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August 13, 2013

Mr. Mohammed Majeed
State of Delaware
Department of Natural Resources
and Environmental Control
Division of Air Quality
715 Grantham Lane
New Castle, DE 19720

Re: Project No. 8718.CI (Duffield Associates)
The Data Centers, LLC – Wolf 1 CHP
Air Quality Impact Analysis Modeling Protocol
550 South College Avenue
Newark, Delaware

Dear Mr. Majeed:

Duffield Associates, Inc. respectfully submits this Air Quality Impact Analysis Modeling Protocol for the proposed Wolf Technology Center 1 Combined Heat and Power Plant (Wolf 1 CHP) to be located at the University of Delaware's Science, Technology and Advanced Research Campus (STAR Campus) in Newark, Delaware. This Air Quality Impact Analysis Modeling Protocol describes our anticipated modeling approach for the project, which will be subject to a Prevention of Significant Deterioration (PSD) review.

Should DNREC have any questions regarding this Air Quality Impact Analysis Modeling Protocol, please feel free to contact us at (302) 239-6634.

Thank you in advance for the Department's timely review of this document.

Very truly yours,

DUFFIELD ASSOCIATES, INC.

Anthony J. McGuire, E.I.
Environmental Engineer

Michael F. Panhuise, P.E.
Environmental Engineer

AJM/MFP:bac
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cc: Mr. Matthew Rendon – DNREC DAQ (electronic)

DUFFIELD ASSOCIATES

AIR QUALITY IMPACT ANALYSIS
MODELING PROTOCOL

WOLF TECHNOLOGY CENTER 1
COMBINED HEAT AND POWER PLANT

SCIENCE, TECHNOLOGY, AND ADVANCED RESEARCH CAMPUS
(STAR CAMPUS)
NEWARK, DELAWARE

August 2013

Prepared for:

State of Delaware
Department of Natural Resources
and Environmental Control
Division of Air Quality
715 Grantham Lane
New Castle, Delaware 19720

On behalf of:

The Data Centers, LLC
1554 Paoli Pike, Suite 325
West Chester, Pennsylvania 19380

Prepared by:

Duffield Associates, Inc.
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Project No. 8718.CI

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1.0 INTRODUCTION

The Data Centers, LLC (TDC) is proposing to develop, construct, and operate a self-sustaining data center complete with an electrical power production plant at the University of Delaware's Science, Technology, and Advanced Research (STAR) Campus in Newark, New Castle County, Delaware (see Figure 1). The proposed generating station, to be called the Wolf Technology Center 1 Combined Heat and Power Plant (Wolf 1 CHP) will be a natural gas-fired, combined-cycle and co-generation facility that generates electricity and steam, which primarily powers an associated data storage facility, but also will provide electricity to the City of Newark and steam to the University of Delaware. The power plant will have a total electrical power production capacity of approximately 230 megawatts (MW). Steam will be generated through heat recovery units located along the exhaust systems of the natural gas fired combustion turbines (CT) and reciprocating gas engines (RGE). Steam will power the additional turbines that in turn will: (1) drive electricity generators (combined-cycle) and mechanical chillers located in the CHP; and (2) be exported to the University of Delaware for use in heating buildings (co-generation). The CHP will also use natural gas solid oxide fuel cells to generate electricity. The combination of varied electrical generating units and the generating capacity of the CHP will ensure that uninterruptable power is provided to the data storage facility. The conceptual CHP design and site layout is included as Figure 2.

The project site is located within the Philadelphia-Wilmington-Atlantic City (PA-NJ-MD-DE) area for ozone and the Philadelphia–Wilmington (PA-NJ-DE) Area for $PM_{2.5}$. This area is currently designated by the State of Delaware as marginal attainment for 8-hour ozone, but maintains its legacy "severe" non-attainment ozone area status from a Federal (and permitting) perspective. This area is also non-attainment for $PM_{2.5}$. The area is in attainment or not listed for all other National Ambient Air Quality Standards (NAAQS).

Wolf 1 CHP will emit several regulated air pollutants, most notably nitrogen oxides (NO_x); carbon monoxide (CO); particulate matter (PM), including PM less than or equal to 10 microns in aerodynamic diameter (PM_{10}) and PM less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$); volatile organic compounds (VOCs); sulfur dioxide (SO_2); sulfuric acid (H_2SO_4) mist; and greenhouse gases (GHGs). The facility will also potentially emit several hazardous air pollutants (HAPs), such as formaldehyde. In addition, PM will be emitted from the cooling tower as water vapor drift losses, which contain dissolved solids. Finally, some ammonia, which will be used in the selective catalytic reduction (SCR) NO_x control process will also be emitted.

Based on our initial emission estimates, we have identified that this project will be subject to a Prevention of Significant Deterioration (PSD) review. For projects subject to PSD review, the Delaware Department of Natural Resources and Environmental Control (DNREC) recommends the submittal of an air quality impact analysis modeling protocol prior to the start of regulatory modeling. Accordingly, Duffield Associates, Inc. (Duffield Associates), prepared this air quality impact analysis modeling protocol for the Wolf 1 CHP facility for review and comment by DNREC and other regulatory agencies including the U.S. Environmental Protection Agency (EPA) and U.S. Fish and Wildlife Service.

2.0 APPLICABLE REGULATIONS

DNREC has adopted Federal EPA regulations pertaining to New Source Review (NSR) which includes a PSD analysis for attainment pollutants and Nonattainment New Source Review (NNSR) for nonattainment pollutants (i.e., NOx and VOCs – potential ozone precursors, as well as $PM_{2.5}$). DNREC's New Source Review regulations are contained in the Delaware Administrative Code (DE Admin. Code) Chapter 7, Part 1125 *Preconstruction Review*.

According to DE Admin. Code 1125, nonattainment pollutants which are emitted at rates that exceed major source thresholds are regulated by Section 2.0 *Emission Offset Provisions.* Attainment pollutants which are emitted by major sources and exceed the significant emission rates (SERs) are regulated by DE Admin. Code 1125 Section 3.0 *Prevention of Significant Deterioration of Air Quality*. Pollutants that are not subject to Sections 2.0 or 3.0 of DE Admin. Code 1125 may be subject to Section 4.0 *Minor New Source Review*. The **requirements** of each Section (i.e., Emission Offsets, PSD, and MNSR) are outlined below. The **applicability** of each section is discussed in the Applicability Determination section of this modeling protocol.

