The latest revision date of Appendix BB to the Empire Offshore Wind COP is May 2022. This appendix was not revised as part of the November 2023 submittal; therefore, the date on the Appendix BB cover sheet remains as May 2022.

Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2)
Construction and Operations Plan

APPENDIX BB

Aircraft Detection Lighting System (ADLS) Analysis

Prepared for

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TETRA TECH

MAY 2022

Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2)

Tetra Tech, Inc.

An analysis of historical air traffic operations to determine the frequency of activation of an Aircraft Detection Lighting System (ADLS)

August 20, 2019

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Summary

Capitol Airspace conducted an air traffic flow analysis for the Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) located southeast of Long Island, New York (blue area, ***Figure 1***). The purpose for this analysis was to determine the effectiveness of implementing an Aircraft Detection Lighting System (ADLS) to control the activation of obstruction lighting. This analysis utilized historic air traffic data to determine the total light system activated duration anticipated after implementing an ADLS system. For the purpose of this assessment, it was assumed the Lease Area will adopt ADLS. The specific ADLS system used for the Empire Wind Project will be customized by the selected ADLS manufacturer based on wind turbine generator (WTG) type, overall height, and layout. As a result, the actual total light system activated duration may vary.

An ADLS utilizes surveillance radar to track aircraft operating in proximity to the wind project. The ADLS will activate the obstruction lighting system when aircraft enter the light activation volume and will deactivate the system when all aircraft depart. This light activation volume is a pre-determined, Project-specific vertical and horizontal distance from the edge of the wind farm[1]. As a result, the ADLS provides nighttime conspicuity on an as-needed basis thereby reducing the amount of time that obstruction lights will be illuminated. Depending on the volume of nighttime flights transiting a wind project's light activation volume, an ADLS could result in a significant reduction in the amount of time obstruction lights are illuminated.

Historical air traffic data indicates that a light system within the Empire Offshore Wind Lease Area controlled by an ADLS would have been activated for a total of 357 hours 46 minutes and 45 seconds over a one-year period. Considering the local sunrise and sunset times, a light system controlled by an ADLS would be activated 7.5% of the time that traditional obstruction lights would be active.

[1] FAA Advisory Circular (AC) 70/7460-1L Change 2, August 17, 2018, Chapter 14. Aircraft Detection Lighting Systems, 14.2 General Standards.

