Challenges to Wind Development

Review of Representative Wind Projects

&

Wind Project Siting Concerns

Massachusetts Wind Working Group Meeting
Wednesday, October 17th, 2012
Held At Aeronautica Windpower
11 Resnik Road
Plymouth, MA

Atlantic®
DESIGN ENGINEERS, INC.

Atlantic Wind Project Overview

To date we have been involved in the siting analysis, permitting and design of over 50 wind turbine project sites throughout New England. Atlantic has developed in-house skills for effective wind turbine project assessment, permitting and construction.

Projects with installed/operating turbines include:

- Mount Wachusetts Community College, Gardner, MA-(2) Vestas V-82 Turbines
- Norfolk County Correctional Institute, Gardner, MA-(2) Vestas V-82 Turbines
- Narragansett Bay Commission, Providence, RI – (3) Goldwind 1.5 MW Turbines
- U Maine, Presque Isle, ME-(1) RRB 600 Turbine
- UMass Dartmouth, MA – (1) Elecon 600 Turbine
- Fairhaven WWTP, Fairhaven, MA – (2) Sinovel 1.5 MW Turbines
- Barnstable WWTP, Barnstable, MA-(2) Northwind 100 Turbines
- Deer Island WWTF, Winthrop, MA-(1) FloDesign Demonstrator Unit 100 kW turbine
- Camelot Wind, Plymouth, MA – (1) Goldwind 1.5 MW Turbine
- Scituate Wind, Scituate, MA – (1) Sinovel 1.5 MW Turbine

Camelot Wind Turbine

Presque Isle, Maine

Mount Wachusetts Community College, Gardner, MA

Fields Point WWTP –Providence, RI
Narragansett Bay Commission

Permitted projects currently in the final design/construction phase include:

- Technology Drive, Falmouth, MA- (1) Aeronautica Wind 225 Turbine
- Future Generation Wind, Plymouth, MA- (3) Nordex 2.5 MW Turbines
- Jericho Mountain, Berlin, NH- (3) –Vestas 3.0 MW Turbines
- Colony Place, Plymouth, MA- (1) 750 kW Aeronautica Wind Turbine
- Varian Semiconductor, Gloucester, MA – (1) Kenersys 2.5 MW Turbine
- Future Generation, Plymouth, MA- (1) Nordex 2.5 MW Turbine
- Equity Industrial Partners, Gloucester, MA – (2) Gamesa 2.0 MW Turbines
- Russell Municipal Light Department – (3) GE 1.6 MW Turbines

Varian Semiconductor
Gloucester, MA

CONSTRUCTION SITE PLANS
FOR THE
GLOUCESTER ENGINEERING WIND PROJECT

11 DORY ROAD

GLOUCESTER, MASSACHUSETTS

50 % SUBMITTAL - DATE: AUGUST 6, 2012

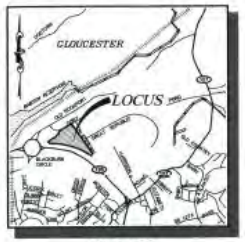
REVISION #1 - ISSUED FOR PERMIT - DATE: AUGUST 24, 2012

REVISION #2 - RELOCATED TURBINES - DATE: AUGUST 30, 2012

OVERALL LOCATION PLAN
SCALE: 1" = 300'

INDEX OF PLANS

SHEET NO.	TITLE	SCALE
1	COVER SHEET	1" = 300'
2	EXISTING CONDITIONS PLAN	1" = 60'
3	OVERALL SITE PLAN	1" = 60'
4	SITE VICINITY PLAN – TOWER 1	1" = 20'
5	SITE VICINITY PLAN – TOWER 2	1" = 20'
6	LOGISTICS PLAN	1" = 40'
7	SITE VICINITY – POST CONDITIONS PLAN	1" = 40'
8	DETAIL SHEET	AS NOTED



LOCUS MAP
(NOT TO SCALE)

ZONING REQUIREMENTS
BUSINESS PARK (BP)
CITY OF GLOUCESTER ZONING ORDINANCE OCTOBER 2008
(SECTION 3.2.3)

MINIMUM LOT SIZE	40,000 S.F.
MINIMUM LOT AREA PER DWELLING UNIT	N/A
MINIMUM LOT WIDTH	100 FEET
MINIMUM FRONTAGE	100 FEET
MINIMUM YARDS:	
FRONT YARD	40 FEET
SIDE YARD	25 FEET
REAR YARD	40 FEET
MAXIMUM BUILDING HEIGHT	40 FEET
MAXIMUM LOT COVERAGE (TOTAL OF ALL STRUCTURES)	50%

COMMERCIAL LAND–BASED WIND ENERGY CONVERSION FACILITIES
(SECTION 5.22)