Section 2.0 – Emission Offset Provisions –

Facilities are required to:

- Install Lowest Achievable Emission Rate (LAER) controls;
- Satisfy emission reductions (offsets)(i.e., obtain Emission Reduction Credits [ERCs]);
- Include analysis of alternative sites, sizes, production processes and environmental control techniques; and
- Demonstrate that the project will not adversely impact Class I areas.

Section 3.0 – Prevention of Significant Deterioration of Air Quality –

Facilities are required to:

- Apply Best Available Control Technology (BACT);
- Conduct an ambient air quality analysis for each pollutant that it will emit by modeling the impact from emissions. Pollutants that do not have a designated NAAQS are not subject to modeling (e.g., $H_2SO_4$and GHGs).
    - If modeling of select pollutants (from the source alone) exceed Significant Impact Level (SIL) concentrations, an additional cumulative impact analysis is required. This cumulative impact analysis incorporates emissions from surrounding sources and background concentrations of select pollutants in addition to emissions from the project.
- Include an additional impact analysis to evaluate impairment to visibility, soils and vegetation that would occur as a result of the source. The additional impact analysis will also include an evaluation of the effect of the general commercial, residential, industrial growth associated with the new source.

- Demonstrate that emissions will not adversely impact Class I areas.

Section 4.0 – Minor New Source Review –

Facilities are required to:

- Install LAER controls, BACT controls, or emission control technology approved in advance by DNREC for the source being constructed.

3.0 APPLICABILITY DETERMINATION

STEP 1: To identify which pollutants require evaluation under their respective DE Admin. Code 1125 New Source Review Sections (i.e., Section 2.0, 3.0, or 4.0), Duffield Associates first estimated the annual maximum potential to emit from the Wolf 1 CHP. Table 1 below includes the approximate potential emissions for the facility on an annual basis in tons per year (tpy).

Table 1. Potential Annual Wolf 1 CHP Emissions

Pollutant	Estimated PTE Annual Emissions (tpy)
NOx	93.15
VOCs	108.52
CO	106.18
SO_2	24.39
PM Total	68.57
PM_{10}	68.57
$PM_{2.5}$	68.57
HAPs (Individual/Aggregate)	8.50 / 12.0
H_2SO_4	20.80
Greenhouse Gases (GHG) in CO2e	1,107,288

Note: These emission totals are subject to change

STEP 2: To determine applicability to the New Source Review – Prevention of Significant Deterioration (PSD) requirements, Duffield Associates compared the projected emissions to State of Delaware Major Source Thresholds for New Castle County (see Table 2). Based on the estimated annual emissions of NOx, VOCs, CO, and GHG, the facility is considered a Major Stationary Source, potentially subject to PSD requirements. Furthermore, based on the estimated GHG emissions and the EPA's "Tailoring Rule," the facility is considered a major source, and all nonattainment pollutants are, therefore, subject to Step 3 and comparison to the Significant Emission Rates (SERs).

Table 2. New Source Review (NSR) Major Source Pollutants

Pollutant	Estimated PTE Annual Emissions (tpy)	Major Source Threshold (tpy)
NOx	**93.15**	**25**
VOC	**108.52**	**25**
CO	**106.18**	**100**
SO_2	24.39	100
PM Total	68.57	100
PM_{10}	68.57	100
$PM_{2.5}$	68.57	100
HAPs (Individual / Aggregate)	8.50 / 12.0	10 / 25
H_2SO_4	20.80	100
Greenhouse Gases (GHG) in CO2e	**1,107,288**	**100,000**

Step 3: To identify which individual pollutants are emitted at such rates that would deem them "significant," Duffield Associates compared the facility's estimated annual emissions to the PSD Significant Emission Rates (SERs). Table 3 below identifies the pollutants that will be emitted in excess of the SERs including: NOx, VOC, CO, PM total, PM_{10}, and $PM_{2.5}$. As such, these pollutants would be subject to PSD requirements. However, since New Castle County is non-attainment for ozone and $PM_{2.5}$, PSD requirements are not applicable to NOx, VOCs, and $PM_{2.5}$.

Table 3. Prevention of Significant Deterioration SER Comparison

Pollutant	Estimated PTE Annual Emissions (tpy)	Significant Emission Rate (SER) (tpy)	Prevention of Significant Deterioration (PSD)
NOx*	**93.15**	**25**	**No***
VOC*	**108.52**	**25**	**No***
CO	**106.18**	**100**	**Yes**
SO_2	24.39	40	No
PM Total	**68.57**	**25**	**Yes**
PM_{10}	**68.57**	**15**	**Yes**
$PM_{2.5}$*	**68.57**	**10**	**No***
HAPs (Individual / Aggregate)	8.50 / 12.0	no SER	N/A
H_2SO_4	**20.80**	**7**	**Yes**
Greenhouse Gases (GHG)	**1,107,288**	**100,000**	**Yes**

*Note: These pollutants exceed the SER, however, since New Castle County is nonattainment for these pollutants, PSD does not apply.

Step 4: Since New Castle County is currently designated as non-attainment for ozone and $PM_{2.5}$, Duffield Associates compared the emissions of NOx and VOCs (ozone precursors) as well as $PM_{2.5}$ to the Major Source Thresholds to determine whether these pollutants would be subject to the more stringent Nonattainment New Source Review requirements. Table 4 below identifies that NOx and VOCs are subject to NNSR. However, since estimated $PM_{2.5}$ emissions do not exceed the Major Source Threshold of 100 tpy, this pollutant is not subject to NNSR.

