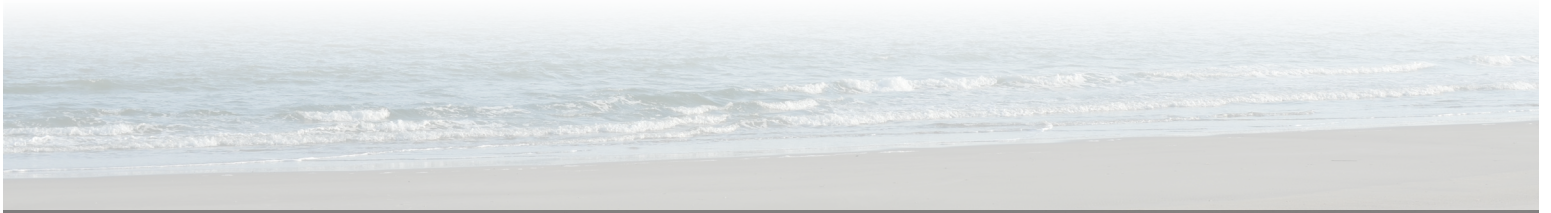




SIMULATIONS

017 Holden Beach
Late Afternoon





SIMULATION

017 Holden Beach

Late Afternoon

Siemens SWT-3.6-107

10 nm

Simulation
017 Holden Beach
Late Afternoon
Siemens SWT-3.6-107
10 nm

GENERAL INFORMATION

Base Photograph

Photo Name: HBA_0156-UV1 levels

Date: April 13, 2012

Time: 6:14 PM

GPS Coordinates¹: lat 33.910173°, long -78.304549°

Viewpoint Elevation: 3'

Sun and Weather

Sun Angle/Azimuth: 278°

Sun Elevation: 6°

Lighting Angle: Side lit

Weather Conditions: Partly cloudy

Visibility²: 10 mi

Wave Height: 1'

Period: 9 sec.

Camera

Camera Make/Model: Nikon D7000

Sensor Dimensions: 23.6 mm X 15.6 mm

Lens Make/Model: Nikkor DX AF-S 35 mm

Lens Focal Length: 35 mm

35 mm Equivalent Focal Length: 52.5 mm

Horizontal and Vertical Angles of View:

37.3° wide and 25.3° high

Camera Height: 1.5 m (5')

Camera Azimuth³: 201°

Wind Turbine Information

Number: 200

Make and Model: Siemens SWT-3.6-107

Height/Dimensions:

Support Structure/Monopile Ht.: 13 m (43')

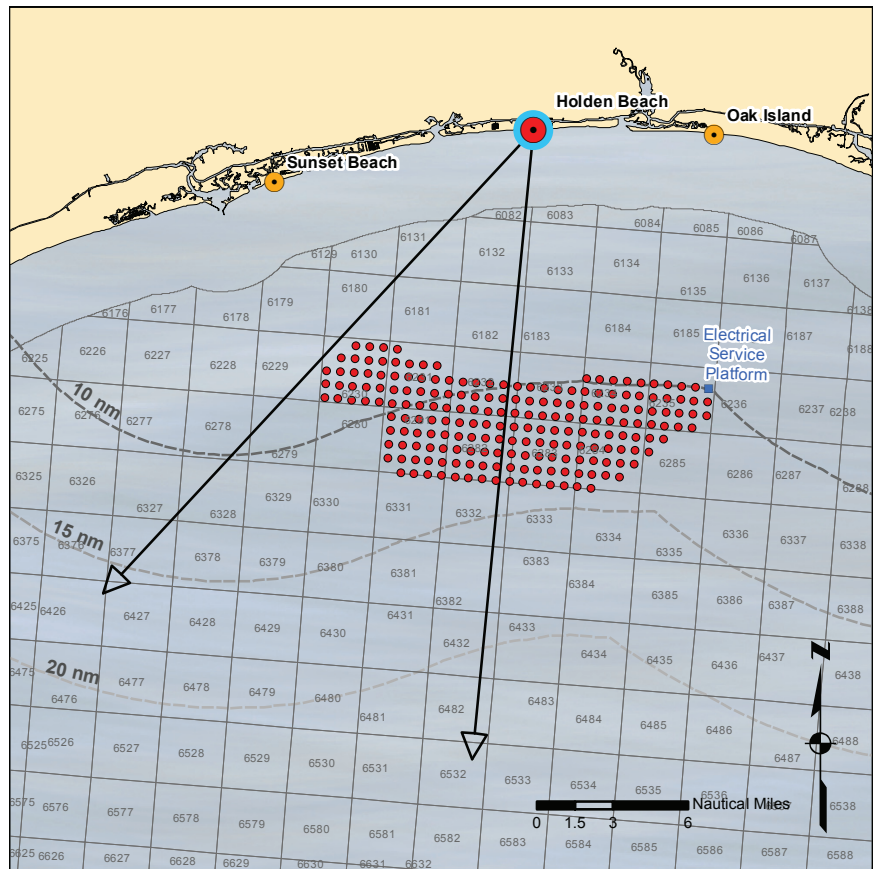
Hub Ht. (above Monopile): 80 m (262')