	REQUIRED	PROVIDED
HEIGHT	NO HIGHER THAN 500 FEET AS MEASURED FROM THE EXISTING AVERAGE GRADE TO THE HIGHEST POINT REACHED BY THE ROTOR BLADES.	403.5'
SETBACKS	THE MINIMUM DISTANCE FROM THE BASE OF WIND TURBINE TOWER TO THE NEAREST BUILDING ON LOT OR ON CONTIGUOUSLY COMMONLY OWNED LOTS SHALL BE 50 FEET.	114.3'
	THE MINIMUM DISTANCE FROM A PUBLIC OR PRIVATE WAY SHALL BE 100 FEET.	101.0'
	THE MINIMUM DISTANCE FROM PROPERTY LINES SHARED WITH ABUTTING PROPERTIES SHALL BE 150 FEET AND NO LESS THAN THE LENGTH OF AN INDIVIDUAL ROTOR BLADE MEASURED FROM THE CENTER OF HUB, WHICHEVER IS GREATER.	296.2'

GENERAL NOTES:

1. RECORD OWNER(S): GLOUCESTER ENGINEERING CO., INC. 11 DORY RD BLACKBURN INDUSTRIAL PARK GLOUCESTER, MA 01930 CERTIFICATE #484766
2. THE LOCUS PROPERTY IS SHOWN AS LOT 16 & 26 ON THE CITY OF GLOUCESTER ASSESSOR MAP 262. TOTAL LOCUS AREA IS APPROXIMATELY 21.6 ACRES.
3. THE PROPERTY LINES OF THE LOCUS ARE BASED UPON A CADD FILE PROVIDED BY THE CLIENT ENTITLED "WETLAND AREAS AND 100' BUFFER" BY R.E. CAMERON & ASSOCIATES, INC. DATED JUNE 10, 2011 AND IS NOT THE RESULT OF A BOUNDARY SURVEY BY ATLANTIC DESIGN ENGINEERS, LLC. THE PROPERTY LINES OFF-SITE ARE BASED UPON THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM AND ARE NOT THE RESULT OF A BOUNDARY SURVEY BY ATLANTIC DESIGN ENGINEERS, INC.
4. THE EXISTING CONDITIONS, ELEVATIONS, CONTOURS AND WETLANDS FOR THE LOCUS, SHOWN HEREON, ARE BASED UPON A CADD FILE PROVIDED BY THE CLIENT ENTITLED "WETLAND AREAS AND 100' BUFFER" BY R.E. CAMERON & ASSOCIATES, INC. DATED JUNE 10, 2011 AND PARTIALLY SUPPLEMENTED BY FIELD SURVEY IN JULY, 2012 BY ATLANTIC DESIGN ENGINEERS, INC.
5. THE EXISTING ELEVATIONS AND CONTOURS ARE BASED UPON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). SEE NOTE 4 FOR ORIGIN. THE COORDINATES (LATITUDE AND LONGITUDE) DEPICTED HEREON ARE BASED UPON THE GPS CONTROL POINTS PROVIDED BY R.E. CAMERON & ASSOCIATES, INC WHICH ARE BASED UPON THE NORTH AMERICAN DATUM OF 1983 (NAD 83) MASSACHUSETTS STATE PLANE.
6. THE PROPERTY LIES WITHIN THE BUSINESS PARK (BP) ZONE BASED UPON A REVIEW OF THE CITY OF GLOUCESTER ASSESSORS DATABASE AND A PORTION OF THE SITE LIES WITHIN THE WATERSHED PROTECTION OVERLAY DISTRICT FOR THE BABSON RESERVOIR. THE PROPERTY ALSO LIES WITHIN THE PERSONAL WIRELESS SERVICE FACILITIES (PWSF) OVERLAY DISTRICT.
7. THE LOCATION OF EXISTING UNDERGROUND UTILITIES, SHOWN HEREON, ARE BASED UPON PLANS PROVIDED BY THE CLIENT AND ARE NOT NECESSARILY COMPLETE. THE LOCATION OF ANY EXISTING UNDERGROUND UTILITIES SHOULD BE CONFIRMED AND DIG-SAFE CONTACTED PRIOR TO ANY CONSTRUCTION. ATLANTIC DESIGN ENGINEERS, INC. ASSUMES NO RESPONSIBILITY FOR THE LOCATION AND EXISTANCE OF ANY SUBSURFACE UTILITIES.
8. THE PROPERTY LIES WITHIN FLOOD ZONE C (AREAS OF MINIMAL FLOODING) BASED UPON A REVIEW OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) COMMUNITY PANEL NUMBER 250082 0004 D, REVISED ON JULY 2, 1982.
9. THE PROPERTY DOES NOT LIE WITHIN AN AREA OF CRITICAL ENVIRONMENTAL CONCERN BASED UPON A REVIEW OF THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM.
10. THE PROPERTY DOES NOT LIE WITHIN A ZONE II BASED UPON A REVIEW OF THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM.
11. THE PROPERTY LIES PARTIALLY WITHIN A SURFACE WATER SUPPLY PROTECTION AREA ZONE B BASED UPON A REVIEW OF THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM.
12. THE PROPERTY DOES NOT LIE WITHIN AN ESTIMATED HABITAT OF RARE WILDLIFE OR A PRIORITY HABITAT OF RARE SPECIES BASED UPON A REVIEW OF THE NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM 2008 MAPS OBSERVED ON THE MASSACHUSETTS GEOGRAPHIC INFORMATION SYSTEM.

