this manner would effect up to 400 permanent residents and several thousand part-year residents.

The characteristics of television reception on Block Island are unique in that it is a fringe reception area with relatively weak signals received from all compass points except the east and southeast. At most other locations, the installation of directional antennas would eliminate interference; however, in this rare instance, the shadow cones about the wind turbine for the various channels almost completely blanket the local populated area.

Due to the adverse impact on television reception which would occur even after the installation of directional antennas on the island, the installation of a cable TV network is the only measure which could totally eliminate the problem.

Due to the uniqueness of the Block Island receiving area, it is not expected or planned that cable television installation would be a regular requirement near wind turbine sites. Thus, this action should not be construed as a precedent for similar federal actions associated with subsequent field-test programs. In addition, the decision to install the CATV system is based on a worst-case estimate of the impact. DOE has chosen this conservative decision due to the fact that this will be the first large wind system with a clear potential for causing TV interference.

Installation of such a network on Block Island would have a positive effect on television reception -- not only in eliminating the potential for interference, but also improving reception capability and picture quality at all residences on the network. The possible installation of cable television network is further discussed in Sections 5.4 and 9.

The FM radio frequencies (88-108 mHz) are between two VHF television bands (channels 6 and 7). Since frequency modulation caused by rotating wind turbine blades is far less severe than amplitude modulation which distorts video signals, interference to FM radio signals is expected to be very slight. The barely noticeable effect which may occur would only be exhibited at receivers which are within several hundred feet of the wind turbine. There are no homes this close to the site.

Impact on Aircraft Navigation

VOR Transmissions -- VOR (Very High Frequency Omnidirectional Range) transmissions use a reference voltage signal and amplitude modulated (variable voltage) time-phased signals to enable a pilot to automatically plot his bearing in relation to a fixed point (the VOR transmitter).

Preliminary analysis of potential interference with VOR transmissions by MOD-OA wind turbine blades indicates that "scalloping" (slow, rhythmic deviations in voltage strength; translated as an error in bearing indication at the VOR receiver) will be very slight as long as a wind turbine is located in compliance with existing FAA guidelines.

FAA requirements stipulate that a region of 500 meters radius around a VOR transmitter be cleared of any source of scattering. The FAA also precludes the existence of any tall scattering object which rises more than 2 degrees above the horizon from the phase center of the VOR antenna. Given this requirement, the nearest the MOD-OA wind turbine can be sited relative to a VOR transmitter is 1.4 kilometers.

Calculations made assuming no basic VOR bearing error and using a theoretical system located in free space were used to develop the following results:

Distance from VOR	Scalloping (Error in Degrees) (Static Blade)	(Potating Blade)
192.0 meters*	5°.7	6°.31
1.4 kilometers	0°.78	+
10.0 kilometers	0°.11	+

* Within maximum FAA radius
\+ Negligible

These calculations show that scalloping decreases dramatically with increased distance from the VOR transmitter, and that bearing error will be greater when the blades are stationary than when the turbine is operating. The latter effect is due to the fact that while the blades are rotating the scattered signal is distributed over a band of frequencies. The VOR receiver is sensitive only to 30 Hz modulated signals. When the blades are stationary, the 30 Hz modulated signals are directly reflected without frequency distribution.

While the FAA has set no limits for scalloping, detailed analyses which future guidelines may be based upon indicate that scalloping of 1°.0 or less is well within an acceptable range, and that bearing deviations of up to 5°.0 may be tolerable in some instances. Since the rotating blades (which are the only feature of a wind turbine which make it unique to the view of a VOR receiver) have less impact than stationary structures, it is apparent that existing FAA guidelines will assure that the impact upon VOR transmissions will be minimal. The open truss-type tower is similar to the radio towers and high voltage transmission towers for which the FAA regulations were designed.

A wind turbine located at the Block Island site would be about 23.5 nautical miles from the nearest VOR beacon at Trumball, Connecticut, well within FAA guidelines.

ADF*- An ADF (Automatic Direction Finding) transmitter operating at 116 khz will be installed at the airport during 1978. The ADF instrument approach will be from the west. Therefore, the WTG will not impact upon either the ADF or the aircraft approach procedure.

DME and TACAN Transmissions -- The DME (Distance Measuring Equipment) and TACAN (Tactical Air Navigation) systems utilize pulsed frequency modulated signals to enable aircraft receiving units to determine a pilot's distance from the signal source. Since wind turbine blades produce no concentrated frequency modulation, even within several hundred feet of a transmission source, no impact with these transmissions is anticipated.

3.2.2 Abiotic and Biotic Environment

Once the wind turbine is installed, impacts on the surrounding natural environment may occur due to the effects of the rotating blades, the presence of NASA and BIPC technical personnel and visitors, and the movement, noise and exhaust emissions of small vehicles, such as the NASA instrumentation van, which will be used during initial and subsequent system check-out. There is virtually no noise and a total lack of chemical pollution from an operating wind turbine.

*Reference letter of comment 2b

Effect on Microclimate and Vegetation

The effects of semi-porous wind breaks (which approximate the effects of the turbine rotor) on surrounding microclimates has been investigated in connection with DOE (ERDA)-sponsored project (see reference 17). Downwind microclimate variations associated with wind breaks include decreased wind speed, increased relative humidity, and increased soil moisture. Downrotor speed retardation caused by a single MOD-OA series wind turbine is negligible (6 mph) and its effects may be moderated by changes in wind direction. It was found that increased soil moisture in a moisture-plentiful environment, such as a freshwater marsh, would have no appreciable abiotic or biotic effects.

The knoll is already impacted by some power plant activity, including vehicular traffic to and from buildings used for storage. The increase in ground level activity on the knoll due to WTG system checkout, operation and maintenance is not expected to be sufficient to disrupt the wetland. The use of heavy equipment such as cranes may be required for some maintenance operations. However, encroachment on the wetland by personnel or vehicles is not anticipated, and no erosion of material into the wetland caused by the vehicular travel on the knoll is expected.

Effects on Animal Populations

<u>Terrestrial Wildlife</u> -- The marsh habitat will not be significantly

disturbed; the effects of terrestrial species will be limited. The possible presence of muskrat or turtle populations will be relatively unaffected by wind turbine operation, personnel or vehicular traffic at the site. As previously mentioned, the controversial Block Island Meadow Vole, conservatively considered endangered by one conservation group, is not known to inhabit the site.

Battelle studies indicate it is highly unlikely that animals in the vicinity of the wind turbine will be either attracted or repelled because of noise emitted during operation. They reveal that studies by others to develop a complete noise profile, including infra- and ultrasound, are currently underway. A review of these results will allow for determination of any unusual sound levels in ranges not audible to humans but possibly influencing other animals.