Table 4. Non-Attainment New Source Review (NNSR) Applicability

Pollutant	Estimated PTE Annual Emissions (tpy)	Major Source Threshold (tpy)	Non-Attainment New Source Review (NNSR)
NOx	**93.15**	**25**	**Yes**
VOC	**108.52**	**25**	**Yes**
$PM_{2.5}$	68.57	100	No

Step 5: Pollutants that are identified as not subject to NSR PSD or NNSR, may be subject to the DE Admin. Code 1125 Section 3.0 *Minor New Source Review* if they exceed the MNSR review threshold. Table 5 lists the pollutants which were exempt from PSD and NNSR. Based on the estimated emissions of SO_2, HAPs, and $PM_{2.5}$ exceeding 5 tpy, these pollutants are, therefore, subject to MNSR.

Table 5. Minor New Source Review Applicability

Pollutant	Estimated PTE Annual Emissions (tpy)	Minor New Source Review Threshold (tpy)	Minor New Source Review (MNSR)
SO_2	**24.39**	**5**	**Yes**
HAPs	**8.50/12.0**	**5**	**Yes**
$PM_{2.5}$	**68.57**	**5**	**Yes**

In summary, Table 6 below includes the regulatory requirements applicable to each specific pollutant for the Wolf 1 CHP facility.

Table 6. Regulatory Permitting Track

Pollutant	Estimated PTE Annual Emissions (tpy)	PSD	NNSR	MNSR
NOx	93.15		X	
VOC	108.52		X	
CO	106.18	X		
SO_2	24.39			X
PM Total	68.57	X		
PM_{10}	68.57	X		
$PM_{2.5}$	68.57			X
HAPs (Aggregate)	8.50 / 12.0			X
H_2SO_4	20.80	X*		
Greenhouse Gases (GHG)	1,107,288	X*		

Note: * No PSD modeling is required for these pollutants since no NAAQS exists for H_2SO_4 and GHGs.

4.0 MODELING EMISSIONS INVENTORY

4.1 ***ON-PROPERTY SOURCES***

The Wolf 1 CHP facility dispersion modeling inventory will begin with modeling of emissions limited to on-site sources including CTs, RGEs, solid oxide fuel cells, and cooling tower. Based on the PSD applicability determination (see Table 6), Duffield Associates anticipates that only CO, PM total, PM_{10}, and NO_2 will be modeled for assessing Class II impacts.

The portion of the PSD analysis submitted to DNREC regarding the ambient air quality impact analysis will include summary tables of emissions rates and operating parameters for each Wolf 1 CHP emissions source. The CTs, RGEs, fuel cells and cooling tower are expected to operate at or near 100 percent load 100 percent of the time except for periods of startup or shut down for maintenance. Based upon preliminary operating configurations, start-ups, shutdowns, and malfunctions are anticipated to account for less than 5 percent of the hours per year. At this frequency, those situations can be dismissed as intermittent sources. Emission rates used for annual average impacts will be based on the projected worst-case operating mode for non-intermittent sources.

4.2 ***OFF-PROPERTY SOURCES***

If pollutants from the Wolf 1 CHP facility are shown to exceed a SIL, cumulative modeling will be conducted. Cumulative modeling will require emissions inventory information from DNREC, and adjacent state regulatory agencies if necessary, for background concentrations and emissions sources located in the significant impact area (to be determined through modeling).

5.0 MODEL PROPOSED AND MODELING TECHNIQUES

5.1 MODEL PROPOSED

For the Wolf 1 CHP facility air quality impact analysis, the current version of the EPA-approved American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) modeling system (Version 12345), together with five years set of hour-by-hour meteorological data, will be used to obtain emissions impact predictions. The EPA's Guideline on Air Quality Models (GAQM), which is codified in 40 CFR Part 51 Appendix W, will be used along with the EPA provided user guides for AERMOD and its associated preprocessor, and the EPA's AERMOD Implementation Guide. Based on the guidance in these documents, AERMOD will be run using the default parameters. AERMOD will also be run using the URBANOPT keyword to account for the heat island effect caused by the urban location of Wolf 1 CHP.

5.2 NO_2 AMBIENT IMPACT ANALYSIS

On January 22, 2010, the EPA announced a new 1-hour average NO_2 NAAQS. The 1-hour NO_2 NAAQS was set at 100 ppb for the 3-year average of the 98th percentile of the annual distribution of daily maximum 1-hour concentrations. This 1-hour NO_2 NAAQS became effective April 12, 2010.

A memorandum issued by the EPA on March 1, 2011 titled "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" described modeling parameters to follow for assessing compliance with the new NO_2 NAAQS. Based upon this memorandum the following conditions/parameters will be followed:

- Ambient air quality modeling will be conducted using the current version of AERMOD;
- NO_2 impact will be estimated using the Tier 2 ratio of 0.80 as the ratio of NO_2/NO. If choices during the final design phase lead to a situation where the Tier 3 ratio of 0.50 for NO_2/NO is justified, the Tier 3 ratio will be used, and the justification will be provided in the PSD analysis;
- For each receptor, the daily 1-hour maximum NO_2 concentrations will be averaged over the 5-year modeling period;
- The predicted averages will be compared to the EPA recommended interim SIL of 7.5 $\mu g/m^3$; and
- If the predicted averages exceed the SIL, cumulative NO_2 modeling will be performed using nearby NO_x sources identified by DNREC along with background data from an appropriate monitoring station. The predicted concentrations in excess of the NAAQS, beginning with the highest, 8th highest (H8H) 1-hour NO_2 concentration over the 5-year modeling period will be assessed to determine if Wolf 1 CHP contributes significantly.

6.0 TERRAIN AND RECEPTOR CONSIDERATION

The GAQM defines simple terrain as terrain at a lower elevation than the height of the stack top and complex terrain as terrain exceeding the height of the stack being modeled. The elevation of the Wolf 1 CHP facility is approximately 30 meters (98 feet) above sea level. The proposed stacks are anticipated to have a maximum height of approximately 65 meters (213 feet), based on Good Engineering Practice (GEP) stack height. Stack heights may be less than this value, but are assumed to be 65 meters for the purposes of this modeling protocol. Accordingly, terrain elevations greater than approximately 95 meters (311 feet) above sea level would be classified as complex terrain, and would require that AERMOD be run for complex terrain.