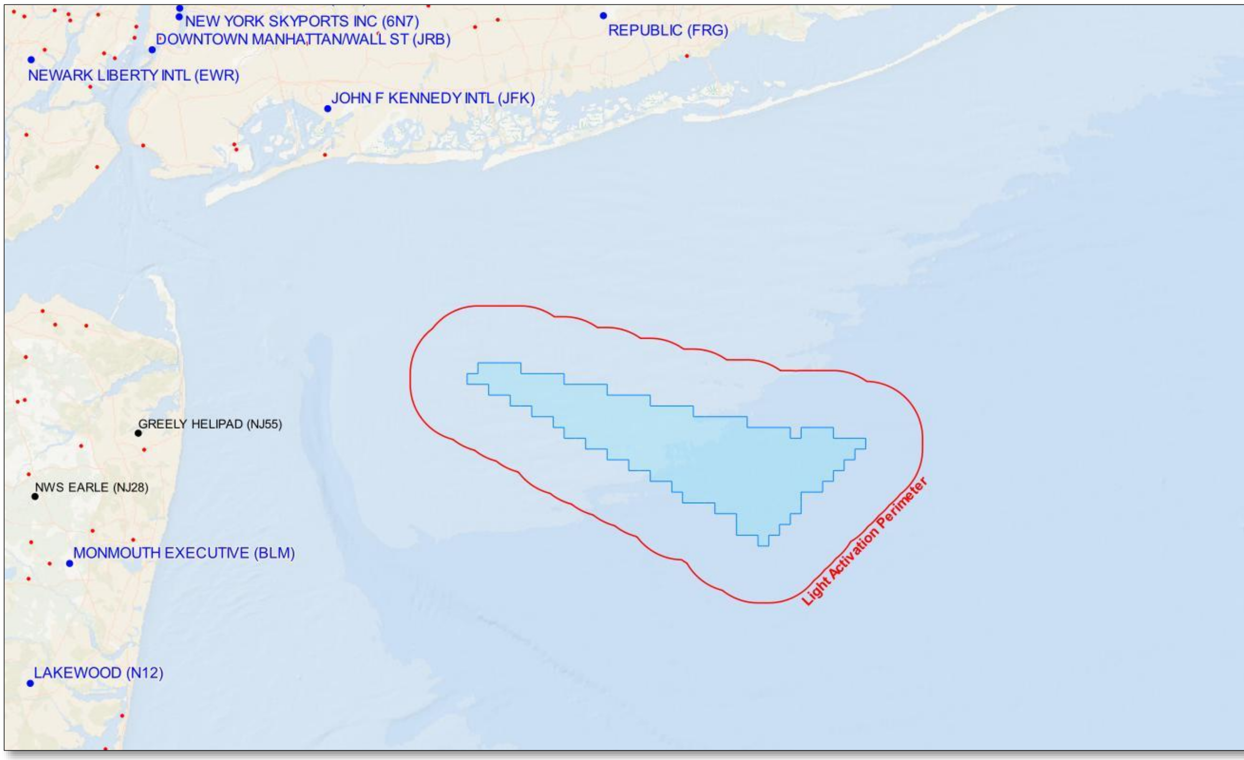

Figure 1: Public-use (blue), private-use (red), and military (black) airports in proximity to the Empire Wind Project with ADLS light activation perimeter

Methodology

Capitol Airspace analyzed Federal Aviation Administration (FAA) National Offload Program (NOP) radar returns in proximity to the Empire Wind Project for the period between March 1, 2018 and February 28, 2019. FAA NOP data only includes secondary radar returns which are created if the identified aircraft is equipped with a transponder. Aircraft operations without an active transponder were not captured as part of this dataset. Within 75 nautical miles of the wind project, the NOP data contained 1,139,058,808 different radar returns from 15 different air traffic control (ATC) facilities.[2] In addition to unique flight and radar track identifiers, each radar return contained: latitude, longitude, altitude, date, and time information.

The parameters used by Capitol Airspace represent known industry best practices. However, the lateral and vertical components of each project's light activation volume will be influenced by the selected vendor's ADLS specifications. As a result, the actual ADLS specifications could result in a different system efficacy than predicted by this analysis. The following process was used to determine the frequency of nighttime aviation operations in proximity to the Empire Wind Project:

1. Parse and Import Radar Data – Original data was provided in compressed comma separated value (CSV) text format. Each CSV file contains one day of radar return data. Each CSV file was uncompressed, combined, and imported into a geographic information system.
2. Define Three-Dimensional Light Activation Volume – In accordance with FAA Advisory Circular 70/7460-1L, lights controlled by an ADLS must be activated and illuminated prior to an aircraft reaching 3 nautical miles from, and 1,000 feet above, any wind turbine. However, the actual light activation volume will vary depending on the ADLS. At the time of this analysis, a specific ADLS had not been selected for the Empire Wind Project. The detection range from the chosen ADLS system will be designed to meet the FAA criteria at a minimum, but will likely exceed the minimum criteria. In order to account for varying radar systems as well as aircraft speeds and descent rates, Capitol Airspace assessed a 3.42 nautical mile buffer around the wind project at altitudes up to 2,500 feet above the highest wind turbine at 952 feet AMSL (solid red outline, ***Figure 2***).
3. Calculate Sunrise and Sunset – Sunrise and sunset times were calculated for each day of the year based on the United States Naval Observatory definition of sunrise and sunset. Sunrise time was calculated at the westernmost edge of the light activation perimeter. Sunset time was calculated at the easternmost edge of the light activation perimeter. The data was validated through comparison to the ***United States Naval Oceanography Portal***.
4. Select Nighttime Radar Returns – Since traditional obstruction lights can rely on ambient light sensors to identify darkness, nighttime was considered to occur between 30 minutes prior to sunset until 30 minutes after sunrise. This represents the time during which a traditional light system would likely be activated. All radar returns occurring within the light activation perimeter and during this period were evaluated. In accordance with guidance provided by the FAA, if an ADLS system loses track of an aircraft, a 30-minute timer should be initiated to keep the lights activated while the aircraft can clear the wind project area. Since the application of ADLS requires site specific radar surveillance systems that will be focused on the project area, Capitol Airspace does not anticipate a likelihood of dropped tracks.
5. Remove Time Overlap – To remove the duration of overlap occurring when more than one flight transits the light activation perimeter at the same time, each nighttime flight was compared to every other nighttime flight. Where overlapping flights were found, the overlapping flight's duration within the light activation perimeter was removed from the total time that the light system would be activated.