Birds -- Block Island lies along the Atlantic flyway, a flight corridor for migrating North American bird species. The island's numerous ponds and its solitary location at sea, midway between two major wildlife refuges on Cape Cod and Long Island make it a convenient resting place for these birds.

Wind turbine towers and rotating blades are potential collision hazards to birds (see reference 17). Birds are apparently able to learn to avoid obstacles placed in their territory. Thus, the turbine is primarily a risk to migrant birds, particularly nocturnal migrants flying at or below 250-feet. Most migratory flights at night take place at about 3,000 feet, but there are great variations under different weather conditions, in different terrains, and for different species (Mahan, 1975). Birds fly higher on clear nights, but not necessarily at the same height for all stages of the flight. A radar study of nocturnal migrants (Able, 1970- see Mahan) reported that 90 percent of the birds were below 5,000 feet and 75 percent below 3,000 feet. Nisbet (1963- see Mahan), also using radar, had similar results (90 percent below 5,000 feet), but also reported occasional shorebirds up to 20,000 feet. Storms or overcast conditions may force birds below their normal cruising altitude or force them to take shelter on land.

Most of the smaller insectivorous species migrate at night, resting and feeding by day, with prolonged stopovers at certain stations, either for replenishing depleted fat supplies or waiting for more favorable flight conditions.

As mentioned in 2.4.7 migrating flocks of waterfowl and other large birds do not appear to frequent the site vicinity. Therefore, the primary hazard would be to large flocks of songbirds, cruising at altitudes below 200 feet, observed near the site during fall migration; low-flying nocturnal migrants such as vireos, warblers, thrushes and sparrows; the occasional flocks of local gulls which fly and land near the site; and individuals of other resident species which may fly over or land at the site.

Relative Hazards of Wind Turbine Components

Tower -- Collisions of nocturnal migrants with the 100 foot tower appear unlikely. A comprehensive radar survey of birds passing over Cape Cod (noted in Griffin, 1964; and Orr, 1970) indicated that most types of birds in that earby sector of the Atlantic flyway migrate at an altitude of 1500 to 2500 feet above ocean or land. The study concluded that only 10 to 20 percent of the birds were flying below 600 feet. This finding seems to be substantiated by recent studies (noted in Battelle, 1976) which indicate that most migrant songbirds in the Eastern United States fly at 500 to 1000 feet above ground level -- well above the 100 foot height of the wind turbine tower.

The danger of the tower to local bird species and diurnal migrants (which fly at elevations below 200 feet) is also slight. A literature survey reveals that almost all significant bird kills occur at night, when birds cannot see lattice-work towers and guy wires, or are confused by warning lights or beacons. The number of bird kills is evidently directly proportional to the height of the tower involved. Without exception, such reports have involved towers and buildings at least 400 feet high or far-reaching beams such as those produced by ceilometers or lighthouses (Vosburgh, 1966; Orr; others listed in Battelle, 1976).

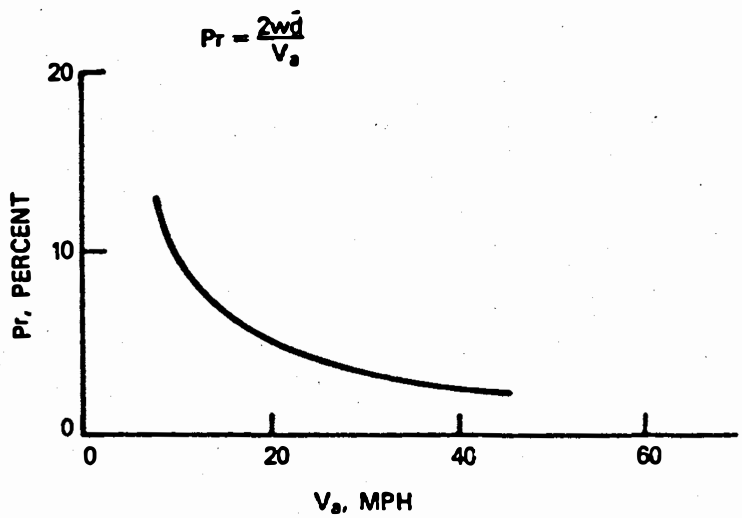
The Turbine Blades -- The blades are the most predominant wind turbine component, covering a relatively large swept area 125 feet in diameter. Analysis indicates that birds will not be swept away from the blades, since the momentum of a flying bird is sufficient to withstand the turning forces imposed by the rotor on the air stream (Battelle, 1976). Nevertheless, the statistical likelihood of a bird flying through the area swept by the rotor actually striking a blade is quite low. Even when a bird passes directly through the swept area, the probability of the bird striking a blade is a function of the width and speed of the blades (rotor solidity) and the speed of the bird's flight. Figure 18 shows the probability curve of the likelihood of bird collision with the MOD-OA blades. The potential for collision is greatest (13 percent) for a cruising or slow-flying bird (8 mph) and decreases to 4 percent at 30 mph, the speed of songbirds during migration (Orr, 1970).

Though the probability of collision by a lone bird flying directly into the rotor disk is relatively slight, the likelihood increases when large flocks of birds are involved, particularly when the flock passes through the blades at an angle. If a flock of 50 songbirds were to pass head-on through the disk at an average speed of 30 mph, two bird collisions could be expected on a statistical basis. The number of collisions could be expected to increase as a function of the angle of descent or ascent.

Behavioral studies of bird reactions to turbine blades rotating at relatively slow velocity are now being carried out by Battelle

Figure 18

PROBABILITY OF A "PASSIVE" BIRD STRIKING THE ROTOR BLADES AS A FUNCTION OF ITS AXIAL VELOCITY



Memorial Institute. It is anticipated that day-flying birds will tend to avoid a flight path in which an obstruction (one of the two blades) appears once every .75 seconds. In addition, small songbirds of the general type which flock near New Meadow Hill Swamp are capable of considerable maneuverability, as evidenced by their ability to avoid collision while flying in close formation and their ability to feed on insects while in full flight. Battelle personnel have reported observing birds taking evasive action to avoid the blades of the MOD-0 turbine at Plum Brook.

Again, analysis indicates that birds will not be swept by the airstream of the rotor, and so will not be "drawn into" the blades.

Insects -- Insects and other small invertebrates populate the air both above land and water habitats. While there are no studies of aerial distribution of arthropods relative to wind turbines, literature supports the synthesis of a general profile of aerial distribution (Glick, 1939; Hardy and Milne, 1938; Freeman, 1945; Johnson, 1969 -- see Battelle). This vertical profile discloses that arthropods have been collected thousands of feet above the ground, but that the majority of these organisms are within 30 meters of the ground.