U.S. Geological Survey (USGS) National Elevation Dataset (NED) terrain data was examined for terrain features within the expected Wolf 1 CHP impact area (see Figure 3). As shown in Figure 3, the general topography in the area surrounding Wolf 1 CHP rises to the north. Additionally, there are a number of local high points south of Wolf 1 CHP, one of which approaches approximately 95 meters above sea level (Iron Hill). Based on this examination, terrain in the vicinity of the Wolf 1 CHP site is classified as complex terrain, and AERMOD will be run accordingly.

AERMAP, the terrain pre-processor for AERMOD, will be utilized to provide a terrain elevation for each receptor used in modeling. The latest version of AERMAP will be utilized (Version 11103). As of April 13, 2013, USGS NED data is no longer available in a digital format consistent with use for AERMAP. The NED data will be obtained from the National Land Cover Database's (NLCD's) Multi-Resolution Land Characteristics Consortium (MRLC) map located at http://www.mrlc.gov/viewerjs/. Duffield Associates understands that AERMAP cannot model terrain nodes which exceed a 10 percent slope line from the receptor. Appropriate NED files will be utilized to include these types of terrain nodes, if appropriate.

A receptor grid was prepared to identify those points at which the ambient air quality will be modeled. Ambient air is identified by the EPA as "that portion of the atmosphere, external to buildings, to which the general public has access." Therefore, the nearest locations of general public access will be at and beyond the Wolf 1 CHP facility fence line. The ambient air receptor grid was prepared with the following constraints, which are illustrated in Figure 4:

- Fence Line Receptors – Receptors will be placed at 25 meter intervals on the Wolf 1 CHP facility fence line;
- Close Receptors – Receptors will be placed at 50-meter intervals on the x and y axes starting at the fence line and extending to a minimum of 1 kilometer (km);
- Medium Receptors – Receptors will be placed at 100-meter intervals on the x and y axes starting at approximately 1 km and extending to a minimum of 5 km; and
- Far Receptors – Receptors will be placed at 1,000-meter intervals on the x and y axes starting at approximately 5 km and extending to a minimum of 10 km.

This receptor grid will be prepared for input into AERMAP along with the receptor heights. The receptor grids used for the ambient impact analysis will be refined following preliminary modeling, as necessary, to ensure that appropriate spacing is used in those areas with the highest ambient impacts for each pollutant and averaging period.

7.0 BUILDING WAKE EFFECTS

Buildings within a close proximity to a stack can produce a downwash effect caused by turbulent air movement around downwind buildings. This turbulent air movement can potentially cause air pollutants to disperse to the ground surface faster than normally modeled, and therefore, increase surface concentrations unexpectedly. To account for potential building downwash effects at TDC, the latest edition of BPIPPRM will be implemented. BPIPPRM relies upon user supplied information of emissions data, building locations, and building dimensions to generate an input file for AERMOD. Although site design is currently in the preliminary phase, Duffield Associates anticipates that the final proposed building locations and dimensions will be available at the time of the construction permit application submission (PSD report). This information, along with the emissions data, will be input in BPIPPRM to account for potential downwash effects in the final AERMOD modeling.

8.0 METEOROLOGICAL DATA

AERMET is the meteorological preprocessor for AERMOD. AERMET uses a collection of inputs including weather observations, land use inputs from the AERSURFACE preprocessor, and wind inputs from the AERMINUTE preprocessor to produce a meteorological input for AERMOD. The latest version of AERMET (Version 12345) will be utilized to develop the meteorological inputs for AERMOD.

AERMET requires input data regarding upper air soundings and hourly surface weather data. Upper air soundings data is collected at a limited number of locations throughout the country. The nearest upper air data stations include Aberdeen Phillips Field Station in Aberdeen, Maryland, and Wallops Flight Facility in Wallops Island, Virginia. Aberdeen is the closest location to the proposed Wolf 1 CHP facility, and upper air soundings data is available at that site from January 1, 2000, to the present day. Data will be collected for the 5-year period from January 1, 2008 to December 31, 2012 from http://www.esrl.noaa.gov/raobs/.

Hourly surface data is available at a greater number of locations compared to upper air data including New Castle Airport (NCA), Aberdeen Phillips Field Station, Philadelphia International Airport, Dover Air Force Base, and Millville Municipal Airport. The closest location to the proposed Wolf 1 CHP facility is NCA, and hourly surface data is available at NCA consistently from January 1, 1973, to the present day. Data will be collected for the 5-year period from January 1, 2008 to December 31, 2012, from ftp://ftp.ncdc.noaa.gov/pub/data/noaa.

AERMINUTE is an AERMET preprocessor that factors in wind speed and direction to compliment the reported surface weather data. AERMINUTE uses 1-minute automated surface observing station (ASOS) data. The latest version of AERMINUTE will be used (Version 11325). Nearby 1-minute ASOS locations include NCA, Sussex County Airport, and Millville Municipal Airport. NCA is the closest location to the proposed Wolf 1 CHP facility, and 1-minute ASOS data is available for NCA from January 2000 to the present day. Data will be collected for the 5-year period from January 1, 2008 to December 31, 2012, from ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/.

AERMET requires information on surface roughness length, albedo, and Bowen ratio to determine the effect of surface conditions on weather patterns. AERSURFACE was developed to calculate surface roughness length, albedo, and Bowen ratio from information on land cover for input to AERMET. The latest version of AERSURFACE will be used (Version 13016). The AERSURFACE land cover input data will be collected from NLCD's MRLC for the year 1992 at the NCA from http://www.mrlc.gov/viewerjs/. The land cover will be collected from NCA according to GAQM guidance which recommends that land cover data be collected for the site where weather information is collected. As shown in Figure 5, the land cover use at NCA has not varied significantly since 1992, therefore, the 1992 land use data is still applicable.