[2] Source facilities included Boston Consolidated (A90) Terminal Radar Approach Control (TRACON), Allentown (ABE) TRACON, Atlantic City (ACY) TRACON, Albany (ALB) TRACON, Wilkes-Barre (AVP) TRACON, Providence (G90) TRACON, Harrisburg (MDT) TRACON, New York (N90) TRACON, Potomac Consolidated (PCT) TRACON, Philadelphia (PHL) TRACON, Reading (RDG) TRACON, Yankee (Y90) TRACON, Boston (ZBW) Air Route Traffic Control Center (ARTCC), Washington (ZDC) ARTCC, and New York (ZNY) ARTCC.

Results

FAA NOP data indicates that as many as 54,321 flights had at least one radar return within the light activation perimeter (red outline, ***Figure 2***). However, the vast majority of these flights occurred during daytime. Using local sunrise and sunset times, Capitol Airspace determined that 17,650 flights (purple tracks, ***Figure*** 3) had at least one radar return within the light activation perimeter during the nighttime period when a traditional light system would be activated.

Each of the 17,650 flights was further evaluated to determine the amount of time it remained within the light activation perimeter. Over a one-year period, these flights would have resulted in a total light system activated duration of 357 hours 46 minutes and 45 seconds. Considering that the Empire Wind Project ADLS light activation perimeter observes 4,751 hours of nighttime each year, the calculated ADLS light system activated duration represents 7.5% of the time that a traditional light system would be active. For reference, the typical duration of light system activation during each month is provided in ***Table 1***.

Month	Nighttime Observed (HH:MM:SS)	Light System Activated Duration (HH:MM:SS)	Percentage
January	481:43:55	47:24:22	9.84%
February	407:03:02	38:53:53	9.56%
March	410:51:12	40:33:55	9.87%
April	357:38:19	26:27:25	7.40%
May	334:33:31	16:54:02	5.05%
June	306:39:43	16:13:22	5.29%
July	325:50:56	14:57:17	4.59%
August	356:35:30	18:46:55	5.27%
September	383:18:08	19:07:04	4.99%
October	437:06:36	32:03:34	7.33%
November	457:51:19	36:35:37	7.99%
December	491:46:33	49:49:19	10.13%
Total	**4750:58:44**	**357:46:45**	**7.53%**

Table 1: Typical duration of light system activation time during each month

Please contact ***Dan Underwood*** or ***Candace Childress*** at (703)-256-2485 with any questions regarding the findings of this analysis.