The absolute distribution and abundance of arthropods aloft differs seasonally, daily, and indeed from hour to hour. The complex interactions of wind turbulence, light, temperature, relative humidity, and other physical properties of air interact in different ways to maintain a fluctuating profile and movement pattern of arthropods. In temperate zones, such as the Block Island area, the greatest population densities occur in the late spring and summer of the year and are small in the winter.

Observations at a 100-kilowatt wind turbine revealed that since most insects are small enough to be turned by the streamlines, their probability of impact is less than for birds. For insects flying at speeds of 3.5 meters per second the probability of striking the blades is approximately eight percent. The probability decreases with increased flight speeds. Thus, the number of insects which will strike the rotor blades of a wind turbine similar to the 100-kilowatt design will be less than ten percent of those passing horizontally through the rotor-swept airspace.

4. UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

4. UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

4.1 Bird Kills*

Block Island lies along the Atlantic flyway, a major route for migratory birds. In spite of the relatively low height of the wind turbine and the low solidity (area swept by the blades) of the rotor disk, the possibility of bird kills cannot be discounted.

The significance of birds, as well as bats and insects, colliding with the rotating blades of a wind energy conversion system varies with the location, time of day, season of the year, and prevailing climatic conditions. Migratory songbirds are more likely to be effected on dark foggy nights at the peaks of migration in spring and fall. Day time migratory birds can be expected to avoid the blades as would most nighttime migrants in fair weather.

Generally, birds avoid obstacles which they can see. The risk of bird kills at a large wind turbine is no higher than the risk posed by any other large structure. Birds will occasionally be killed by collision with the tower or rotors. However, DOE studies and experience with other turbines indicate that the bird kill problem is minimal; and rather than fund an extensive bird monitoring study at this site, DOE will initiate informal bird collision monitoring by on-site Block Island Power Company personnel. Further, DOE and NASA personnel will make occasional on-site visits to

*Reference letter of comment #1.

assure identification of unusual unanticipated bird collision problems.

4.2 Disruption of Television Signals

The introduction of the wind turbine power generator will have a detrimental impact on the reception of the video portion of TV signals transmitted to Block Island. A noticeable distortion of the television image can be expected for at least one, and up to six of the VHF channels at 111 reception points, while 536 reception points will experience a loss in picture quality for at least one UHF channel. At the outer edge of the interference radius surrounding the WTG image distortion will be characterized by the appearance of dark horizontal lines moving vertically across the TV screen and the beginning of a "snow effect". A closer proximity of the reception point and/or the orientation of turbine rotor will increase picture break-up for one or more TV signals. This loss of TV reception may have an impact on the island's tourist industry as well as an effect on TV viewing by permanent inhabitants of the island.

The installation of directional antennas to the affected areas would reduce much of the negative impact. But, due to the 40 degree shadow cone (described in Section 3), installation of directional antennas will not alleviate all problems associated with TV reception. On the other hand, the introduction of a Cable TV network would eliminate the potential for interference by the WTG and also improve the reception capability and picture quality of all residences connected to the network (Cable TV is also discussed in Section 5.4 and 9.2).

5. ALTERNATIVES

5. ALTERNATIVES

The following section deals with the description and evaluation of possible alternatives to the installation and field testing of the large experimental wind turbine generator on Block Island. To effectively evaluate possible avenues of action, and to do so in a manner that will result in an environmentally sound alternative, this analysis considers only what are believed to be the practical alternatives.

5.1 Field Test Project Discontinuation

The field test project at the Block Island site or at one having comparable characteristics is essential to the Federal effort to demonstrate the feasibility of the operation of large wind turbines for electric power generation. The DOE objective in the performance of this field test is to enable the early implementation of wind energy systems, thus providing an alternative energy source which is economical, renewable, and non-polluting.

This test project is essential for the evaluation of characteristics associated with an isolated installation of wind energy turbine generators. These characteristics include:

- o Isolated utility interface operational data
- o Wind machine dynamics
- o Power output performance
- o Economic benefits of wind power

Without such information, the planned refinement of current system designs and the subsequent development of more reliable and economical wind turbines for this category of operation could not be achieved. Discontinuation of this field test project would be a substantial setback to the Federal wind energy program.

5.2 Alternative Site Selection

An evaluation of candidate alternative sites has indicated that the Block Island site offers great probable benefit to this category of Federal field test program. Analysis of the overall suitability of this site with respect to the important project parameters, including wind characteristics such as duration and velocity, indicates that the selection of an alternative site has the potential for providing less than the optimal performance expected from the Block Island site. Selection of a different site would also require additional expenditures of time, labor and funds.

5.3 Selection of an Alternative Site on Block Island

Consideration of an alternate site on the island is dependent upon the potential for effectively interfacing the wind turbine with the existing utility distribution system. Block Island Power Company property was selected by the co-proposers as the optimum location for the installation of a large experimental wind turbine generator. The site set forth in their proposal is on land wholly owned by BIPC and is presently under the surveillance and security by BIPC employees. The electric power from the wind turbine generator will most easily be fed into the system, evaluated, and recorded at the power plant from this site. In addition, most residents are of the opinion that the WTG unit should be placed in the vicinity of the BIPC facility where the contrast will be less striking than in a less developed portion of the island. Selection of another site on the island would not eliminate the need for amelioration of an impact on television reception.

5.4 Alleviation of Adverse Effects

5.4.1 Reduction of Bird Kills

Alternative measures that could be taken by DOE to reduce the possibility of bird collisions with the turbine are not presently known to exist.

5.4.2 Alleviation of Television Interference

Cable TV Installation

As mentioned in Sections 3.2.1 and 4.2, the installation of a cable television network has been identified as the best means of alleviating wind turbine-induced interference at the Block Island site. Therefore DOE is planning the concurrent installation of a Cable TV (CATV) system. The cable system will preclude the possibility of interference while permitting separate measurements of any actual interference.

The Town of New Shoreham has formed a committee to study CATV as a town-operated municipal system. Their recommendations to the Town Council reflect the general public acceptance of CATV as shown in a survey taken in December of 1976. It is anticipated that the town or the utility will elect to take ownership of the proposed CATV system and become fully responsible for the maintenance and operating costs at the completion of the two-year project. DOE will not receive reimbursement for the system nor will DOE be required to provide financial support for the system after termination of the field-test project. Should the wind turbine be turned over to the utility after project completion, transferral documents will require that the CATV system be maintained to alleviate wind turbine impacts on television reception.