9.0 CLASS I AREA ANALYSES

According to Section 2.0 and Section 3.0 of DE Admin. Code 1125, Emission Offset Provisions and PSD analysis requires that new major source facilities demonstrate that potential air quality impacts will not adversely impact Class I areas. Class I areas were identified by the Clean Air Act Amendments of 1977 as national parks greater than 6,000 acres and national wilderness areas greater than 5,000 at the time of the amendments in 1977. A map of Class I areas within a 300 km radius of TDC is provided in Figure 6. Two Class I areas are located within this radius including: Brigantine National Wildlife Refuge, located approximately 113 km from TDC; and Shenandoah National Park, located approximately 225 km from TDC.

The Federal Land Managers' Air Quality-Related Values Workgroup Phase I Report provides an initial screening method for determining if air dispersion modeling must be performed for the Class I areas. The screening method relies upon dividing the total annual emissions (Q, in tons per year) of pollutants including SO_2, NO_x, PM_{10}, and H_2SO_4 by the distance from the facility to the Class I area (D, in kilometers). If the resulting quotient (Q/D) is less than 10, then additional air dispersion modeling is not required. Table 7 below includes the results of the screening method for each applicable pollutant and Class I area.

As indicated in Table 7, no quotient is greater than ten. Based upon these results, air dispersion modeling will not be performed for a Class I area analysis.

Table 7. PSD Class I Area Initial Screen Analysis

	NOx	SO_2	H_2SO_4	PM10	Total Annual Emissions (Q)
	Tons per year				
TDC potential emissions	93.15	24.39	20.80	68.57	206.91

	Brigantine National Wildlife Refuge	Shenandoah National Park
	km	
Distance from TDC (D)	113	225
	Ton/yr-km	
Q/D screening ratio	1.8	0.92

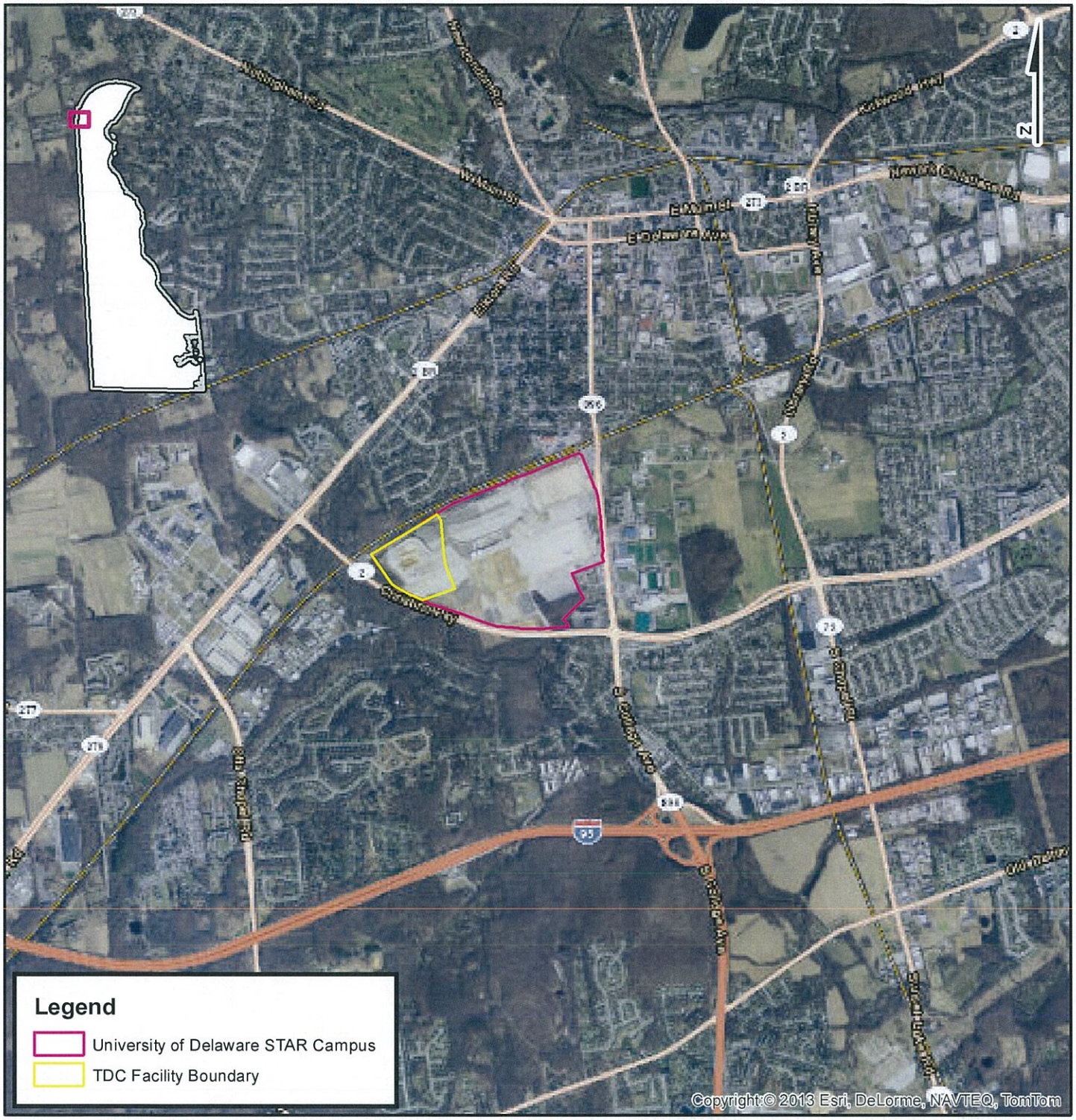
10.0 MODEL RESULTS

The purpose of conducting the Wolf 1 CHP facility ambient impact analysis is to show compliance with PSD regulations. In order to meet the requirements of those regulations, Duffield Associates must demonstrate through air quality modeling that the emission from the Wolf 1 CHP facility will not exceed PSD increments or NAAQS for a Class II area. Duffield Associates has already shown in this modeling protocol that a Class I area analysis is not appropriate for this facility and location.

Refined modeling results obtained from the AERMOD modeling system will be summarized in tabular format. The PSD ambient air quality monitoring results will be compared to the *de minimis* values, SIL values, and maximum allowable increases. If the SIL value is exceeded for an applicable pollutant, a "cumulative" ambient air quality analysis will be conducted. The modeled increase in ambient air pollutant concentrations will be added to background concentrations and other off-site stationary source emissions information to be provided by DNREC. This calculated cumulative ambient air concentration will be compared to appropriate NAAQS.