Rotor Diameter: 107 m (351')

Total Height to Tip of Blade: 147 m (481')

Service Platform: A bldg. 50'H X 100'W X 200' L
elevated 50' above the water

CONTEXT MAP



VIEWING INSTRUCTIONS

The simulation is properly printed on an 11" X 17" sheet at actual size. If viewed on a computer monitor, use the highest screen resolution. The simulated image is at the proper perspective when viewed at 23.5" from the eye, or at a distance of approximately twice the image height.

NOTES

- The image was taken with a UV filter.
- Image RGB levels were adjusted in Photoshop.
- Refraction Coefficient⁴ (k) = .075

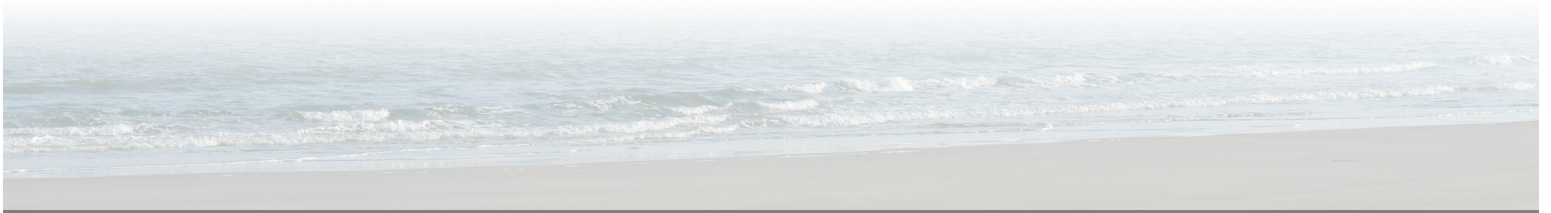
PANORAMA



Simulation location within the panorama view (190° X 60°)
from the Holden Beach site

T. J. Boyle Associates
landscape architects • planning consultants





SIMULATION

017 Holden Beach

Late Afternoon

Siemens SWT-3.6-107

15 nm

Simulation

017 Holden Beach

Late Afternoon
Siemens SWT-3.6-107
15 nm

GENERAL INFORMATION

Base Photograph

Photo Name: HBA_0156-UV1 levels

Date: April 13, 2012

Time: 6:14 PM

GPS Coordinates¹: lat 33.910173°, long -78.304549°

Viewpoint Elevation: 3'

Sun and Weather

Sun Angle/Azimuth: 278°

Sun Elevation: 6°

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Camera Height: 1.5 m (5')

Camera Azimuth³: 201°

Wind Turbine Information

Number: 200

Make and Model: Siemens SWT-3.6-107

Height/Dimensions:

Support Structure/Monopile Ht.: 13 m (43')