The owner (whether it is the Town of New Shoreham or BIPC) will be required to obtain the operating franchise for the CATV system from the Rhode Island Public Utilities Commission. The Public Utilities Commission understands the time-dependent problems of coordinating the construction of a Cable TV system with the WTG project and has given assurances that any application for a CATV franchise, in connection with this project, will be expedited.

The proposed CATV system would offer eight channels which include all three networks as well as public broadcast outlets and possess an ultimate 14* channel capability. This will far exceed the current level of reception at most homes. The primary purpose of this

*Reference letter of comment #2.

system shall be to reach the permanent year-round residents of the island and secondly to reach those seasonal residents of the island whose homes have electrical service. Costs to implement the CATV system and thereby alleviate turbine-induced interference are included in Section 9.3.

Impacts of Cable TV Installation and Operation.

The main CATV antenna and small tower to which it is attached will be located near the existing fire station. CATV tower erection activities will not significantly impact the island's economy, transportation network or land use alternative. The slight noise and visual disruption experienced at the tower site and along the cabling route are expected to be limited and of short duration.

CATV cables will either be hung on existing power lines or buried in ditches along existing roads. Care will be taken in the positioning of these cables so as not to greatly disturb vegetation and soil patterns.

Impacts associated with the operation of the CATV network are expected to be beneficial to the local community. Residents will realize better television reception and will have a greater choice of viewing alternatives.

*Reference letter of comment #2.

6. RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

6. RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Neither short-term use of the site for the field test project by DOE nor subsequent transferral of the MOD-OA to the utility will have a significant impact on the long-term productivity of the region or on future options of the people of the island or the power utility.

The rate to be charged by the Block Island Power Company for electricity generated in the DOE funded WTG will be established by the Rhode Island Public Utilities Commission.

7. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS

7. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS

7.1 Federal

The legal and institutional implications of wind energy systems was the emphasis of a recent study prepared for the National Science Foundation (see reference 18). This study concluded that there are relatively few serious legal impediments to wind system implementation. Such serious constraints as do exist are often closely related to social, economic and technical problems which vary for each particular application.

7.1.1 Preservation

New Meadow Hill Swamp's location within the major sphere of development on Block Island makes it an unlikely candidate for future preservation under existing Federal programs. The U.S. Bureau of Outdoor Recreation's publication, Islands of America (1970), the culmination of a two-year study of the recreational, scenic, natural and historical value of America's islands, recommends no specific actions for Block Island, although Martha's Vineyard, Nantucket, and the nearby Elizabeth chain were all recommended for preservation and protection. The Rhode Island Historical Preservation Commission notes, however, that a preliminary survey indicates that several districts (other than the two existing districts) on the island could be identified as eligible for the National Register of Historic Places. They express the possibility of the entire island being considered a historical district, as has been done at Nantucket. The National Historic Preservation Act mandates review of Federal activities which might affect property that is listed or eligible for listing in the National Register of Historic Places.

The U.S. Fish and Wildlife Service maintains a cooperative agreement with the private Sachem Pond Wildlife Refuge, four miles north of the site -- a distance which appears to preclude any possible conflict.

7.1.2 Development

There is no evidence of Federal plans or programs involving the possible future development of the site or development projects on the island. The site is far enough from the island's Coast Guard Station, one and three-quarter miles across Great Salt Pond, to preclude any possible conflicts with that facility's operations or future expansion.

7.1.3 Inter-agency Approvals

Since the proposed wind turbine tower is not in the flight pattern for take-off and landing at the airport, approximately one-half mile to the southwest, and since a tall meteorological tower with

FAA visibility features is located nearby, FAA makes no requirements for painting and lighting the WTG tower structure and blades.

Federal Communications Commission (FCC) standards relating to wind energy systems as incidental power sources emitting electromagnetic interference (with radio, television, and other reception) are rather general. As written, current regulations could preclude the operation of offending systems, and FCC review of this project is warranted. However, the possibility of television interference will be eliminated by the planned Cable TV system (see Section 3.2.1).

7.2 State and Local

The MOD-OA project has received firm backing from the governor of Rhode Island and is co-sponsored by the Rhode Island Division of Public Utilities -- a state government agency. The New Shoreham Town Council has also expressed its support for the project.

The zoning code of the Town of New Shoreham (Block Island) has been amended to include wind turbines as permitted uses. On March 7, 1976, the New Shoreham Planning Board approved the site for installation of "a wind turbine generator or windmill tower not more than 150 feet high with wind swept revolving blades not more than 150 feet in diameter."

On April 10, 1976, the New Shoreham building inspector agreed to issue a building permit provided: 1) a blade clearance of at least 10 feet is designed and 2) the structure shall be enclosed by a fence or other means.

In light of these approvals and expressions of support, no potential conflict seems to exist with state or local government programs. Letters of support for the WTG project and amendments to zoning ordinances are provided in Appendix B.

8. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

8. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Under the proposed plan considered in this statement, the materials and energy used in construction will be an irretrievable commitment of resources. Necessary changes in the natural topography and unavoidable loss of vegetation through construction are considered irretrievable. However, if the wind turbine is removed after project completion, the land on which the WTG will be situated will be restored upon termination of the test project. No loss in property values or future land use alternatives is anticipated, even if the facility remains in service with BIPC.

On one hand, the state and Federal funds committed to this project will be an irreversible and irretrievable commitment of financial resources in that such funds will be unavailable for other projects or needs. On the other hand, such an investment is not irretrievable since it will be manifested in the obtainment of valuable experience and data regarding wind turbine design features, the durability of machine components, wind characteristics, and electrical stability and control requirements of a WTG utility interface.

9. ENVIRONMENTAL TRADE-OFF ANALYSES

9. ENVIRONMENTAL TRADE-OFF ANALYSIS

9.1 Benefits

Significant benefits which will result from this action include:

1) The Block Island site's high average wind speeds and the small size of the Block Island utility system provide an excellent "laboratory" environment for testing of the MOD-OA wind turbine. These site characteristics assure that the turbine will have maximum operating time during the test period and that the characteristics of its electrical output will be readily measured against the background of the utility's conventional generation equipment. Block Island represents the type of remote area where wind energy may offer near-term benefits as a cost-competitive alternative to high-cost imported oil.

2) The field test program will allow assessment of the dynamics, performance, and durability of large horizontal wind turbines. It is essential that these machine characteristics be tested before they are manufactured in large quantities by private industry.

3) The field test program will allow the identification of methods to reduce the cost of future wind turbines and machine components. In addition, the interface of the turbine and power network will allow the development of cost-effective electrical

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interconnection hardware and procedures. Monitoring of environmental effects, as deemed necessary by DOE, will enable a more precise determination of the extent and impact of these effects.