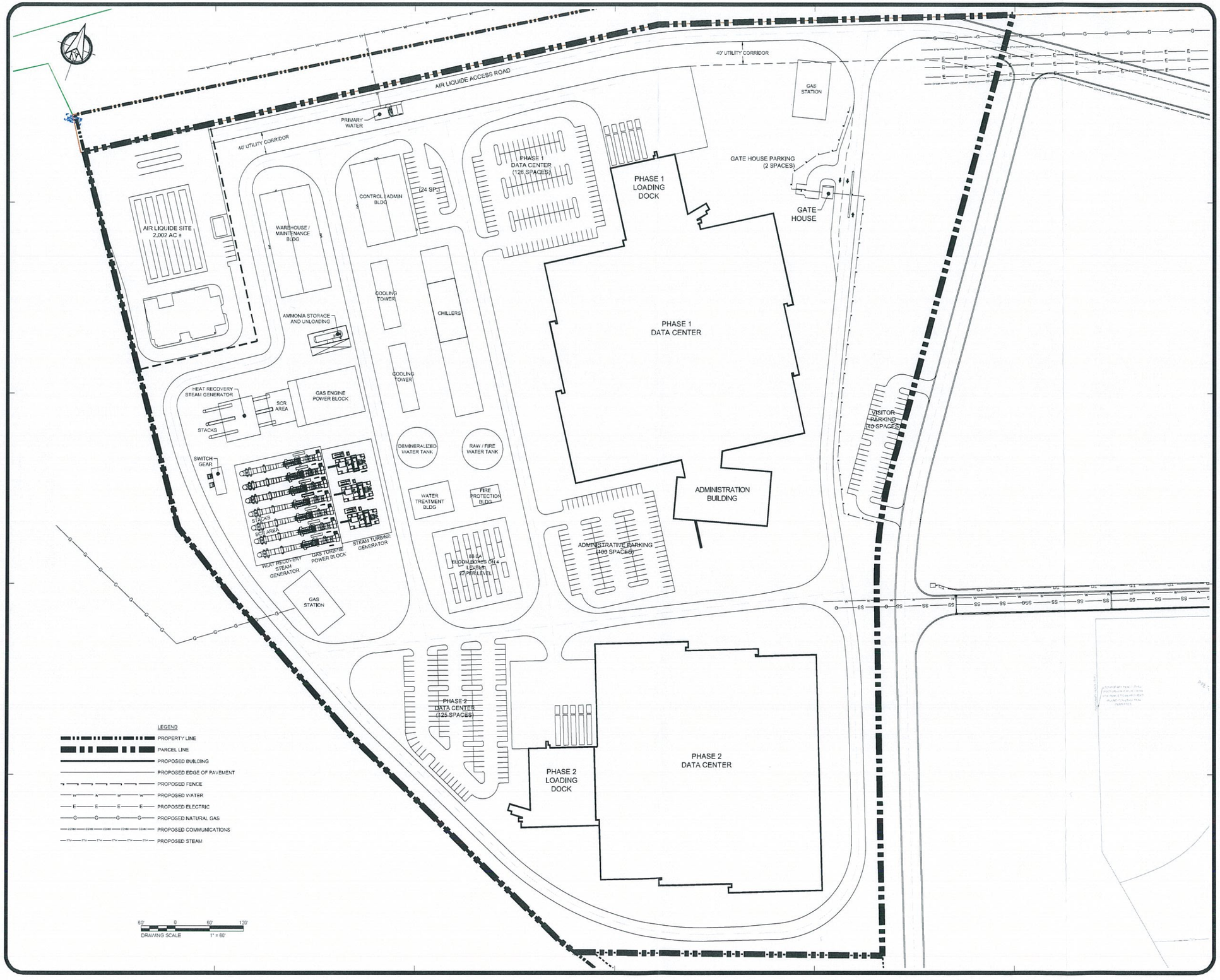
The PSD report will include documentation of the data files and input files used for the air quality impact analysis modeling, along with digital copies of the files.

FIGURES



NOTES:
THIS SKETCH IS PART OF A REPORT TITLED "WOLF 1 CHP AIR QUALITY IMPACT ANALYSIS MODELING PROTOCOL," DATED SEPTEMBER 2013 AND PREPARED BY DUFFIELD ASSOCIATES, INC. AND AS SUCH, THIS SKETCH SHOULD ONLY BE VIEWED IN THE CONTEXT OF THAT REPORT.

DATE: JULY 2013	SITE LOCATION SKETCH	DESIGNED BY: MFP	DUFFIELD ASSOCIATES
SCALE: 1 in = 4,000 feet	**WOLF 1 CHP**	DRAWN BY: MPN	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 8718.CI		CHECKED BY: MFP	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
SHEET: FIGURE 1	NEWARK~NEW CASTLE COUNTY~DELAWARE	FILE: 8718CI_SiteLocationSketch.mxd	EMAIL: DUFFIELD@DUFFNET.COM



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OFFICES IN DELAWARE, MARYLAND, PENNSYLVANIA, OHIO AND NEW JERSEY

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No.	REVISION	DATE	BY

DESIGNED BY: WDH
DRAWN BY: DP/JH
CHECKED BY:
FILE NAME: PH-MSTR-PLAN

OWNER:

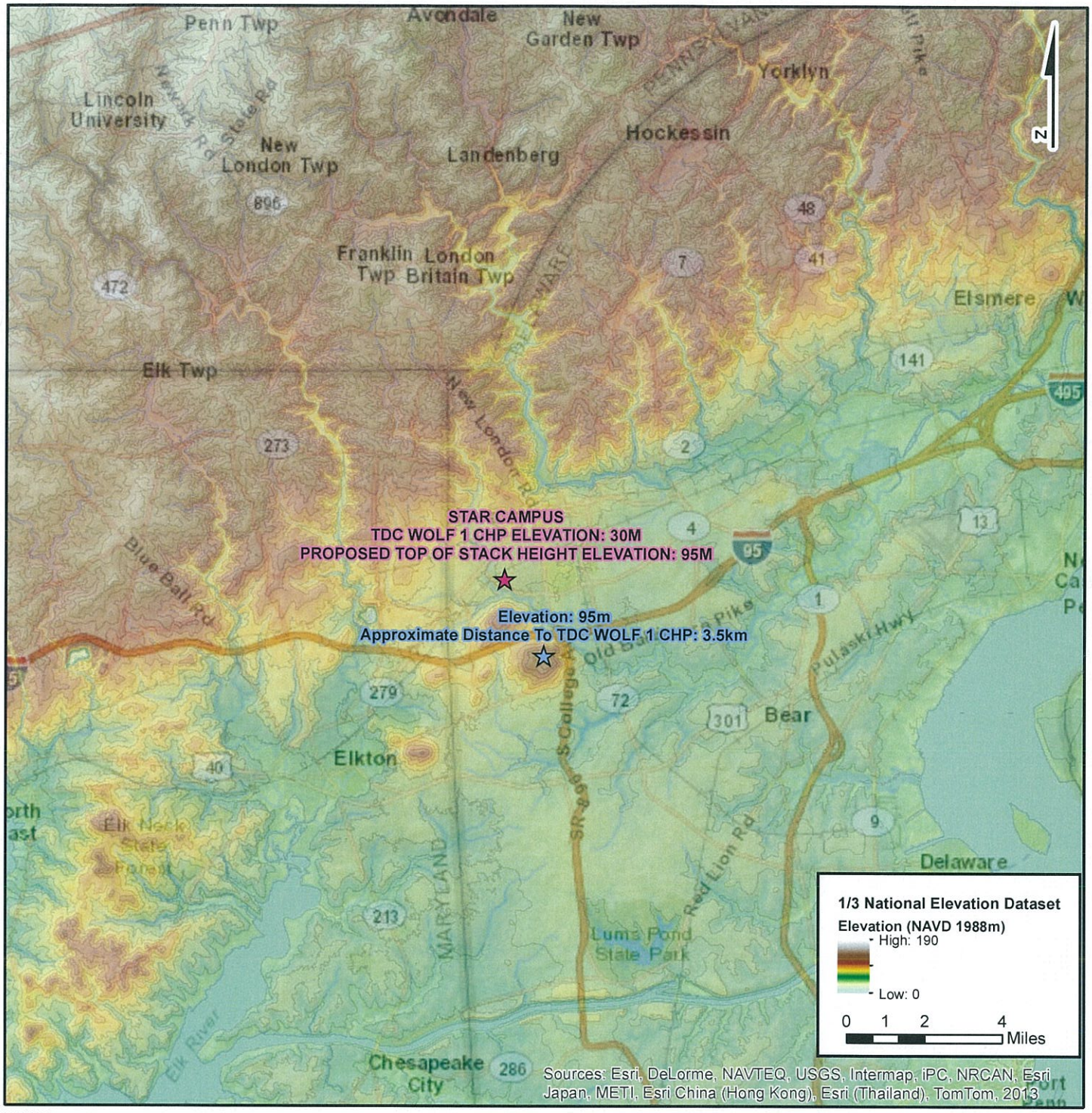
SITE PLAN

UD STAR CAMPUS

CITY OF NEWARK ~ NEW CASTLE COUNTY ~ DELAWARE

DATE: 07 AUGUST 2013
SCALE: [redacted]
PROJECT NO. 8718.CI
SHEET: FIGURE 2

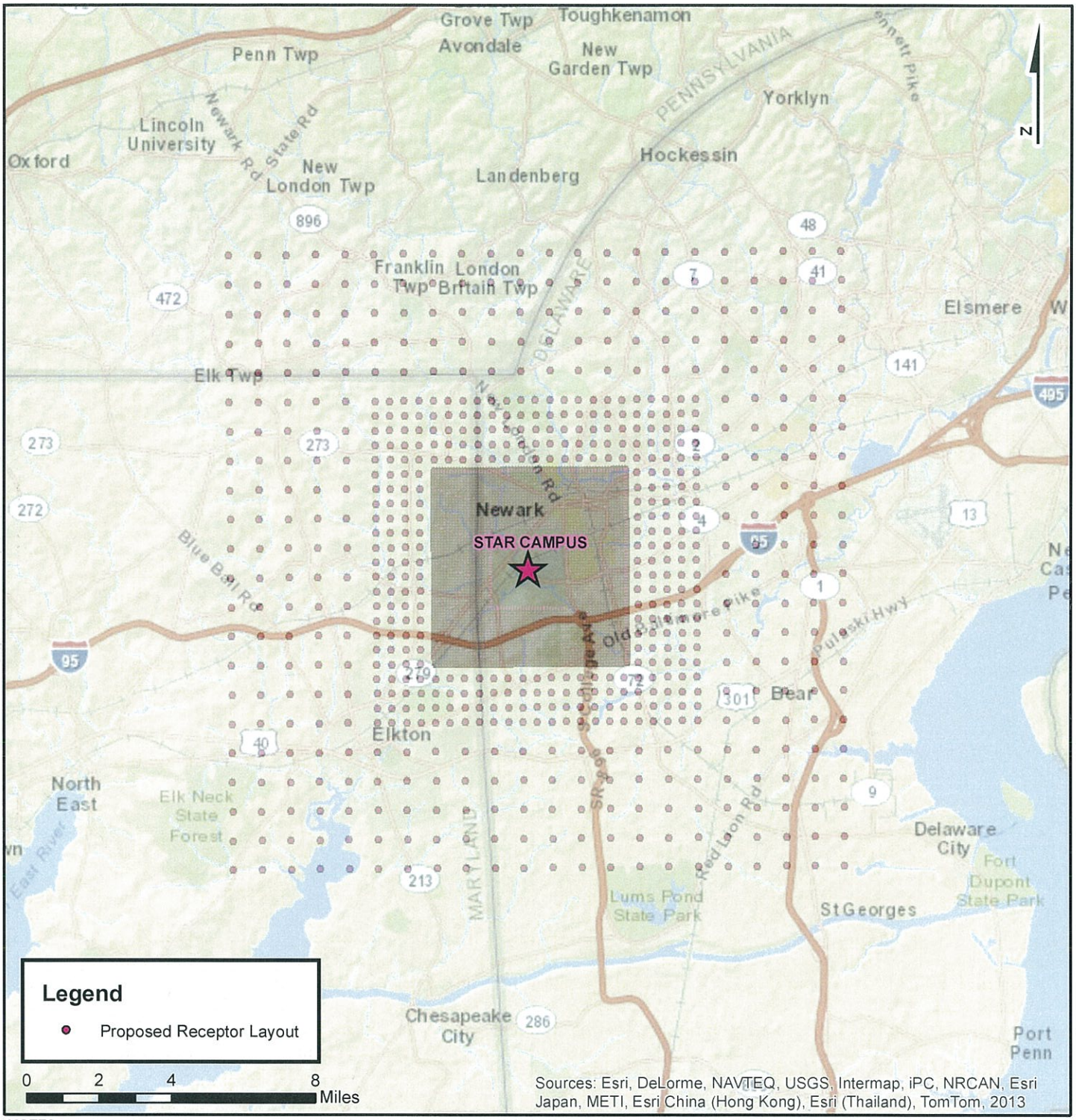
N:\Projects\8000\8718\CAD\CI\8718-CI-SITE PLAN-R0.dwg SITE PLAN - 60 SCALE 8/12/2013 11:55:25 AM



