APPENDIX C

MODELING PROTOCOL AND AGENCY COMMENTS

ECT
Environmental Consulting & Technology, Inc.

July 10, 2009
ECT No. 090408-0100

Mr. Cleve Holladay
Florida Department of Environmental Protection
Division of Air Resource Management
111 South Magnolia Drive, Suite 4
Tallahassee, Florida 32301

Re: Gainesville Renewable Energy Center (GREC)—Air Quality Impact Analysis Modeling Protocol

Dear Mr. Holladay:

Gainesville Renewable Energy Center, LLC, intends to construct, own, and operate a nominal net 100-megawatt, biomass-fired electric generating facility at a site in Gainesville, Alachua County, Florida. The proposed electrical power plant will be called the Gainesville Renewable Energy Center (GREC). The GREC project will be built on property that is leased from Gainesville Regional Utilities and contained within the site of the existing Deerhaven Generating Station.

An air quality impact analysis modeling protocol for the proposed GREC biomass power project is enclosed for your review and comments.

Please contact me at 352/248-3351 or email at tdavis@ectinc.com if there are any questions regarding this modeling protocol.

Sincerely,

ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.

Thomas W. Davis, P.E.
Vice President

TWD/dlm

cc: Meredith Bond, USFWS (w/enc)
Stan Krivo, EPA Region 4 (w/enc)
Josh Levine, GREC LLC (w/enc)

Enclosure

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AIR QUALITY IMPACT ANALYSIS MODELING PROTOCOL

Prepared for:

Gainesville Renewable Energy Center
An American Renewables Company

Prepared by:

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3701 Northwest 98th Street
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ECT No. 090408-0100

July 2009

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1.0 INTRODUCTION

Gainesville Renewable Energy Center, LLC, intends to construct, own, and operate a nominal net 100-megawatt (MW) biomass-fired electric generating facility at a site in Gainesville, Alachua County, Florida. The proposed electrical power plant will be called the Gainesville Renewable Energy Center (GREC). The GREC project will be built on property that is leased from Gainesville Regional Utilities (GRU) and contained within the site of the existing Deerhaven Generating Station (DGS).

The GREC project will include: (a) areas and equipment used for receiving, processing, handling, and storing woody biomass (biomass) fuel; (b) one biomass-fired bubbling fluidized bed (BFB) steam boiler; (c) one steam turbine generator (STG); and (d) materials handling and storage systems for sand, fly ash, and bottom ash. Ancillary equipment will include a process water treatment system, a four-cell mechanical draft cooling tower, a zero liquid discharge (ZLD) treatment system, and emergency firewater pump and generator diesel engines.

The BFB boiler will be fired with chipped/ground forest residue (primarily residual tops and limbs of trees, unutilized cull trees, precommercial thinning, and slash), mill residue (including sawdust), and urban wood waste (primarily clean wood waste from land clearing and right-of-way maintenance operations as well as waste pallets and storm debris). The BFB boiler will be equipped with natural gas-fired burners for startup purposes only. The two diesel engines will be fired with ultra-low sulfur diesel (ULSD) fuel oil.

The BFB boiler with be equipped with an enhanced selective noncatalytic reduction (SNCR) control system to reduce nitrogen oxides (NO_x) emissions and a fabric filter (i.e., baghouse) to control particulate matter (PM)/particulate matter less than or equal to 10 micrometers (PM_{10}) emissions. Material (i.e., biomass fuel, sand, bottom ash, and fly ash) handling and storage PM/PM_{10} emissions will be controlled by means of covers, enclosures, watering as necessary, baghouses, and bin vent filters.

GREC will be subject to review and licensing under the Florida Electrical Power Plant Siting Act (FEPPSA) and will also require a Prevention of Significant Deterioration (PSD) air construction permit. For projects subject to PSD review, the Florida Department of Environmental Protection (FDEP) recommends that an air quality impact analysis modeling protocol be submitted for agency review and approval prior to the start of regulatory modeling. Accordingly, this modeling protocol for the GREC project PSD air quality impact analysis was prepared by Environmental Consulting & Technology, Inc. (ECT), for agency review and comments.