4) Other long-term benefits associated with the large-scale use of wind systems include a) the lower cost of wind power systems as opposed to the relatively higher cost of fossil fuel systems; and b) the potential of wind systems as clean, non-imported, renewable energy sources.

5) On Block Island, residents will benefit temporarily from an increase in revenue due to the rental of equipment, the purchase of materials and an anticipated increase in tourist activity. The Block Island Power Company will benefit temporarily from the addition of a generating unit to their distribution network. Also to the extent that electricity is generated, BIPC will benefit from a slight reduction in fuel costs.

9.2 Island Logistics

Cost Impact

Present MOD-OA construction cost estimates made by NASA-LeRC were based on a benign and highly accessible mainland installation such as Plum Brook Station, Sandusky, Ohio. The following is a summary of estimated additional costs for installation on Block Island:

	Least Cost Estimate	Block Island Estimate Least	Most
Construction Labor (6 persons-9 mos. @ $40K per man-year	$180K	$270K	$314K
Foundation Concrete	$ 2K	$11.5K	$11.5K
Equipment Transportation			
5 Barge Trips (85-ton crane, 35-ton crane, and tower)	-	$ 9K	$ 15K
7 Ferry Trips (rotor blades, wind turbine, and mobile data van.)	-	$ 3.5K	$ 3.5K
Electrical	-	$ 20K	$ 30K
Cable TV System	-	$200.5K	$274.5K
Totals	$182K	$514.5K	$648.5K

Based on the above considerations, the additional cost of installing the MOD-OA (200-kilowatt) wind turbine on Block Island is estimated to be in the range of $332.5K ($514.5 minus 182) to $466.5K (648.5 minus 182) depending largely on inclement weather conditions such as heavy seas actually encountered during stages of the construction period. This additional expenditure of government funds will be offset by the valuable and unique experience anticipated to be gained from the conduct of the WTG project on Block Island.

The probable cost impact as estimated above includes direct costs only, and does not account for inflation or contingencies. These factors could increase the wind turbine installation costs by 20 to 25 percent.

Schedule Impact

Barge and ferry boat operators serving Block Island indicate that, based on past experience, trips to Block Island during the winter period (November through April) were made on the average of about four out of five days per week. Therefore, it would seem reasonable to expect a three to four week delay in the present MOD-OA schedule due to inclement weather. The cost impact associated with this delay is already included in the above range of cost impact.

9.3 Cost of Alternatives

Termination of the Project

Termination of the project would result in a loss of government funds already expended for selection and assessment of the site. Project postponement or a significant delay would result in higher machine and labor bids for a revised schedule. Postponement could also result in the withdrawal or expiration of the utility proposal, necessitating additional government expense for the selection of an alternative, and perhaps less than optimal, field test site.

Cable TV Installation

Based on analyses on the potential for television interference (discussed in Sections 3.2.1 and 5.4), DOE is arranging for the concurrent installation of a Cable TV (CATV) system. The cable system will preclude the possibility of significant interference. Estimated costs of a CATV system installation on the major portion of the island amount to 274,500 dollars. The approximate per mile cost of construction (installation) is 7,000 dollars per mile. A description of the CATV system and an explanation of initial costs are included in Appendix C.

10. COMMENTS RECEIVED ON DRAFT STATEMENT

10. COMMENTS RECEIVED ON DRAFT STATEMENT

Comments were received from:

1. United States Department of the Interior
2. State of Rhode Island and Providence Plantations
   a. Public Utilities Commission
   b. Statewide Planning Program
   c. Historical Preservation Commission
3. National Aeronautics and Space Administration
4. Department of Health, Education and Welfare
5. National Science Foundation

Copies of the letters received are included in this section.

Concerns were expressed in the following five areas and the text has been revised to address these concerns.

Tourism Effects

Concern was expressed about the impacts on water supply and sanitation systems from increased tourism, and it was suggested that a viewer accommodation area be provided.

Section 3.2.1, pages 80-81, have been revised to reflect the current view that the number of visitors will be inconsequential and that no impact will be observable. The Clayton New Mexico turbine generator site has had very few visitors in spite of it being on the mainland in a recreation/visitor oriented state and the need for a viewer accommodation area will be assessed after the windmill is in operation.

Effects on Birds

Concern was expressed about the potential for damage to birds and the corollary desirability of monitoring for bird reactions and collisions with the operating turbine.

Pages 108 and 22 have been revised to clarify the fact that DOE studies and experience indicate that bird kill is minimal. Instead of funding an extensive site study, DOE will have Block Island Power Company personnel monitor for bird kills from operation of this windmill. They will notify DOE if any large kill occurs.

Endangered Species

Concern was expressed for the Block Island Meadow Vole and it was recommended that DOE should have an extensive field study made.

The text has been corrected, pages 58-60, to reflect that the Vole is flourishing on the island as determined by an unpublished paper by Yale University students. Further, the vole is not on the U. S. Department of Agriculture's current list of endangered and threatened wildlife. A study by a resident naturalist failed to locate voles or traces of voles at the specific turbine site.

Television Reception

Concern was expressed that fourteen television channels are received on Block Island, but the proposed cable system would offer only eight channels, thereby depriving some househould of some of the variety they now enjoy.

The currently proposed cable system will have the capability for expansion to fourteen channels and this change has been incorporated on page 115.

Aerial Navigation Interference

Concern was expressed regarding the potential impact of the windmill operation on a 116 KHz nondirectional beacon to be installed at the Block Island airport.

Page 98 was revised after determining that there will be no electronic interference created by the wind turbine and that the nondirectional beacon (NDB) instrument approach to the airport will not cross the turbine site.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 78/261

MAY 5 1978

Mr. W. H. Pennington, Director
Office of NEPA Coordination
Department of Energy
Washington, D. C. 20545

Dear Mr. Pennington:

Thank you for your letter of March 24, 1978, transmitting copies of the Department of Energy's draft environmental impact statement for wind turbine generator system, Block Island, Washington County, Rhode Island.

Our comments are presented according to the format of the statement or by subject.

Impacts of Tourism

The draft statement on pages 81-82 indicates that the proposed project will be a major attraction to people who visit Block Island, and will probably result in increased tourism near the site, and that a "viewer accommodation area" may be required. We recommend that a public observation area site be tentatively planned by the Block Island Power Company and Town of Shoreham, perhaps in conjunction with the visitor control plan identified on page 82 of the draft statement.

In addition, we find that the proposed project will not affect any existing or proposed administrative units of the National Park System.

The final statement should assess at least in a general manner, the probable impacts on water supply and sanitation systems, and thus on groundwater resources, resulting from the anticipated increase in tourism.