PREPARED FOR:

SUSTAINABLE NEW ENERGY
241 BOSTON POST ROAD W
MARLBOROUGH, MASSACHUSETTS 01752

ENGINEER:

Atlantic® DESIGN ENGINEERS, INC.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 – 9282

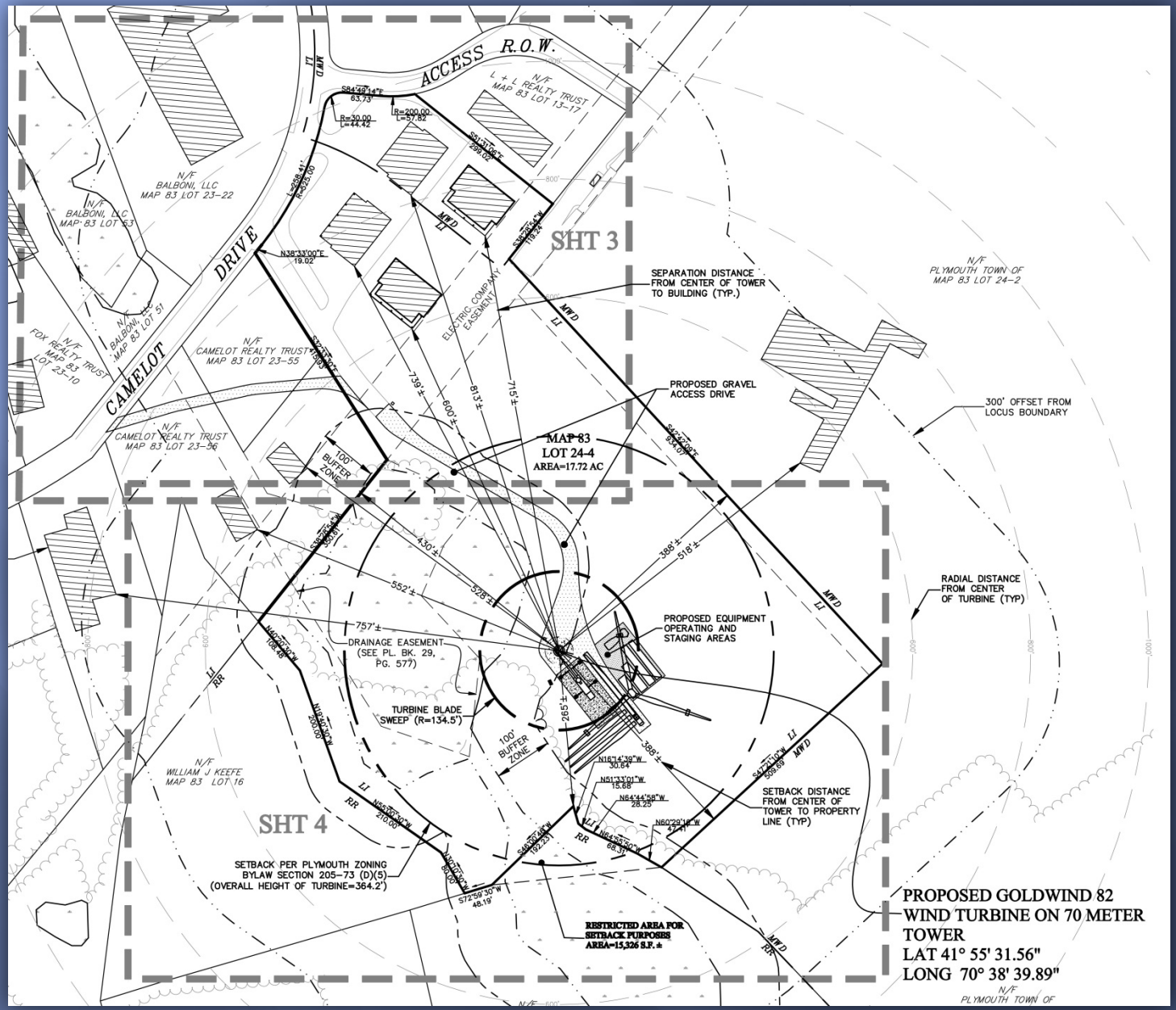
Sheet 1 of 8
JOB NUMBER 2721.00