This modeling protocol addresses the following major topics:

- General project information, including project description, location, and emissions.
- Pollutants to be evaluated.
- Dispersion models and model options.
- Building wake effects (downwash).
- Receptor grids including terrain considerations.
- Meteorological data.
- Format of model results.
- Additional impacts analysis.

Following this introduction, the GREC project modeling protocol is organized as follows:

- Section 2.0—Project Overview.
- Section 3.0—Modeled Emissions Inventory.
- Section 4.0—Models Proposed and Modeling Techniques.
- Section 5.0—Terrain Consideration.
- Section 6.0—Building Wake Effects.
- Section 7.0—Receptor Grids.
- Section 8.0—Meteorological Data.
- Section 9.0—Class I Area Analyses.
- Section 10.0—Format of Model Results.

2.0 PROJECT OVERVIEW

2.1 PROJECT LOCATION

The GREC project will be built on leased property at the existing GRU DGS, which is located approximately 8 miles northwest of downtown Gainesville and approximately 7 miles southeast of the city of Alachua. Figure 2-1 illustrates the location of the GREC project within the state of Florida and within Alachua County. Figure 2-2 provides an aerial showing the location of the GRU DGS, the GREC site, and the preliminary location and layout of the GREC facility.

2.2 PROJECT DESCRIPTION

The GREC project will include biomass fuel receiving, processing, handling and storage areas; one biomass-fired BFB steam boiler; one STG; and systems used for the handling and storage of sand, fly ash, and bottom ash. Ancillary equipment will include a process water treatment system, a four-cell mechanical draft cooling tower, a ZLD treatment system, and two diesel engines that will be used for the emergency firewater pump and the generator.

The biomass fuel receiving, processing, handling, and storage system will consist of three truck tippers, two sets of screens and hogs (i.e., machines used to grind wood chips), and automatic and manual stacker/reclaimers to maintain an approximate 25-day supply of biomass fuel for the BFB boiler based on full-load operation and average biomass fuel moisture content.

Biomass fuel, consisting of chipped/ground forest residue (primarily residual tops and limbs of trees, unutilized cull trees, precommercial thinning, and slash), mill residue (including sawdust), and urban wood waste (primarily clean wood waste from land clearing and right-of-way maintenance operations as well as waste pallets and storm debris) will be transported to the GREC site by truck. The biomass material will be chipped, ground, or otherwise reduced in size before it is delivered to the GREC site. Between 130 and 150 fuel truck deliveries per day are expected based on the maximum BFB boiler biomass fuel consumption rate/average moisture content and a 6-day-per-week delivery