We hope these comments will be helpful to you in the preparation of a final statement.

Sincerely,

Larry E. Meierotto
Deputy Assistant SECRETARY

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 78/261

MAY 19 1978

Mr. W. H. Pennington, Director
Office of NEPA Coordination
Department of Energy
Washington, D. C. 20545

Dear Mr. Pennington:

It has come to our attention that we have supplementary comments to those provided in our letter of May 5, 1978, on the wind turbine generator system, Block Island, Washington County, Rhode Island. The following comments should also be considered in the final statement.

Impact on Endangered Species

The draft statement does not indicate whether a recent scientific field study was conducted of the endangered Block Island meadow vole at the site to determine the impact of the proposed project on this species. We recommend that the Department of Energy undertake a more comprehensive examination of the Block Island meadow vole population in the project area and other endangered and threatened species as discussed in the draft statement. Consultation with the Fish and Wildlife Service under Section 7 of the Endangered Species Act should also be initiated.

Impacts on Birds

This section of the draft statement discusses studies being carried out by Battelle Memorial Institute to assess bird reactions to the tower and turbine blades. We recommend that the Department of Energy fund monitoring studies of bird reactions and collisions with the tower after it is operational. We believe that the results from these monitoring studies could provide valuable information that could be applied in the design and operation of future projects of this nature.

We hope these comments will be helpful to you in the preparation of the final statement.

Sincerely,

Larry E. Meierotto
Deputy Assistant SECRETARY

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

PUBLIC UTILITIES COMMISSION
100 Orange Street
Providence R I 02903

May 2, 1978

Mr. W.H. Pennington, Director
Office of NEPA Coordination
Department of Energy
Washington, DC 20545

Dear Mr. Pennington:

The Division of Public Utilities, as a co-sponsor of the wind turbine generator experiment, has given serious consideration to the impact of this project. I am convinced that the development of domestic, environmentally-sound energy sources such as wind is in the best interest of the nation. The State of Rhode Island is pleased to sponsor Block Island as a site for testing the NASA Mod-OA windmill.

The longterm benefit to the nation's energy policy makers is ennanced by the immediate benefit to the people of Block Island. Presently they face some of the highest electricity costs in the nation.

Study of the Draft EIS prepared by the Department of Energy shows that there are few problems associated with windpower. One of the blessings of windpower is its lack of a chemical impact. I am satisfied that DOE has made a thorough investigation of the impact on the local environment.

The major effect, television interference, is significant enough to warrant the response DOE has described in the impact statement, the installation of a community antenna television system (CATV). The importance of this communication link with the mainland is particularly great in a small isolated community like New Shoreham.

A few details about the description of the cable system proposed in the Draft EIS do prompt some comment, however. First, after further consideration, the Town of New Shoreham now prefers the fire station to the sewage plant as a site for the CATV tower. The Division understands that this site has been approved by the New Shoreham planning board and the fire chief.

Secondly, the EIS reports that fourteen channels are presently received over the air by Block Island residents. A survey conducted by the Block Island Power Company shows that some additional channels are received by Block Island residents. The proposed system described on pp. 115-116 would offer only 8 channels with an ultimate 12 channel capacity.

Granted, not all 14 channels are received by everyone in the community. Still these households would be deprived of some of the variety they now enjoy. I recommend that a cable system with greater built-in capacity be constructed to allow for this factor. Simple expansion of the cable tv system to provide at least 14 channels will be sufficient to correct this oversight.

Again, I wish to express my support for Block Island as a test site in the Department of Energy's wind power experiment. The harnessing of this local natural resources is an exciting prospect.

Sincerely,

Edward F. Burke

Edward F. Burke
Administrator

EFB/nb
cc: John O'Brien, Statewide Planning Program

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Administration
STATEWIDE PLANNING PROGRAM
265 Melrose Street
Providence, Rhode Island 02907

May 8, 1978

Mr. W.H. Pennington, Director
Office of NEPA Coordination
Department of Energy
Washington, D.C. 20545

Dear Mr. Pennington:

This is to inform you that the Technical Committee of the State Planning Council has reviewed the Draft Environmental Impact Statement on a Wind Turbine Generator System, Block Island, Rhode Island in accordance with OMB Circular A-95, Part II.

After having reviewed the document and considered the comments received the Committee moved to transmit the comments of the R.I. Public Utilities Commission, R.I. Department of Transportation-Division of Airports and the R.I. Historical Preservation Commission.

Thank you for the opportunity to comment.

Yours very truly,

Daniel W. Varin
Chief

DWV/JOB/mag
Enclosures 3

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

HISTORICAL PRESERVATION COMMISSION
Old State House
150 Benefit Street
Providence, R.I. 02903
(401) 277-2678

April 12, 1978

Mr. Daniel W. Varin, Chief
Statewide Planning Program
265 Melrose Street
Providence, R.I. 02907

RE: EIS-78-02

Dear Mr. Varin:

This office has reviewed the above-referenced project for a wind turbine generator on Block Island. The proposed site is not within the Old Harbor Historic District, entered on the National Register of Historic Places, but will be visible from the district. The project has therefore been reviewed for its effect on the district and upon archeological resources.

It is our finding that the proposed wind turbine will have no adverse effect on the Old Harbor Historic District nor upon the archeological resources of Block Island. We therefore have no objections.

Sincerely,

Eric Hertfelder
Deputy State Historic
Preservation Officer

/mm

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

INTER OFFICE MEMO

TO: John O'Brien — DATE: May 2, 1978

DEPT: R. I. Statewide Planning Program

FROM: Allen F. Day
Chief, Engineering Section

DEPT: DOT, Division of Airports

SUBJECT: Review of Draft Environmental Impact Statement for Wind Turbine Generator System at Block Island, RI

We have reviewed the subject draft nvironmental Impact Statement and find that there will be no appreciable conflict with aircraft operations at Block Island State Airport. The proposed Wind Turbine Generator (WTG) is so situated and of such a height that there is no penetration of imaginary airport approach control surfaces. It is understood that blade tips will be strobed for night obstruction lighting.

One feature not mentioned in the Impact Statement is a nondirectional beacon which will be installed this summer on airport property, operating at a frequency of 116 KHz. I have been informed that this frequency, similar to FM transmissions, will not be affected by the WTG. However, for evaluation of this item and/or other electronic aids, existing or future, I rely on the expertise of FAA's separate review.