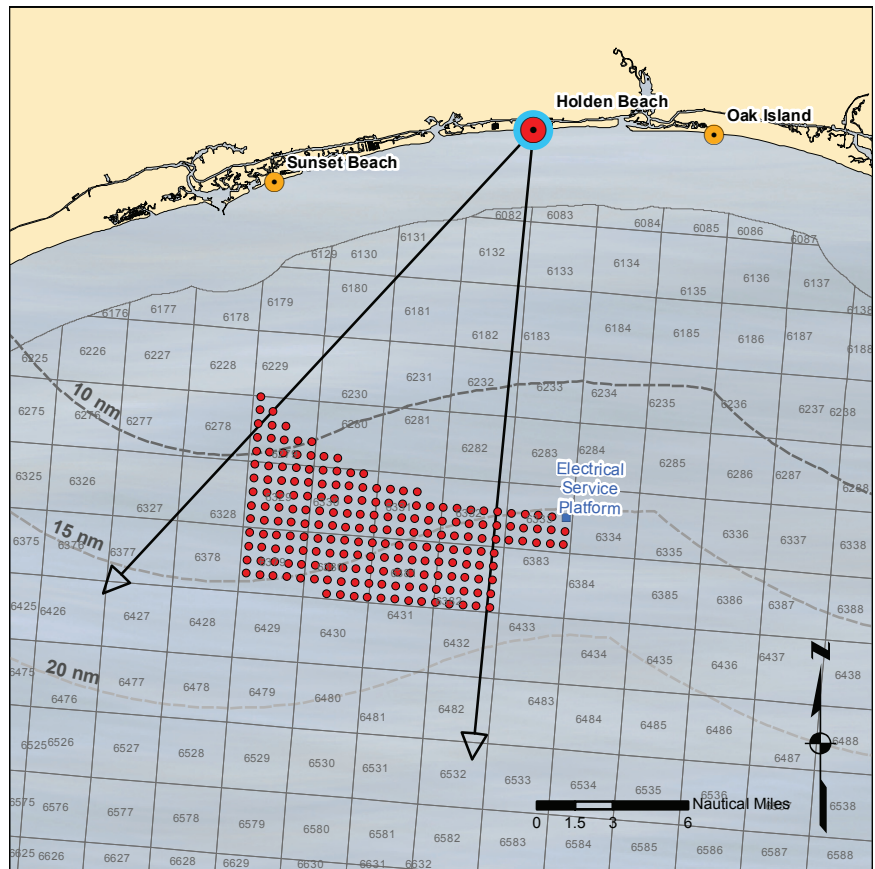
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CONTEXT MAP



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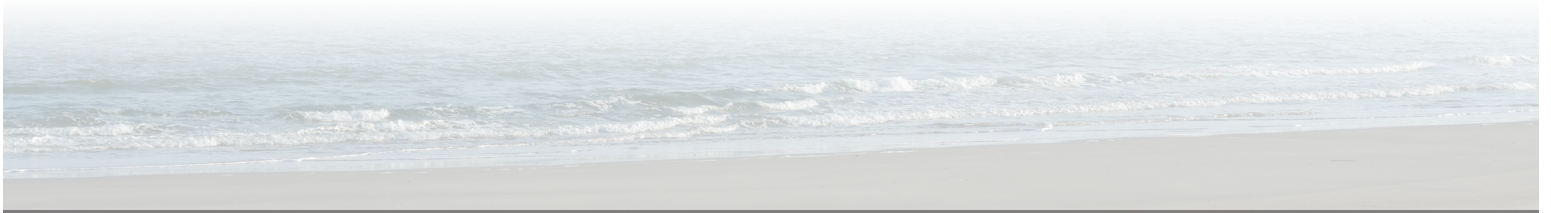
PANORAMA



Simulation location within the panorama view (190° X 60°)
from the Holden Beach site

T. J. Boyle Associates
landscape architects • planning consultants





SIMULATION

017 Holden Beach

Late Afternoon

Siemens SWT-3.6-107

20 nm

Simulation

017 Holden Beach

Late Afternoon
Siemens SWT-3.6-107
20 nm

GENERAL INFORMATION

Base Photograph

Photo Name: HBA_0156-UV1 levels

Date: April 13, 2012

Time: 6:14 PM

GPS Coordinates¹: lat 33.910173°, long -78.304549°

Viewpoint Elevation: 3'

Sun and Weather

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Camera Azimuth³: 201°

Wind Turbine Information

Number: 200

Make and Model: Siemens SWT-3.6-107

Height/Dimensions:

Support Structure/Monopile Ht.: 13 m (43')