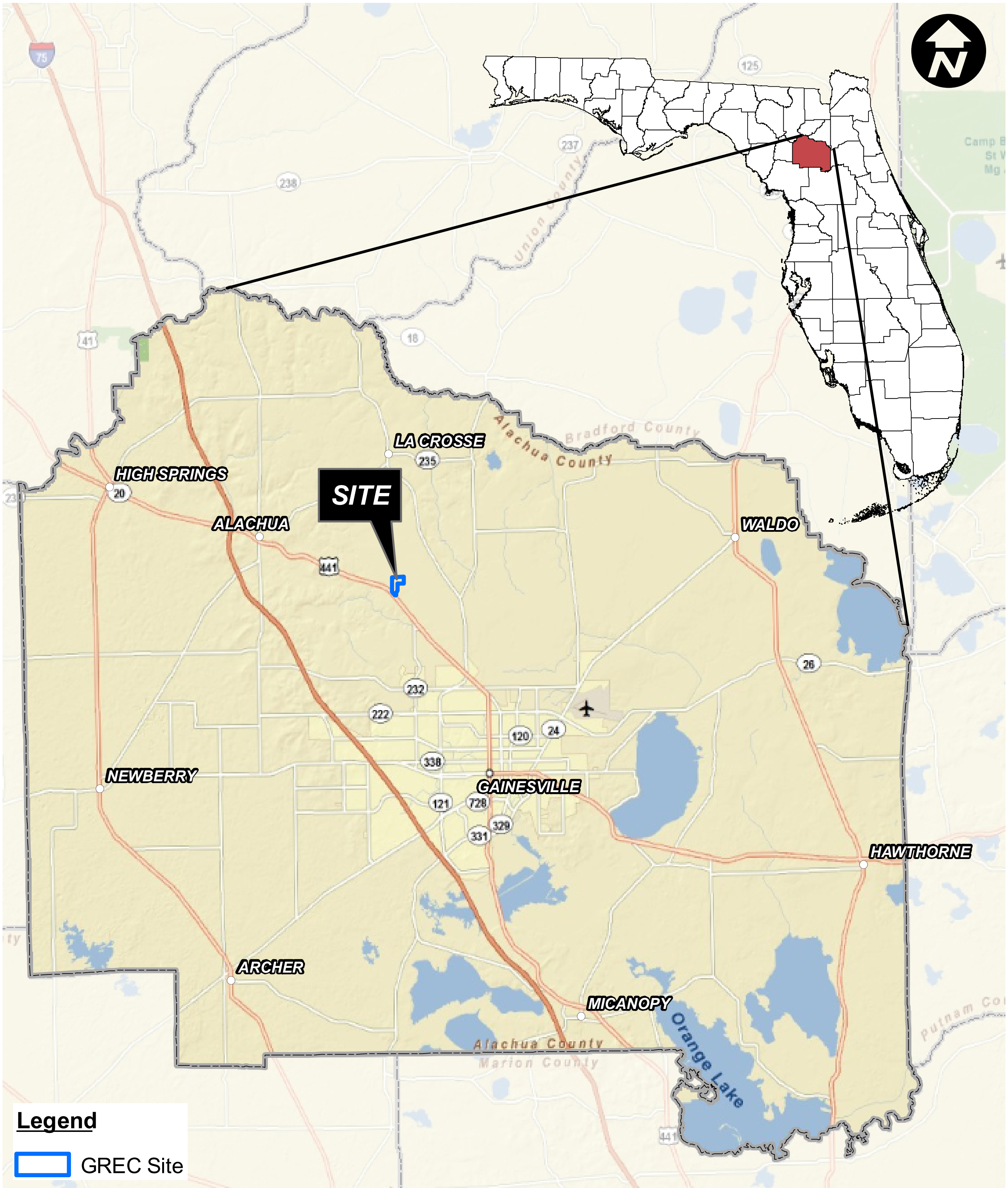

FIGURE 2-1.

GREC SITE LOCATION

Sources: ERSI, 2009; US Census, 2000; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

FIGURE 2-2.
GAINESVILLE RENEWABLE ENERGY CENTER
PRELIMINARY SITE LOCATION AND LAYOUT

Sources: FDOT, 2008; ECT, 2009.

ECT
Environmental Consulting & Technology, Inc.

schedule. The biomass fuel trucks will enter the GREC site from U.S. Highway 441 on the southern side of the site and travel north on a paved roadway to the truck weigh scale and biomass fuel receiving areas. In addition, there will be approximately 40 trucks per week delivering boiler bed sand, aqueous ammonia, and miscellaneous chemicals, as well as removing fly ash and other waste material.

Three truck tippers will be located within a single three-sided (two walls and a roof) shed, which the trucks will enter from one end and exit from the other. Within the biomass fuel unloading shed, a hydraulic dumper will tilt each truck to cause its contents to drop into below-grade receiving hoppers, which will be covered by hydraulic lids when not in use. From these hoppers, the biomass fuel will then be transferred by covered conveyor belts to the biomass fuel processing building. Prior to entering the processing building, the biomass fuel will first pass under a metal detector and magnet to remove ferrous metals.

Incoming biomass fuel will be screened and resized, if necessary, in the fully enclosed fuel processing building. Scalping screens will be used to separate oversize biomass chips from the fuel flow and redirect them to a hogging system. The hogging system will consist of two electric motor-driven hogs that will reduce oversize biomass fuel chips to the size suitable for firing in the BFB boiler. The properly sized biomass fuel and the biomass fuel resized in the hogging system will be transferred from the fuel processing building by covered conveyor belts to the biomass fuel storage piles. The fully enclosed biomass fuel processing building will be vented to a baghouse for abatement of PM/PM_{10} emissions.