Allen F. Day

Chief, Engineering Section

AFD:av

cc: Victor C. Ricci
Louis W. Cappelli

May 2, 1978

Mr. W.H. Pennington, Director
Office of NEPA Coordination
Department of Energy
Washington, DC 20545

Dear Mr. Pennington:

The Division of Public Utilities, as a co-sponsor of the wind turbine generator experiment, has given serious consideration to the impact of this project. I am convinced that the development of domestic, environmentally-sound energy sources such as wind is in the best interest of the nation. The State of Rhode Island is pleased to sponsor Block Island as a site for testing the NASA Mod-OA windmill.

The longterm benefit to the nation's energy policy makers is enhanced by the immediate benefit to the people of Block Island. Presently they face some of the highest electricity costs in the nation.

Study of the Draft EIS prepared by the Department of Energy shows that there are few problems associated with windpower. One of the blessings of windpower is its lack of a chemical impact. I am satisfied that DOE has made a thorough investigation of the impact on the local environment.

The major effect, television interference, is significant enough to warrant the response DOE has described in the impact statement, the installation of a community antenna television system (CATV). The importance of this communication link with the mainland is particularly great in a small isolated community like New Shoreham.

A few details about the description of the cable system proposed in the Draft EIS do prompt some comment, however. First, after further consideration, the Town of New Shoreham now prefers the fire station to the sewage plant as a site for the CATV tower. The Division understands that this site has been approved by the New Shoreham planning board and the fire chief.

Secondly, the EIS reports that fourteen channels are presently received over the air by Block Island residents. A survey conducted by the Block Island Power Company shows that some additional channels are received by Block Island residents. The proposed system described on pp. 115-116 would offer only 8 channels with an ultimate 12 channel capacity.

Granted, not all 14 channels are received by everyone in the community. Still these households would be deprived of some of the variety they now enjoy. I recommend that a cable system with greater built-in capacity be constructed to allow for this factor. Simple expansion of the cable tv system to provide at least 14 channels will be sufficient to correct this oversight.

Again, I wish to express my support for Block Island as a test site in the Department of Energy's wind power experiment. The harnessing of this local natural resources is an exciting prospect.

Sincerely,

Edward F. Burke
Administrator

EFB/nb
cc: John O'Brien, Statewide Planning Program

NASA
National Aeronautics and
Space Administration

Washington DC
20546

Reply to Attn of: LB-4

May 16, 1978

Mr. W. H. Pennington, Director
Office of NEPA Coordination
Department of Energy
Washington, DC 20545

Dear Mr. Pennington:

This responds to your letter of 24 March 1978 requesting comments on the Department of Energy's (DOE) draft Environmental Impact Statement, Wind Turbine Generator System, Block Island, Rhode Island. The statement has been reviewed by interested offices in NASA, and we have no comments to offer.

We appreciate the opportunity to work with DOE on the subject project and look forward to our continued cooperation in the important national program to develop alternative energy resources.

Sincerely,

Nathaniel B. Cohen, Director
Management Support Office (External Relations)

DEPARTMENT OF HEALTH EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA GEORGIA 30333
TELEPHONE [illegible]

May 22, 1978

Mr. W. H. Pennington
Director
Office of NEPA Coordination
Department of Energy
Washington, D.C. 20545

Dear Mr. Pennington:

We have reviewed the draft environmental impact statement on the Wind Turbine Generator System, Block Island, Rhode Island, on behalf of the Public Health Service. We do not have any comments to offer.

Thank you for the opportunity to review this document.

Sincerely yours,

William H. Foege, M.D.
Assistant Surgeon General
Director

NATIONAL SCIENCE FOUNDATION
WASHINGTON D.C. 20550

OFFICE OF THE ASSISTANT DIRECTOR FOR ASTRONOMICAL, ATMOSPHERIC, EARTH AND OCEAN SCIENCES

June 5, 1978

Mr. W. H. Pennington
Director
Office of NEPA Coordination
Department of Energy
Washington, D.C. 20545

Dear Mr. Pennington:

I am responding to your letter of March 24, 1978, concerning the DOE DEIS on the Wind Turbine Generator System, Block Island, Rhode Island, DOE/EIS-0006-D. The NSF has reviewed the draft and has one reservation as follows:

The statement on page 6 that "The threatened Block Island Vole has not been observed in the site area" is weak as it stands. The amplifying information on pp. 58, 60 to the effect that this vole prefers beach grass/uncut field habitat is reassuring, but still falls short of providing the level of assurance required when dealing with a threatened species. If the statement could indicate that the zero observations reco ded here result from a specifically stated and appropriate level of effort to locate the animal at this site, it would be substantially stronger in the face of any possible challenge. If the level of effort does not justify confidence, additional field work should be required.

Subject to this reservation the NSF finds that:

(a) this represents an adequate environmental impact study;

(b) the relatively minor impacts identified are more than offset by the prospective environmental gains; therefore,

(c) the project seems justified so far as environmental considerations are concerned;

(d) the electronic interference seems a question for the appropriate regulatory agency and is not addressed here.

Sincerely yours,

Daniel Hunt
Deputy Assistant Director
for Operations

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J F KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

May 8, 1978

Assistant Secretary for Energy Technology
U.S. Department of Energy
Washington, DC 20545

Dear Sir/Madam:

We have completed our review of the Draft Environmental Impact Statement (EIS) for the proposed Wind Turbine Generator System at Block Island, Rhode Island.

From the standpoint of EPA's areas of jurisdiction and expertise, we believe the project, as described in the EIS, will not cause severe impacts to the physical environment. Therefore, in accordance with our national rating system, we have rated the project and EIS LO-1 (see enclosed explanation).

Thank you for the opportunity to review the EIS. We would appreciate receiving a copy of the Final EIS when it becomes available.

Sincerely,

Wallace E Stickney

Wallace E. Stickney, P.E.
Director, Environmental & Economic
Impact Office

Enclosure

EXPLANATION OF EPA RATING

Environmental Impact of the Action

LO -- Lack of Objections

EPA has no objections to the proposed action as described in the draft environmental impact statement; or suggests only minor changes in the proposed action.

ER -- Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating federal agency to reassess these aspects.

EU -- Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1 -- Adequate

The draft environmental impact statement sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2 -- Insufficient Information

EPA believes that the draft environmental impact statement does not contain sufficient information to assess fully, the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft environmental impact statement.

Category 3 -- Inadequate

EPA believes that the draft environmental impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft environmental impact statement is assigned a Category 3, no rating will be made of the project or action; since a basis does not generally exist on which to make such a determination.