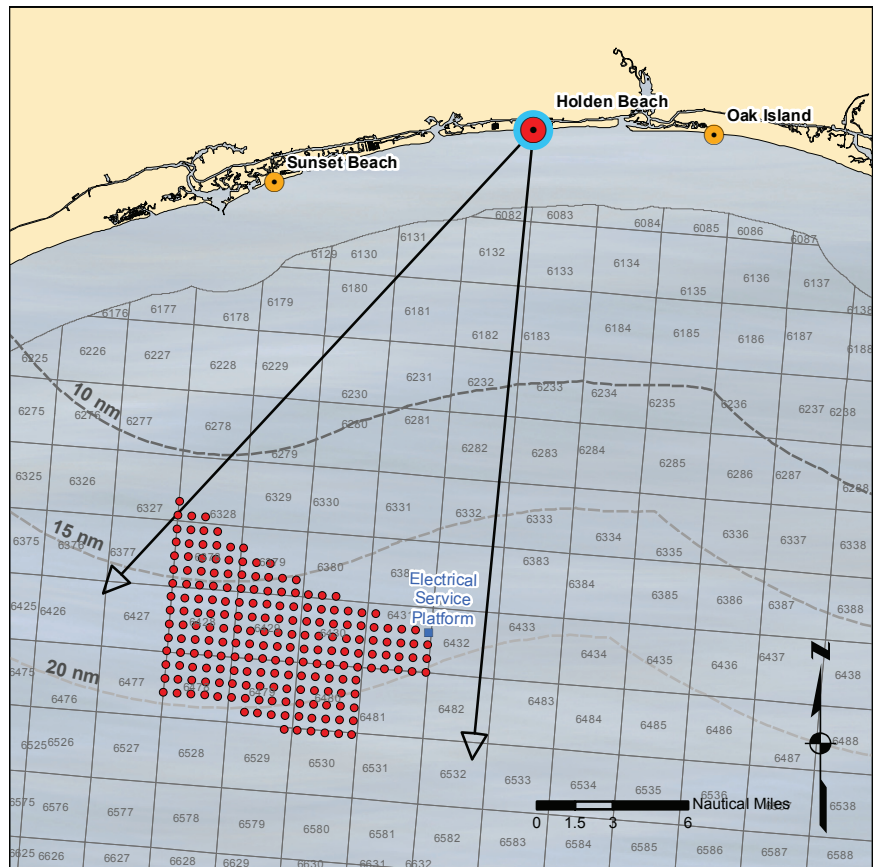
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PANORAMA



Simulation location within the panorama view (190° X 60°)
from the Holden Beach site

T. J. Boyle Associates
landscape architects • planning consultants





SIMULATION

017 Holden Beach **Late Afternoon**

Vestas V164-7.0 MW
10 nm

Simulation

017 Holden Beach

Late Afternoon
Vestas V164-7.0 MW
10 nm

GENERAL INFORMATION

Base Photograph

Photo Name: HBA_0156-UV1 levels

Date: April 13, 2012

Time: 6:14 PM

GPS Coordinates¹: lat 33.910173°, long -78.304549°

Viewpoint Elevation: 3'

Sun and Weather

Sun Angle/Azimuth: 278°

Sun Elevation: 6°

Lighting Angle: Side lit

Weather Conditions: Partly cloudy

Visibility²: 10 mi

Wave Height: 1'

Period: 9 sec.

Camera

Camera Make/Model: Nikon D7000

Sensor Dimensions: 23.6 mm X 15.6 mm

Lens Make/Model: Nikkor DX AF-S 35 mm

Lens Focal Length: 35 mm

35 mm Equivalent Focal Length: 52.5 mm

Horizontal and Vertical Angles of View:

37.3° wide and 25.3° high

Camera Height: 1.5 m (5')

Camera Azimuth³: 201°

Wind Turbine Information

Number: 200

Make and Model: Vestas V164-7.0 MW

Height/Dimensions:

Support Structure/Monopile Ht.: 13 m (43')