From the biomass fuel processing building, the chipped biomass fuel will be stored in two open piles, which will be managed by a stacker/reclaimer (Storage Pile 1), a fixed stacker (Storage Pile 2), and rolling stock equipment. The biomass fuel reclaim system will provide for automatic reclaim from Storage Pile 1 using the stacker/reclaimer from Storage Pile 1 and manual reclaim from Storage Pile 2 using a front-end loader. The reclaimed biomass fuel from both storage piles will be transferred via a series of covered conveyors and hoppers to the main conveyor belt, which will transfer the biomass fuel to the BFB boiler fuel bins. Telescoping chutes will be employed on both stackers to reduce fugitive PM/PM_{10} emissions during the transfer of biomass fuel to the storage piles. The two storage piles will be watered, as necessary, to control wind-blown fugitive PM/PM_{10} emissions. The biomass fuel conveyor belts will be covered and transfer points enclosed, as practicable, to reduce fugitive PM/PM_{10} emissions.

In addition to the chipped/ground biomass fuel, moist sawdust (typically obtained from sawmill operations) will be received at the site for use as a supplementary fuel in the BFB boiler. Sawdust will be delivered with self-unloading trucks and deposited in an open area adjacent to Storage Pile 2. The front-end loaders used to manually reclaim fuel from Storage Pile 2 will also be used to reclaim sawdust. The reclaimed sawdust will be blended with the chipped biomass fuel and transferred to the BFB boiler fuel bins. The sawdust storage pile will be watered, as necessary, to control wind-blown fugitive PM/PM_{10} emissions.

The two BFB boiler biomass fuel bins will each provide storage of biomass fuel sufficient to fuel the boiler for approximately 45 minutes. The BFB boiler biomass fuel bins will be equipped with bin vent filters for control of PM/PM_{10} emissions.

The biomass fuel will then be transferred from the fuel bins and combusted in the BFB boiler to generate steam. In the BFB boiler, combustion of biomass fuel takes place in the dense fluidized sand bed located at the bottom of the furnace and above the bed. Small fuel particles will burn rapidly above the fluidized bed, while larger particles filter into the bed where they will be dried and gasified. In addition to the biomass fuel, the fluidized bed consists of sieved natural sand, which is maintained in suspension by the fluidizing air system. Sand will be delivered to the site by truck and pneumatically conveyed to a sand silo. The sand silo will be vented to the boiler to control PM/PM_{10} emissions. The BFB boiler will be equipped with an enhanced SNCR control system to reduce NO_x emissions, and a baghouse to control PM/PM_{10} emissions.

Steam generated by the BFB boiler will be sent to an STG for the production of electricity. Electricity will be transmitted from the STG to a switchyard located at the GREC facility, which will be used to increase the voltage. The electricity then will be transmitted through aerial transmission lines to a GRU switchyard for transmission to the electric grid.

The majority of ash created by the combustion of biomass fuel will exit the BFB boiler as fly ash with only a small amount leaving as bottom ash. Fly ash will be pneumatically conveyed to a single fly ash silo that will be equipped with a baghouse for control of PM/PM_{10} emissions. From the silo, the fly ash will either be stabilized using water in a pugmill or loaded dry into a receiving truck. For the fly ash stabilization case, fly ash and water will be mixed in a pug mill and then transferred via a chute into open trucks and hauled offsite for reuse or disposal. During the dry transfer of fly ash, an enclosed process will be used to transfer ash from the silo through a chute into sealed trucks. Air displaced from the trucks will be returned to the ash silo via a vacuum system.

The coarse bottom ash will be removed from the BFB boiler through ash hoppers and chutes. Coarse material will fall from the bed into the ash hoppers, which form a gas-tight seal with the furnace bottom. The coarse material will be sieved in a rotating screen prior to being conveyed to the bottom ash container. Suitable sand fractions recovered by the rotating screen will be transferred pneumatically to the sand silo with the remaining coarse material conveyed to the bottom ash container. The contents of the bottom ash container will be taken offsite for disposal in a properly licensed landfill.

Ancillary GREC emission sources include a four-cell mechanical draft cooling tower and two emergency diesel engines. GREC will operate as a baseload electrical generating facility with continuous operations up to 8,760 hours per year (hr/yr). The boiler will normally operate between 70- and 100-percent load, with commensurate STG load.