NOTES:

1. THIS SKETCH IS PART OF A REPORT TITLED "THE DATA CENTERS, LLC - WOLF 1 CHP AIR QUALITY IMPACT ANALYSIS MODELING PROTOCOL," DATED SEPTEMBER 2013 AND PREPARED BY DUFFIELD ASSOCIATES, INC. AND AS SUCH, THIS SKETCH SHOULD ONLY BE VIEWED IN THE CONTEXT OF THAT REPORT
2. 1/3 NATIONAL ELEVATION DATASET OBTAINED FROM THE USGS SEAMLESS SERVER WEB MAPPING SERVICE

DATE: SEPTEMBER 2013	REGIONAL TERRAIN MAP	DESIGNED BY: MFP	DUFFIELD ASSOCIATES
SCALE: 1 in = 4 miles	**TDC WOLF 1 CHP**	DRAWN BY: MPN	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 9718.CI	**AIR MODELING PROTOCOL**	CHECKED BY: MFP	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
SHEET: FIGURE 3	NEWARK~NEW CASTLE COUNTY~DELAWARE	FILE: 8718CI_TerrainMap.MXD	EMAIL: DUFFIELD@DUFFNET.COM



NOTES:
THIS SKETCH IS PART OF A REPORT TITLED "THE DATA CENTERS, LLC - WOLF 1 CHP AIR QUALITY IMPACT ANALYSIS MODELING PROTOCOL," DATED SEPTEMBER 2013 AND PREPARED BY DUFFIELD ASSOCIATES, INC. AND AS SUCH, THIS SKETCH SHOULD ONLY BE VIEWED IN THE CONTEXT OF THAT REPORT.

DATE: JULY 2013	AMBIENT AIR RECEPTOR GRID	DESIGNED BY: MFP	DUFFIELD ASSOCIATES
SCALE: 1 in = 4 miles	**WOLF 1 CHP**	DRAWN BY: MPN	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 8718.CI	**AIR MODELING PROTOCOL**	CHECKED BY: MFP	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
SHEET: FIGURE 4	NEWARK~NEW CASTLE COUNTY~DELAWARE	FILE: 8718CI_ReceptorMap.mxd	EMAIL: DUFFIELD@DUFFNET.COM

NOTES:
THIS SKETCH IS PART OF A REPORT TITLED "THE DATA CENTERS, LLC - WOLF 1 CHP AIR QUALITY IMPACT ANALYSIS MODELING PROTOCOL," DATED SEPTEMBER 2013 AND PREPARED BY DUFFIELD ASSOCIATES, INC. AND AS SUCH, THIS SKETCH SHOULD ONLY BE VIEWED IN THE CONTEXT OF THAT REPORT.

DUFFIELD ASSOCIATES
Soil, Water & the Environment

5400 LIMESTONE ROAD
WILMINGTON, DE 19808
TEL. (302)239-6634
FAX (302)239-8485

OFFICES IN DELAWARE, MARYLAND, PENNSYLVANIA, AND NEW JERSEY

E-MAIL: DUFFIELD@DUFFNET.COM

BASEMAP:
DELAWARE DEMAC

DRAWN BY:
MPN

CHECKED BY:
MFP

FILE:
8718CI_LANDUSECOVER.MXD

LAND USE COVER

WOLF 1 CHP

AIR MODELING PROTOCOL

NEWARK-NEW CASTLE COUNTY-DELAWARE

DATE:
SEPTEMBER 2013

SCALE:
1 in = 1 miles

PROJECT NO.
8718.CL

SHEET:
FIGURE 5

NOTES:
THIS SKETCH IS PART OF A REPORT TITLED "THE DATA CENTERS, LLC - WOLF 1 CHP AIR QUALITY IMPACT ANALYSIS MODELING PROTOCOL," DATED SEPTEMBER 2013 AND PREPARED BY DUFFIELD ASSOCIATES, INC. AND AS SUCH, THIS SKETCH SHOULD ONLY BE VIEWED IN THE CONTEXT OF THAT REPORT.

DATE: SEPTEMBER 2013	CLASS 1 AREAS	DESIGNED BY: MFP	DUFFIELD ASSOCIATES
SCALE: 1 in = 74 miles	**TDC WOLF 1 CHP**	DRAWN BY: MPN	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 8718.CI	**AIR MODELING PROTOCOL**	CHECKED BY: MFP	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
SHEET: FIGURE 6	NEWARK~NEW CASTLE COUNTY~DELAWARE	FILE: 8718CI_Class1Areas.MXD	EMAIL: DUFFIELD@DUFFNET.COM