Gloucester Engineering Wind Project
Gloucester, MA

Representative Project Site Plans

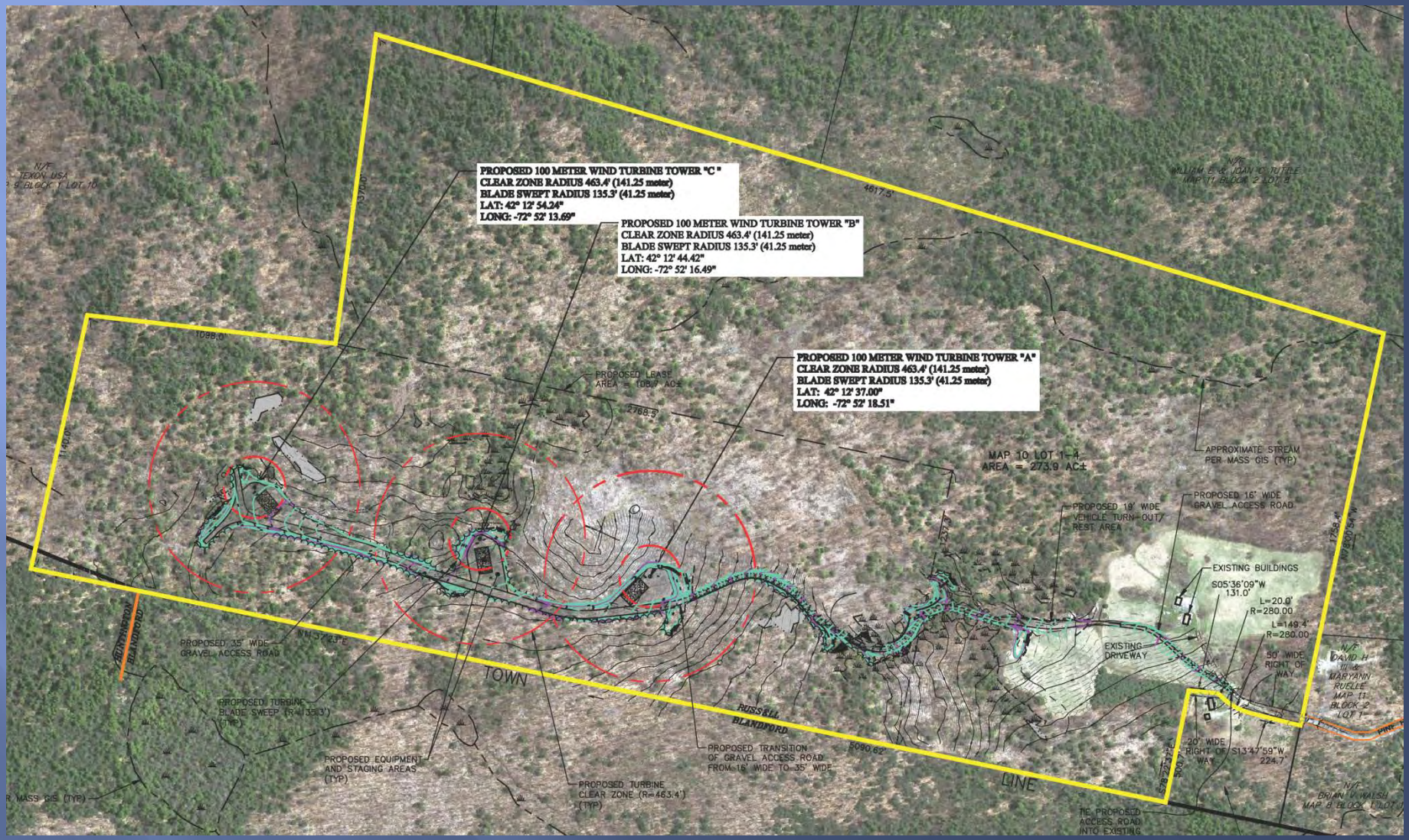
- Camelot Wind Project – Plymouth, MA
- Holiday Hill Wind Project – Russell, MA
- Future Generation Wind – Plymouth, MA
- Scituate Wind Project – Scituate, MA