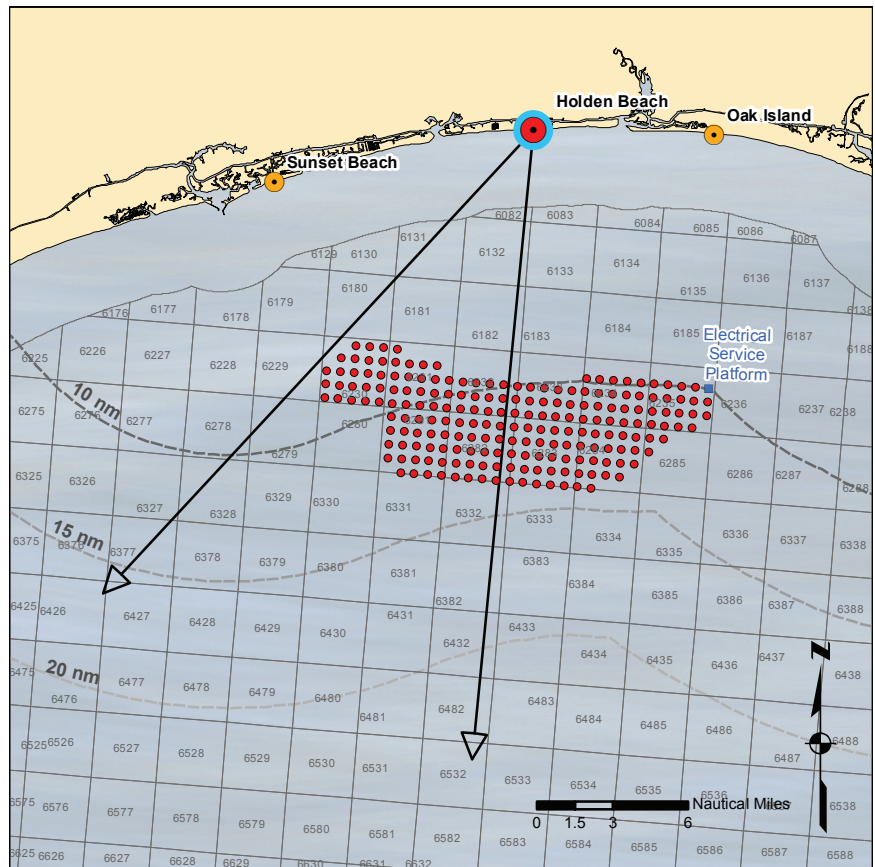
Hub Ht. (above Monopile): 105 m (345')

Rotor Diameter: 164 m (538')

Total Height to Tip of Blade: 200 m (656')

Service Platform: A bldg. 50'H X 100'W X 200' L
elevated 50' above the water

CONTEXT MAP



VIEWING INSTRUCTIONS

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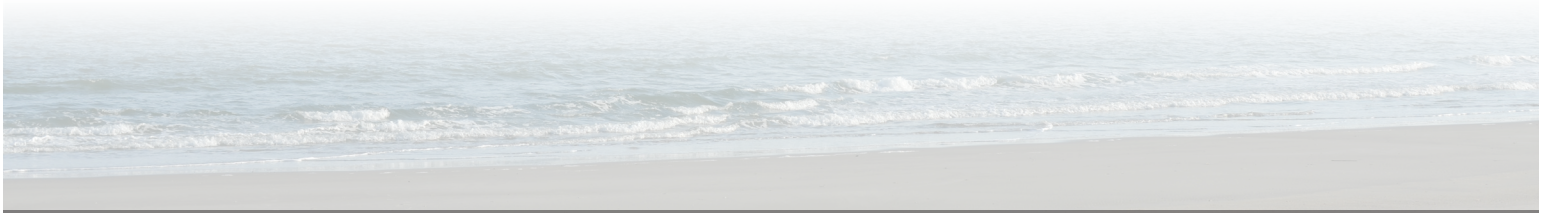
PANORAMA



Simulation location within the panorama view (190° X 60°)
from the Holden Beach site