2.3 TYPE OF PERMIT REVIEW

GREC will have potential emissions of one or more PSD-regulated pollutants in excess of the PSD significant emission rates (SERs). Therefore, the project will qualify as a *major* source and will be subject to the PSD preconstruction requirements of Section 62-212.400, Florida Administrative Code (F.A.C.), for those pollutants that are emitted at or above the specified PSD SER levels. Among the PSD preconstruction review requirements is the need to conduct an ambient impact analysis, including a dispersion modeling study.

2.4 POLLUTANTS TO BE EVALUATED

Operation of GREC will result in emissions of PM/PM_{10}, sulfur dioxide (SO_2), NO_x, carbon monoxide (CO), volatile organic compounds (VOCs), and minor amounts of metallic, inorganic, and organic compounds. The BFB boiler will be the primary source of GREC emissions. The biomass fuel, sand, and fly/bottom ash material receiving, processing, handling, and storage systems will result in fugitive and point-source emissions of PM/PM_{10}.

Detailed emission estimates and supporting calculations will be included with the PSD permit application for the GREC project. Based on a preliminary evaluation of potential emission rates, NO_x, CO, VOC, SO_2, PM, PM_{10}, and sulfuric acid (H_2SO_4) mist emissions are each anticipated to exceed the applicable PSD SER.

Ozone is formed in a complex series of chemical reactions involving primarily NO_x and VOCs during warm ambient temperatures in the presence of sunlight. Since ozone is formed from precursor pollutants, assessment of ambient ozone impacts is conducted on a regional basis using resource-intensive models such as the U.S. Environmental Protection Agency (EPA) Community Multiscale Air Quality (CMAQ) model. GREC impacts on ambient ozone concentrations will be evaluated by reviewing current and projected future regional emissions of ozone precursors.

There are no air quality standards or PSD increments for H_2SO_4 mist and PM. On July 18, 1997, EPA revised the National Ambient Air Quality Standards (NAAQS) for PM to add new standards for fine particulate matter less than or equal to 2.5 micrometers ($PM_{2.5}$) particles. The PM NAAQS were again revised by EPA on October 17, 2006. This revision reduced the existing 24-hour average $PM_{2.5}$ NAAQS from 65 to 35 micrograms per cubic meter ($\mu g/m^3$), retained the existing 15-$\mu g/m^3$ annual $PM_{2.5}$ NAAQS, retained the existing 150-$\mu g/m^3$ 24-hour average PM_{10} NAAQS, and revoked the existing 50-$\mu g/m^3$ annual PM_{10} NAAQS. On May 16, 2008, EPA issued a final rule implementing the New Source Review (NSR) program with respect to the 1997 $PM_{2.5}$ NAAQS. This rule, which became effective July 15, 2008, requires states with approved state implementation plan (SIP) PSD programs to submit revised PSD programs implementing the $PM_{2.5}$ NSR requirements within 3 years of the effective date of EPA's final rule. Accordingly, Florida (which has a SIP-approved PSD program), is required to submit its $PM_{2.5}$ NSR SIP revision no later than July 15, 2011. On October 23, 1997, EPA issued guidance regarding interim implementation of NSR for $PM_{2.5}$. The 1997 guidance stated that sources should continue to implement an approved PM_{10} NSR program as a surrogate for meeting $PM_{2.5}$ NSR requirements until certain issues were resolved. As discussed in the preamble to the May 16, 2008, EPA final rule, during the 3-year $PM_{2.5}$ NSR SIP development period, states may continue to implement a PM_{10} program as a surrogate to meet the PSD program for $PM_{2.5}$ pursuant to the 1997 guidance.

Accordingly, the GREC air quality analysis will evaluate impacts for NO_x, CO, SO_2, and PM_{10}.