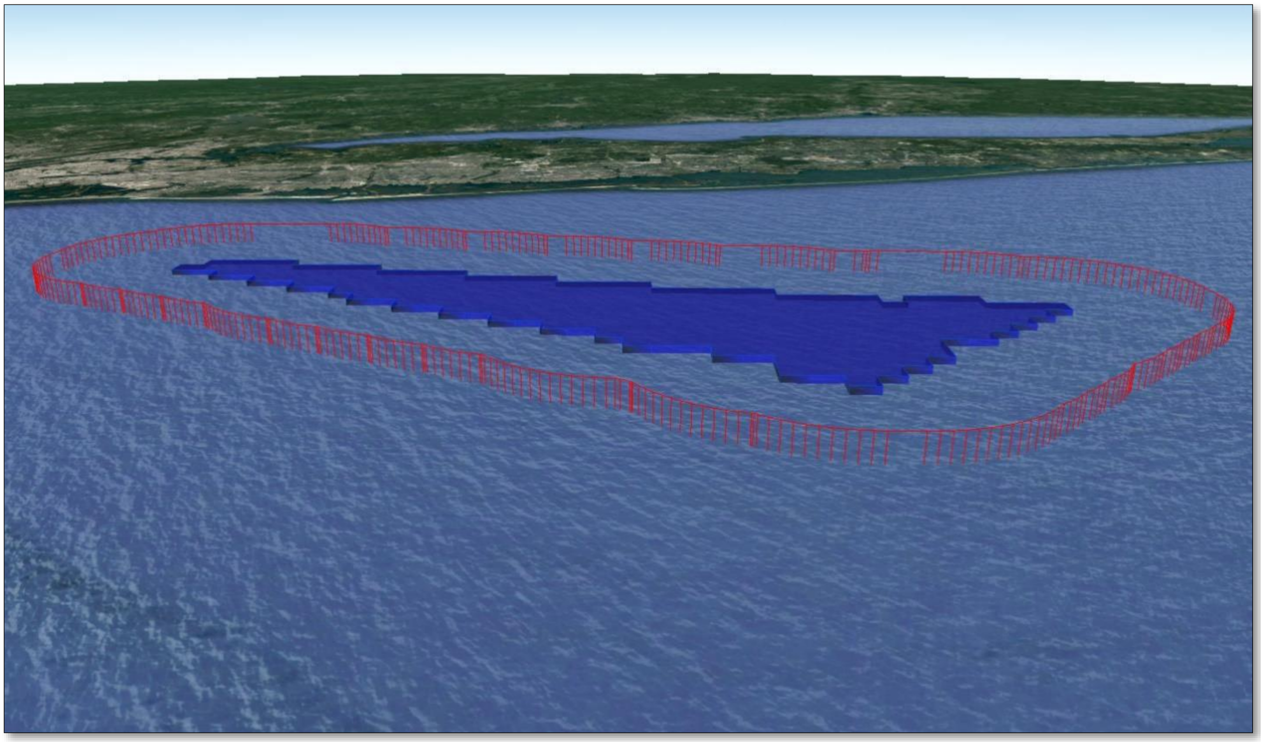

Figure 2: FAA perimeter (black outline) and light activation area (red outline)

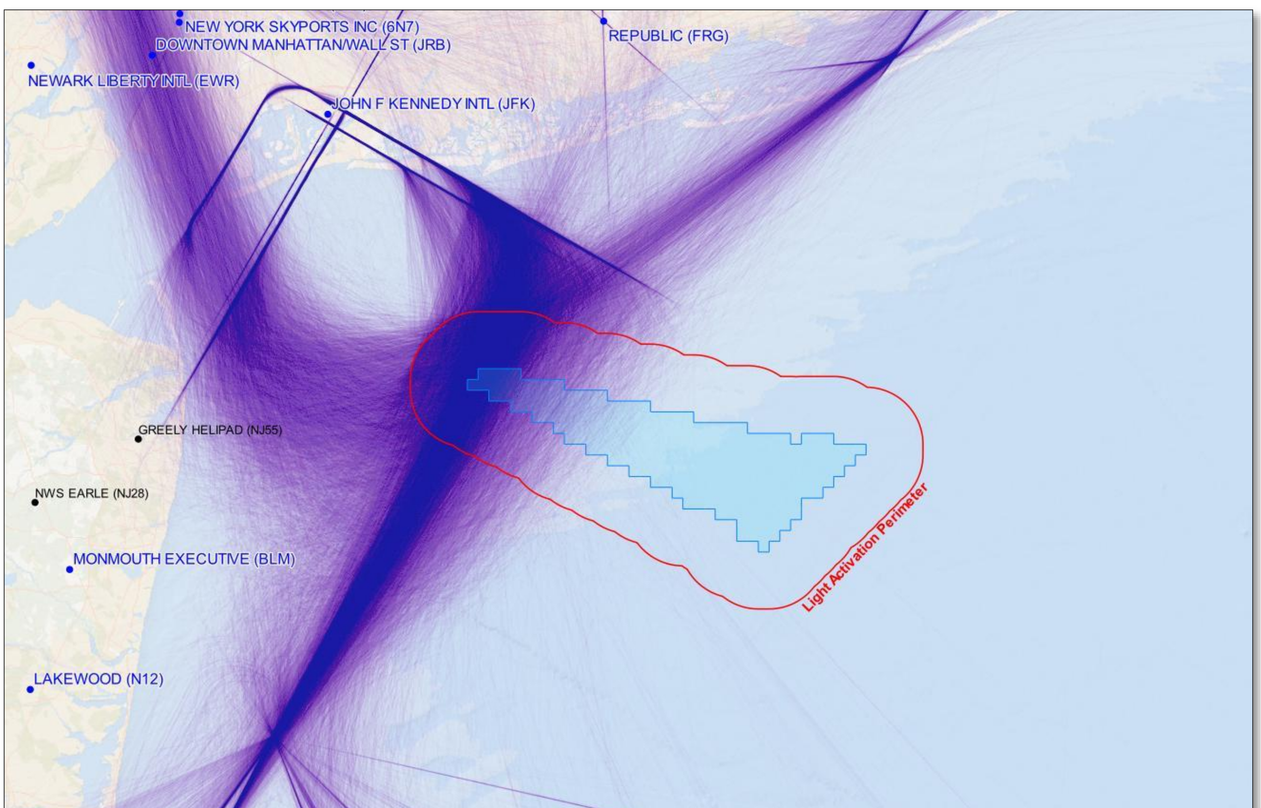

Figure 3: Flight tracks (purple) that would have activated ADLS obstruction lights