T. J. Boyle Associates
landscape architects • planning consultants





SIMULATION

017 Holden Beach

Late Afternoon

Vestas V164-7.0 MW

15 nm

Simulation

017 Holden Beach

Late Afternoon
Vestas V164-7.0 MW
15 nm

GENERAL INFORMATION

Base Photograph

Photo Name: HBA_0156-UV1 levels

Date: April 13, 2012

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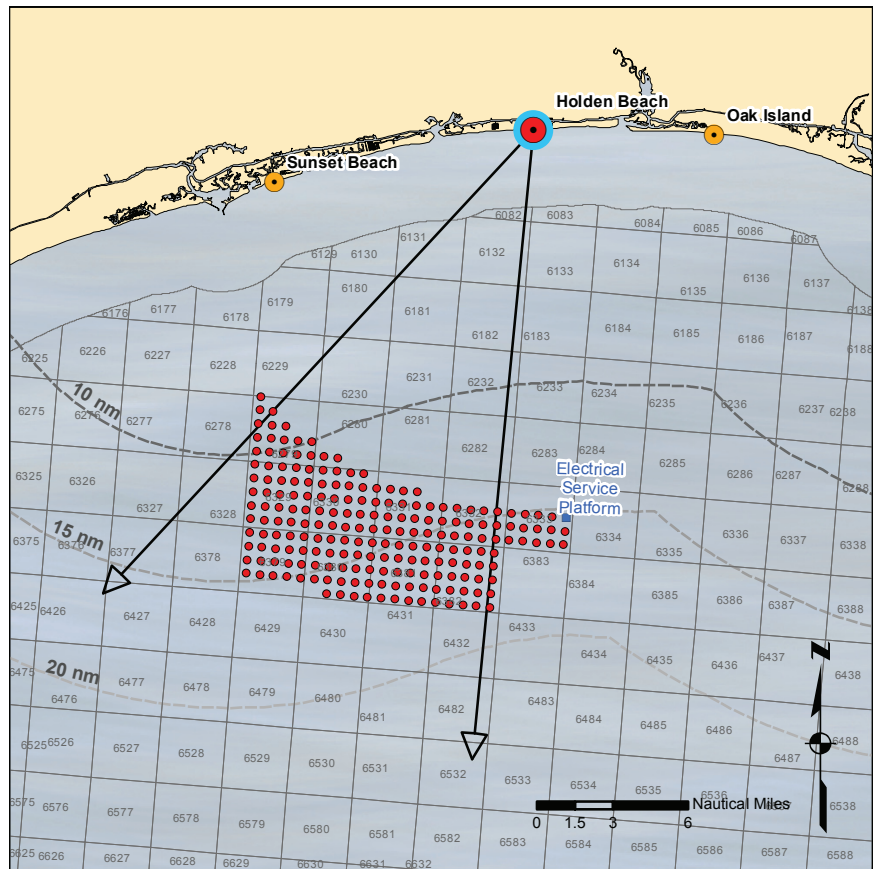
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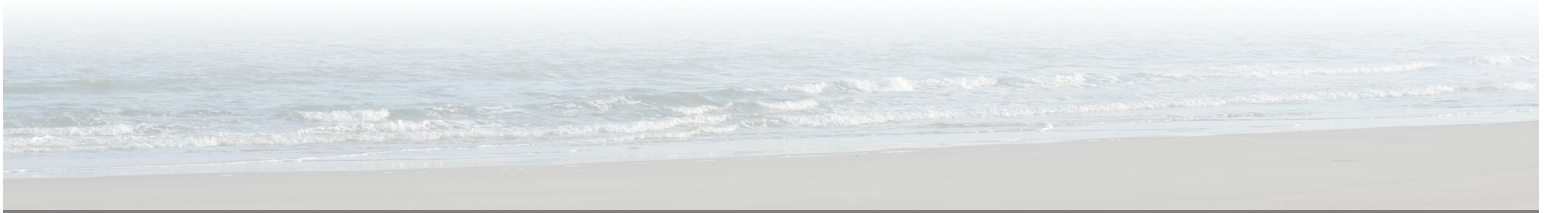
PANORAMA



Simulation location within the panorama view (190° X 60°)
from the Holden Beach site