3.0 MODELING EMISSIONS INVENTORY

3.1 ON-PROPERTY SOURCES

GREC will include the following emission sources:

- Material (i.e., biomass fuel, BFB boiler sand, aqueous ammonia, fly ash, bottom ash, and miscellaneous chemicals) truck traffic on paved facility roads (fugitive source of PM_{10}).
- Biomass fuel receiving, processing, handling, and storage areas and systems (fugitive and point sources of PM_{10}).
- BFB boiler (point source of NO_x, CO, VOC, SO_2, and PM_{10}).
- Fly ash handling, storage, and truck loading systems (fugitive and point sources of PM_{10}).
- Mechanical draft cooling tower (point source of PM_{10}).
- Emergency diesel engines (NO_x, CO, VOC, SO_2, and PM_{10} point sources).

The primary GREC emission source will be the BFB boiler. Excluding startups, shutdowns, and malfunctions, the BFB boiler will operate between 70 and 100 percent of its design capacity. The GREC dispersion modeling analysis will evaluate air quality impacts for the BFB boiler at both 70- and 100-percent load conditions.

With the exception of the emergency diesel engines, all of the GREC emission sources listed previously will be addressed in the air quality impact analysis. Excluding emergencies, the firewater pump and generator diesel engines will each be operated for up to 100 hr/yr for periodic reliability and maintenance testing. Since these emergency diesel engines will operate infrequently, their impacts on short-term standards will be insignificant; i.e., the joint probability of occurrence of worst-case meteorology and diesel engine operation will be low.

The ambient impact analysis submitted to FDEP will include summary tables of maximum short-term emission rates and stack parameters for each modeled GREC emission source. Emission rates used for annual average impacts will be annualized based on the projected worst-case annual operating mode.

3.2 OFF-PROPERTY SOURCES

Maximum GREC air quality impacts are expected to be below the PSD significant impact levels (SILs) for all PSD pollutants. Accordingly, a cumulative multisource assessment of NAAQS attainment and PSD Class I and II increment consumption should not be required for the GREC project. This preliminary conclusion of project impacts will be discussed and fully documented in the GREC air quality impact analysis. If necessary, cumulative modeling will be conducted by obtaining appropriate emission inventories from the FDEP for emission sources located within 50 kilometers of any GREC significant impact area (SIA).

3.3 EMISSION RATE SCALING FACTORS

No scaling factors or variable emission rates will be used in the ambient impact analysis.

4.0 MODELS PROPOSED AND MODELING TECHNIQUES

4.1 MODELS PROPOSED

Air quality models are applied at two levels: screening and refined. At the screening level, models provide conservative estimates of impacts to determine whether more detailed modeling is required. Screening modeling can also be used to identify worst-case operating scenarios for subsequent refined modeling analysis.

The refined level consists of techniques that provide more advanced technical treatment of atmospheric processes. Refined modeling requires more detailed and precise input data, but also provides improved estimates of source impacts. For the GREC air quality impact analysis, the current version of the EPA-approved American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) modeling system, together with two sets of 5 years of hour-by-hour National Weather Service (NWS) meteorology will be used to obtain refined impact predictions for short-term periods (i.e., periods equal to or less than 24 hours) as well as annual average concentrations.

Recommended procedures for conducting air quality impact assessments are contained in EPA's *Guideline for Air Quality Models* (GAQM) (EPA, 2006d). The GAQM is codified in Appendix W of Chapter 40, Part 51, Code of Federal Regulations (CFR). In the November 9, 2005, Federal Register, EPA approved use of AERMOD as a GAQM Appendix A *preferred* model effective December 9, 2005. AERMOD is recommended for use in a wide range of regulatory applications, including both simple and complex terrain. The AERMOD modeling system consists of meteorological and terrain preprocessing programs (AERMET and AERMAP, respectively) and the AERMOD dispersion model. Accordingly, the current EPA-approved version of AERMOD (Version 07026 – January 26, 2007) will be used to assess GREC project air quality impacts at receptors located within 50 kilometers (km) of the project site.

Procedures applicable to the AERMOD modeling system specified in the latest version of the *User's Guide for the AMS/EPA Regulatory Model – AERMOD* (September) (EPA, 2004a), addenda to the User's Guide (EPA, 2006a), the *AERMOD Implementation Guide* (last revised March 19, 2009), and EPA's GAQM will be followed. In particular, the AERMOD control pathway MODELOPT keyword parameters DFAULT and CONC will be selected. Selection of the parameter DFAULT, which specifies use of the regulatory default options, is recommended by the GAQM. The CONC option specifies the calculation of concentrations. GREC will be located in rural Alachua County. Therefore, AERMOD options regarding urban area increased surface heating (URBANOPT keyword), pollutant exponential decay (HALFLIFE and DCAYCOEF keywords), and flagpole receptors (FLAGPOLE keyword) will not be employed.