Representative Project Site Plans



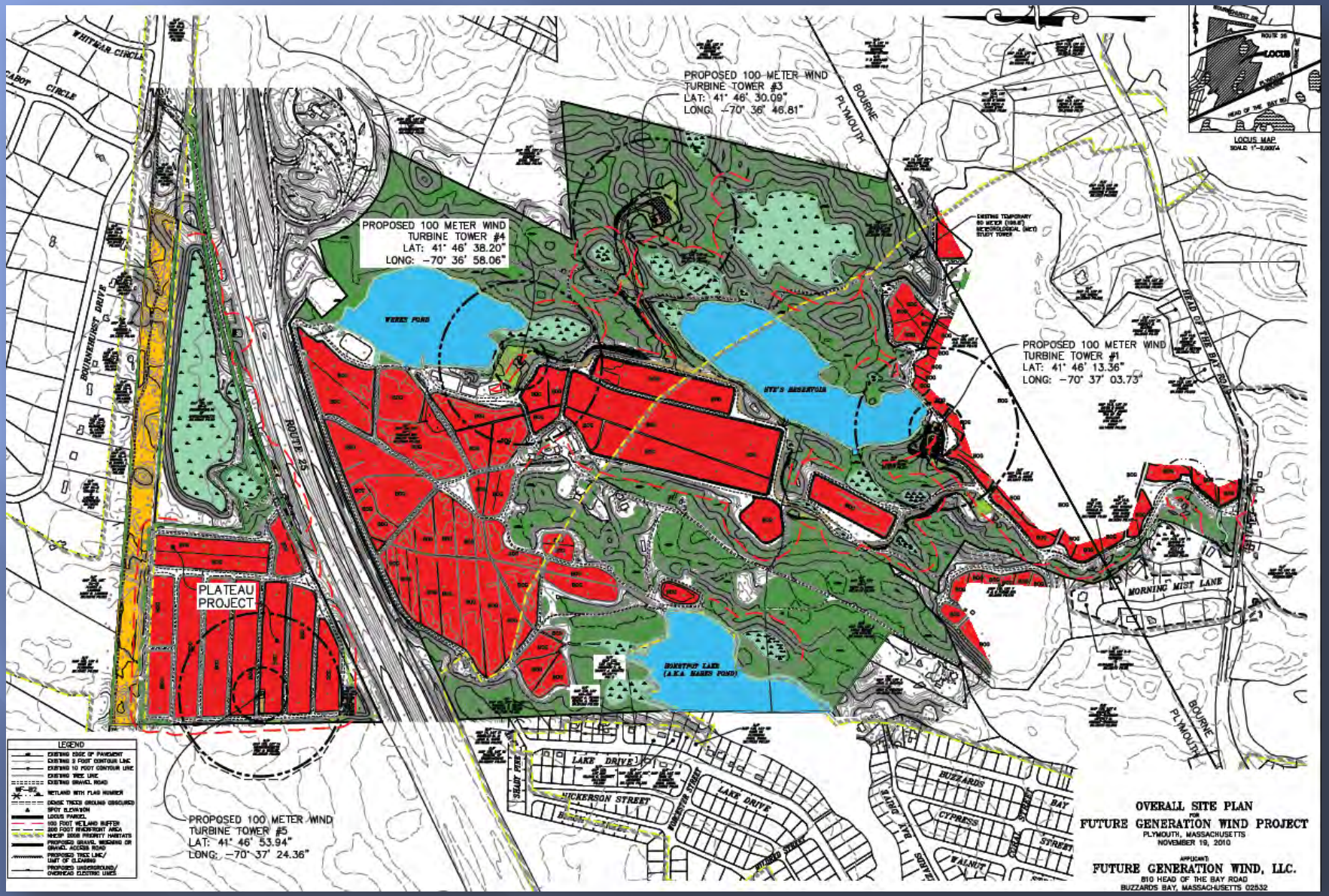
Camelot Wind

Representative Project Site Plans



Russell Municipal Light Department

Representative Project Site Plans

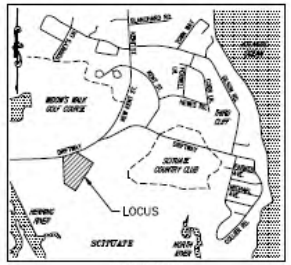


Future Generation Wind Project

Representative Project Plans

SITE PLANS
FOR THE
SCITUATE COMMUNITY WIND PROJECT
SCITUATE, MASSACHUSETTS
DATE: JANUARY 22, 2010

INDEX OF PLANS		
SHEET NO.	TITLE	SCALE
1	COVER SHEET	1" = 150'
2	EXISTING CONDITIONS PLAN	1" = 50'
3	SITE VICINITY PLAN	1" = 50'
4	ELEVATION AND DETAIL PLAN	AS NOTED



ZONING REQUIREMENTS	
COMMERCIAL W/HB,HC,HE AND D OVERLAYS TOWN OF SCITUATE ZONING BYLAWS; SEPTEMBER 4, 2008	
MINIMUM LOT SIZE	10,000 SF
MINIMUM LOT FRONTAGE	60 FEET
MINIMUM YARDS:	
FRONT YARD	60 FEET
SIDE YARD	8 FEET
REAR YARD	20 FEET
MAXIMUM BUILDING HEIGHT	40 FEET
WIND ENERGY CONVERSION SYSTEM BYLAW (SECTION 740)	
MAXIMUM HUB HEIGHT	25% MORE THEN SETBACK
PROPERTY LINE SETBACK	.75% OVERALL HT.
SETBACK TO RESIDENCES AND PLACES OF BUSINESS	CLEAR ZONE: TOTAL HEIGHT FROM BASE OF TOWER TO TIP OF BLADE AT IT'S HIGHEST POINT

OWNER:
TOWN OF SCITUATE
600 CHIEF JUSTICE CUSHING HIGHWAY
SCITUATE, MA 02066

APPLICANT:
SCITUATE WIND, LLC.
C/O SOLAYA ENERGY
56 CUMMINGS PARK
WOBURN, MASSACHUSETTS 01801

ENGINEER:
Atlantic DESIGN ENGINEERS, L.L.C.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 - 9282