REFERENCES AND SELECTED BIBLIOGRAPHY

REFERENCES AND SELECTED BIBLIOGRAPHY

1. Anthony, H. E. Field Book of American Mammals. New York: G. P. Putnam's Sons, 1928.

2. Blanchard, F. S. Block Island to Nantucket. Princeton, New Jersey: D. Van Nostrand Co., Inc., 1961.

3. Block Island Power Co., Narragansett Electric Company and Rhode Island Division of Public Utilities. Installation and Field Testing of Large Experimental Wind Turbine Generator System - Proposal, and related correspondence. April 19, 1976.

4. Collins, H. H., Jr. Complete Field Guide to American Wildlife, East, Central, & North. New York: Harper and Row Publishers, 1959.

5. Eldridge, F. R. Proceedings of the Second Workshop on Wind Energy Conversion Systems, NSF.RA-N75-050. McLean, Virginia: The Mitre Corporation, 1975.

6. Federal Writer's Project. Rhode Island, A Guide to the Smallest State. Boston: The Riverside Press, 1937.

7. Fisher, J., et al. Wildlife in Danger. New York: The Viking Press, 1969.

8. Geisser, R. F. and Associates, 120 Pershing Street, East Providence, Rhode Island. (Records of soil boring taken at Block Island site in August 1976.)

9. Gemming, E. Block Island Summer. Riverside, Connecticut: The Chatham Press, Inc., 1972.

10. Griffin, D. R. Bird Migration. Garden City, New York: The Natural History Press, 1964.

11. Leonard, J. N. Atlantic Beaches. New York: Time-Life Books, 1972.

12. Mahan, H. D. and G. J. Wallace. An Introduction to Ornithology. New York: MacMillan Publishing Co., Inc., 1975.

13. National Academy of Engineering. Engineering for Resolution of the Energy=Environment Dilemma. Washington, D.C.: Committee on Power Plant Siting, 1972.

14. National Aeronautics and Space Administration. Fabrication and Assembly of the ERDA/NASA 100-Kilowatt Experimental Wind Turbine, NASA Technical Memorandum X-3390. Washington, D.C.: 1976.

15. National Aeronautics and Space Administration. Large Experimental Wind Turbines - Where We Are Now, NASA Technical Memorandum X-71890. Washington, D.C.: 1976.

16. National Aeronautics and Space Administration. Prediction of Hazards from Wind Power Machine Blade Fragments. R. E. Ricker, Southwest Research Institute, San Antonio, October 1976.

17. National Science Foundation. An Evaluation of the Potential Environmental Effects of Wind Energy System Development - Interim Final Report, Contract No. AER 75-07378, RANN Document No. NSF/RA-760188, ERDA/NSF-07378/75/1. Columbus Ohio: Battelle, Columbus Laboratories, August 1976.

18. National Science Foundation. Legal-Institutional Implications of Wind Energy Conversion Systems (WECS) - Executive Summary, NSF/RA-770203. Washington, D.C.: September 1977.

19. National Science Foundation. Public Reactions to Wind Energy Devices. Survey Research Laboratory, University of Illinois, March 1977.

20. Niering, W. A. The Life of the Marsh, The North American Wetlands. New York: McGraw-Hill, 1966.

21. Orr, R. T. Animals in Migration. London: The MacMillan Company, 1970.

22. Pettingill, O. S., Jr. A Guide to Bird Finding. New York: University Press, 1951.

23. Putnam, P. C. Power From the Wind. New York: Van Nostrand Reinhold Co., 1948.

24. Rhode Island Dept. of Community Affairs. Comprehensive Community Plan - Town of New Shoreham, Rhode Island, Project No. R.I.P.-34. Providence, R. I.: Planning and Development Division, 1972.

25. Robbins, C. S. et al. A Guide to Field Identification-Birds of North America. New York: Golden Press, 1966.

26. Thomson, A. L. Bird Migration. London: H. F. and G. Witherby, Ltd., 1949.

27. U.S. Dept. of the Interior. Birds in OUr Lives. Washington, D.C.: 1966.

28. U.S. Dept. of the Interior. Islands of America. Washington, D.C.: Bureau of Outdoor Recreation, 1970.

29. U.S. Dept. of the Interior. The National Register of Historic Places. Washington, National Bark Service, 1972 Supplement, 1974.

30. U.S. Dept. of the Interior. Threatened and Endangered Species in the United States. Washington, D.C.: Fish and Wildlife Service, 1973.

31. U.S. Energy Research Development Administration. Draft Environmental Development Plan (EDP) - Wind Energy Conversion. Washington, D.C.: Office of Assistant Administrator for Environment and Safety and Office of Assistant Administrator for Solar, Geothermal and Advanced Energy Systems, 1977.

32. U.S. Energy Research and Development Administration. Environmental Impact Assessment - Installation and Field Testing of Large Experimental Wind Turbine Generator System on Block Island, Rhode Island. Washington, D.C.: Division of Solar Energy, Wind Systems Branch, 1976.

33. U.S. Energy Research and Development Administration. Environmental Impact Assessment - Installation, Operation and Maintenance of Instrumented Meteorological Towers at Candidate Sites for the Installation and Field-Testing of Experimental Wind Turbine Generator Systems. Division of Solar Energy, June 1976. (Available for inspection at Government Document Rooms)

34. U.S. Environmental Protection Agency. Final Environmental Impact Statement - Wastewater Collection and Treatment Facilities - New Shoreham, Rhode Island. Boston, Mass.: New England Region I, September 1975.

35. U.S. Energy Research and Development Administration. "Information from ERDA - Two Sites and Utilities Selected for Wind Turbine Field Tests", No. 77-97. Washington, D.C.: June 8, 1977.

36. U.S. Energy Research and Development Administration. Request for Proposal E(49-18)-2283 - Candidate Sites for Installation and Field Testing of Large Experimental Wind Turbine Generator System. Washington, D.C.: March 1976.

37. U.S. Energy Research and Development Administration. Solar Program Assessment: Environmental FActors - Wind Energy Conversion, ERDA 77-47/6. Washington, D.C.: Division of Solar Energy, Environmental and Resource Assessments Branch, March 1977.

38. U.S. Energy Research and Development Administration. Summary Report - Federal Wind Energy Program, ERDA - 77-32. Washington, D.C.: Division of Solar Energy, Wind Systems Branch, January 1, 1977.

39. U.S. Energy Research and Development Administration. TV and FM Interference by Windmills, U. M. No. 014438-1-F, Contract No. E(11-1)-2846. Ann Arbor, Mich.: University of Michigan, College of Engineering, February 1977.

40. U.S. Geological Survey. Ground - Water Resources of Block Island, Rhode Island, Geological Bulletin No. 14. Rhode Island Water Resources Coordinating Board, 1964.

41. Walker, E. P., et al. Mammals of the World, Volume II. Baltimore, Maryland: The Johns Hopkins Press, 1964.

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