T. J. Boyle Associates
landscape architects • planning consultants





SIMULATION

017 Holden Beach Late Afternoon

Vestas V164-7.0 MW
20 nm

Simulation

017 Holden Beach

Late Afternoon
Vestas V164-7.0 MW
20 nm

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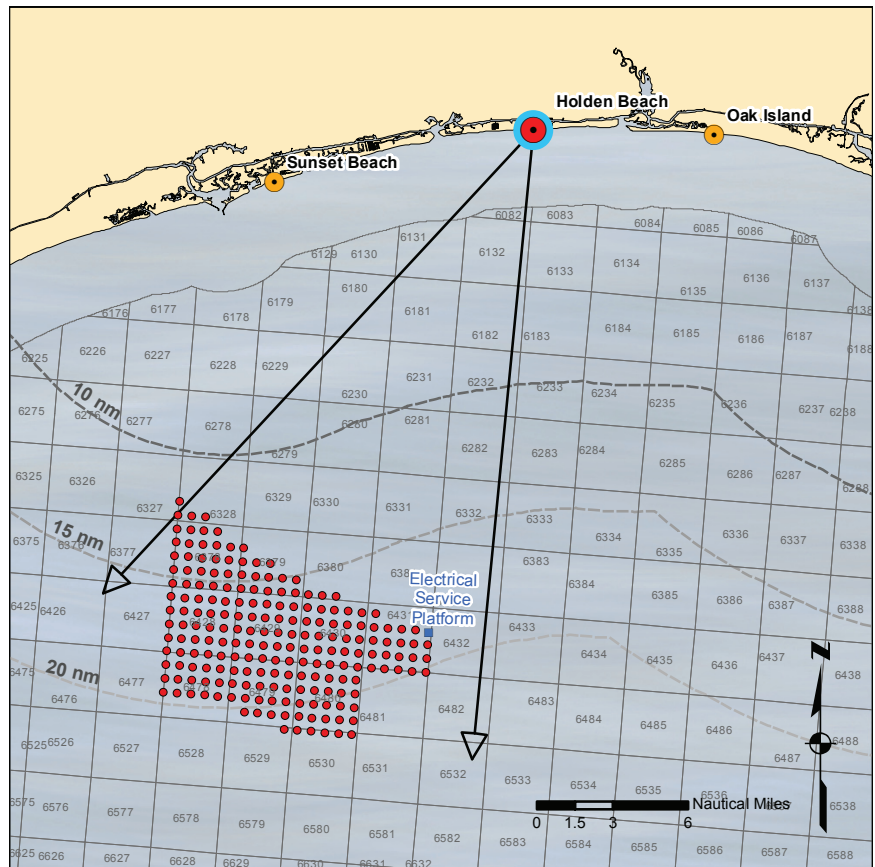
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PANORAMA



Simulation location within the panorama view (190° X 60°)
from the Holden Beach site

T. J. Boyle Associates
landscape architects • planning consultants



INFORMATION PAGE FOOTNOTES

¹GPS Coordinates

Location coordinates as used in WindPRO to register the wireframe diagram to the photograph. Due to slight errors and lens distortion, these values may differ at the fourth significant digit as obtained from a handheld GPS device at the time the photographs were taken and as shown on the Project Location Map.

²Visibility

Visibility is obtained from the closest airport weather station (see chart at right). The chart shows which weather station was used for each site. Visibility is measured up to ten statute miles.

³Camera Azimuth

Camera azimuth was obtained using a magnetic compass at the time of photography. However magnetic anomalies in the study area make some of these measurements unreliable. The camera azimuth reported here is for true north and reflects the bearing used to register the wind turbines to the photograph in WindPRO.

⁴Refraction Coefficient

The correction for refraction comes from Technical Appendix F Earth Curvature and Refraction of Light, in the report *Visual Representation of Windfarms Good Practice Guidance*, prepared for Scottish Natural Heritage (h+m 2006). The coefficient of refraction k is commonly defined as the ratio between the radius of the earth and the radius of the light in the line of sight between an object and the observer (Hirt 2010). The value reported here is half this value, but it is multiplied by two in the Technical Appendix's equation.

ABBREVIATIONS

nm	nautical miles
mi	statute miles
mm	millimeters
m	meters
sec.	seconds
'	feet
"	inches
°	degrees
lat	latitude
long	longitude

REFERENCES

h+m and envision. 2006. Visual Representation of Windfarms Good Practice Guidance. Scottish Natural Heritage.

Hirt C., Guillaume S., Wisbar A., Bürki B. and Sternberg, H. 2010. Monitoring of the refraction coefficient of the lower atmosphere using a controlled set-up of simultaneous reciprocal vertical angle measurements. Journal of Geophysical Research, 115, D21102, doi:10.1029/2010JD014067

Closest Airport Weather Station to Sites

Site	Weather Station Location NC
001 Corolla Lighthouse	Kill Devil Hills
002 Beach at Duck	Kill Devil Hills
003 Kitty Hawk	Kill Devil Hills
004 Coquina Beach	Kill Devil Hills
005 Bodie Island Lighthouse	Hatteras
006 Cape Hatteras Lighthouse	Hatteras
007 Lighthouse Beach	Hatteras
008 Ocracoke Beach	Hatteras
009 Portsmouth Life Saving Station Tower	Hatteras
010 Long Point Camps	Hatteras
011 Great Island Camps	Beaufort
012 Cape Lookout Lighthouse	Beaufort
013 Cape Point	Beaufort
014 Atlantic Beach	Beaufort
015 Bald Head Island	Southport
016 Oak Island	Southport
017 Holden Beach	Southport
018 Sunset Beach	Southport