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Sheet	of
1	4

JOB NUMBER
2659.00

Scituate Wind Project

Noise (Acoustic Analysis)

Massachusetts CEC Acoustic Study Methodology

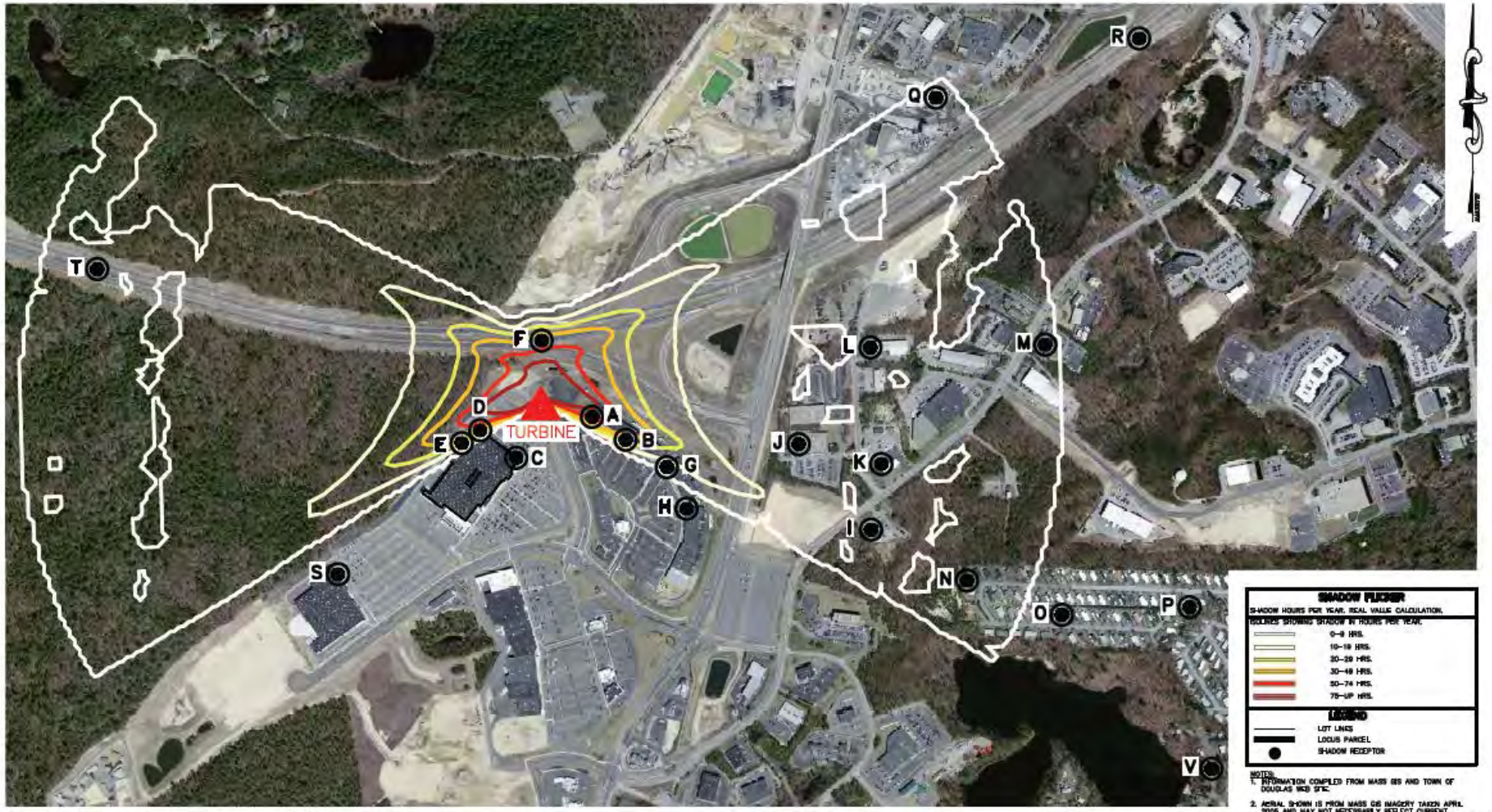
- Must use ANSI Type 1 Sound Level Meters or equivalent ISO or IEC standard
- On-site wind speed measurements by either an on-site MET tower or at 10-meters above ground level and extrapolated to hub height using the appropriate on-site wind shear
- Locations selected for long-term monitoring to represent the nearby residence with the lowest ambient sound levels
- Long-term and short-term measurements
  - Long-term Measurements:
    - Must be completed for 14 consecutive days during reasonable meteorological conditions
    - L90 and Leq must be determined in dB(A) for 10-minute intervals
  - Short-term Measurements:
    - Must be completed during the 14 day monitoring period, must be taken at least once during the day (6a.m. and 10p.m.) and once between the hours of 1a.m. and 4a.m.
    - Must be completed simultaneously with long-term measurements
    - Must document audible sound sources during entire monitored period

Shadow Flicker Impact Analysis

Shadow flicker from wind turbines is the effect resulting from the shadows cast by the rotating turbine blades on a sunny day. Shadow flicker is most commonly measured in terms of the "hours per year" during which a receptor would be exposed to flicker from a wind turbine.

Shadow flicker modeling is performed using the software WindPRO, version 2.7, developed by EMD International. This modeling uses geometry and site specific data to estimate the number of hours per year that shadows could be cast on general areas, as well as specific locations or "receptors", surrounding the site.

Shadow Flicker Impact Plan



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Designed by :
Drawn by :
Checked by :
Survey chkd. by :
Approved by :

SCALE
SCALE 1" – 650'
0 650 1,100

PREPARED FOR
SAXON REAL ESTATE PARTNERS, LLC
174 COLONY VILLAGE DRIVE
PLYMOUTH, MA 02360

SHADOW FLICKER IMPACT PLAN
FOR
COLONY PLACE WIND PROJECT
COLONY PLACE, PLYMOUTH, MA
JULY 13, 2010

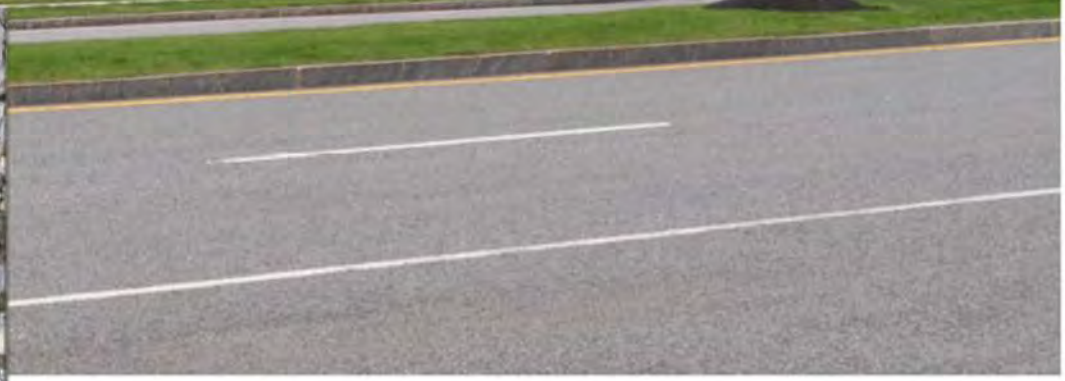
Sheet 1 of 1
JOB NUMBER 2581.01

VISUAL IMPACTS

Photosimulations are used to accurately depict what an installed turbine would look like from specified areas surrounding the proposed site. They are meant to provide a fair representation of the visual impact of the project on the surrounding neighborhoods.

The procedure involves superimposing an object, such as a wind turbine, onto a photograph at the proper scale, location and elevation to provide a visual representation of what the proposed turbine would look like from the specific location where the photograph was taken.

The purpose of a balloon test is to properly orient the photographer in the direction of the proposed turbine and to provide an object in the photograph that can be used during the photosimulation process as a reference point, from which the scale and height of the proposed turbine can be accurately depicted.



COLONY PLACE WIND PROJECT
PROPOSED CONDITIONS WITH (1 65M TOWER)
LOCATION 'A' - COLONY PLACE BUS STOP
(LOOKING NORTH)

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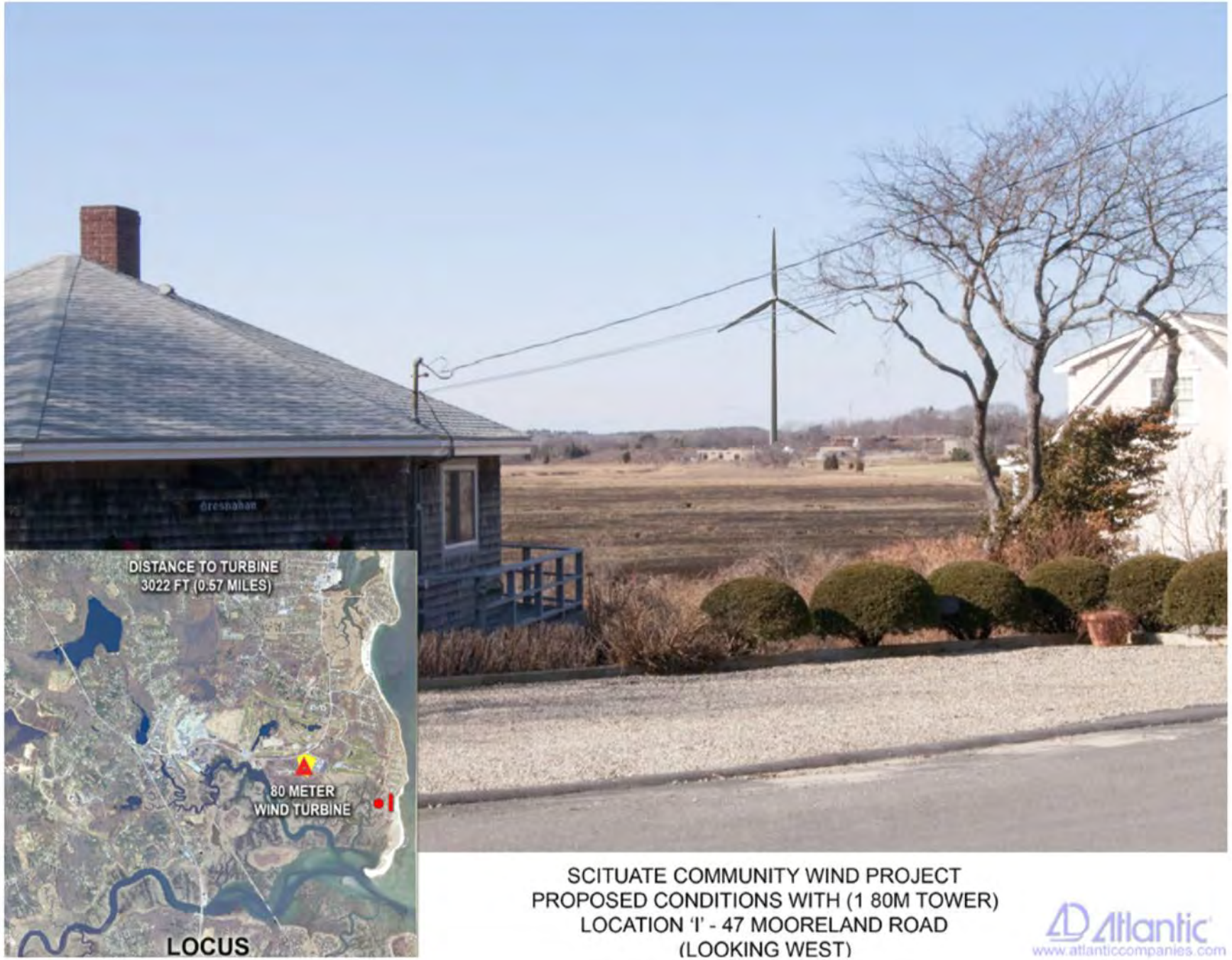

SCITUATE COMMUNITY WIND PROJECT
PROPOSED CONDITIONS WITH (1 80M TOWER)
LOCATION 'I' - 47 MOORELAND ROAD
(LOOKING WEST)

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CAMELOT DRIVE WIND PROJECT
PROPOSED CONDITIONS WITH 80M TOWER
LOCATION 'C' - REGISTRY OF DEEDS/ COURT HOUSE
(LOOKING SOUTH)

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MITIGATION OPTIONS

- Noise
- Shadow
- Visual
- Environmental

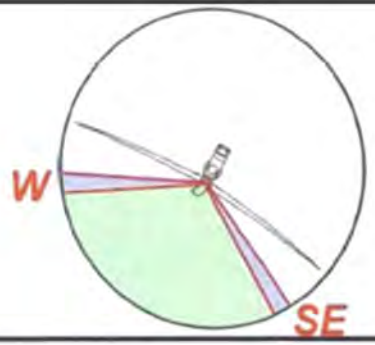
Noise Reduced Modes

Possibility to curtail wind turbines according to 4 parameters:

- *Time of the day*
- *Wind direction*
- *Wind speed*
- *Power output*

Mitigation Example

Mitigation plan is programmed into the project Control System to operate only at production levels that maintain noise compliance.

ANGULAR SECTOR	
TIME of DAY 	**Night** 10:00 PM - 6:00 AM
WIND SPEED 	Curtailment for winds Greater than 5 m/s
SEASON	Off Summer Nov - Apr

Shadow Flicker Mitigation

Shadow flicker can impact residences/structures during certain identifiable time periods during the year. The effect can be precisely calculated to determine whether a flickering shadow will fall on a given location near a wind turbine and the time of year, duration and total hours in a year it will do so.

Mitigation measures include:

- Computer modeling – Control modules programmed in the turbine for shutdown times to minimize shadow flicker.
- Outdoor Plantings such as vegetated buffers, fences, window coverings, or screening barriers

VISUAL IMPACT MITIGATION

Mitigation measures to prevent and/or minimize visual impact from turbines may include:

- Design of wind turbine according to the site characteristics and with sensitivity to the surrounding landscape.
- Maximizing the distance of wind turbines from the nearest property line.
- Selection of wind turbine design (tower, color) according to landscape characteristics.
- Selection of neutral color and anti-reflex painting for towers and blades.
- Underground cables.
- Screening such as fencing/treelines can provide partial or full visual mitigation.