As previously mentioned, the AERMOD modeling system will be used to determine annual average impacts, in addition to short-term averages, by using the PERIOD parameter for the AVERTIME keyword.

4.2 NO_2 AMBIENT IMPACT ANLAYSIS

For annual NO_2 impacts, the tiered screening approach described in GAQM, Section 6.2.3, will be used. Tier 1 of this screening procedure assumes complete conversion of NO_x to NO_2. Tier 2 applies an empirically derived NO_2/NO_x ratio of 0.75 to the Tier 1 results.

5.0 TERRAIN CONSIDERATION

The GAQM defines *flat terrain* as terrain equal to the elevation of the stack base, *simple terrain* as terrain lower than the height of the stack top, and *complex terrain* as terrain exceeding the height of the stack being modeled. As previously discussed in Section 4.1, AERMOD is capable of developing estimates of air quality impacts for all three types of terrain.

In accordance with the GAQM recommendations for AERMOD, each modeled receptor will be assigned a terrain elevation based on U.S. Geological Survey (USGS) 7.5-minute digital elevation model (DEM) data and use of the AERMAP (Version 09040 – April 17, 2009) preprocessing program. AERMAP will be used in accordance with the latest version (October) (EPA, 2004b) of the *User's Guide for the AERMOD Terrain Preprocessor (AERMAP)*, addenda to the User's Guide (EPA, 2006b), and EPA's GAQM.

6.0 BUILDING WAKE EFFECTS

The Clean Air Act Amendments of 1990 require the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds good engineering practice (GEP) or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (40 CFR 51). The stack heights for the GREC emission sources will comply with the EPA stack height regulations (40 CFR 51).

While the GEP stack height rules address the maximum stack height that can be employed in a dispersion model analysis, stacks having heights lower than GEP stack height can potentially result in higher downwind concentrations due to building downwash effects. AERMOD evaluates the effects of building downwash based on the plume rise model enhancements (PRIME) building downwash algorithms. For the GREC ambient impact analysis, the complex downwash analysis implemented by AERMOD will be performed using the current version of EPA's Building Profile Input Program (BPIP) for PRIME (BPIPPRM—Version 04274 [September 30, 2004]). The EPA BPIPPRM program will be used to determine the area of influence for each building, whether a particular stack is subject to building downwash, the area of influence for directionally dependent building downwash, and to generate the specific building dimension data required by the model. BPIPPRM output consists of an array of 36 direction-specific (10 to 360-degree [°]) building heights (BUILDHGT keyword), lengths (BUILDLEN keyword), widths (BUILDWID keyword), and along-flow (XBADJ keyword) and across-flow (YBADJ keyword) distances for each stack suitable for use as input to AERMOD.

7.0 RECEPTOR GRIDS

Receptors will be placed at locations considered to be *ambient air*, which is defined as "that portion of the atmosphere, external to buildings, to which the general public has access." GREC will be located on property leased from GRU. The entire perimeter of the GRU DGS site, including the property to be leased to GREC, is fenced. Therefore, the nearest locations of general public access will be at the GRU DGS fence line.

Consistent with GAQM and FDEP guidance, the GREC ambient impact analysis will use the following receptor grids:

- <u>Fence Line Receptors</u>—Receptors placed on the GREC leased property boundary spaced 50 meters apart.
- <u>Near-Field Cartesian Receptors</u>—Receptors at 100-meter spacings starting 100 meters from the GREC leased property boundary receptors and extending to 3,000 meters from the center of the GREC site.
- <u>Mid-Field Cartesian Receptors</u>—Receptors at 250-meter spacings starting at 3,250 meters and extending to 6,000 meters from the center of the GREC site.
- <u>Far-Field Cartesian Receptors</u>—Receptors at 500-meter spacings starting at 6,500 meters and extending to 15,000 meters from the center of the GREC site.

The receptor grids used for the ambient impact analysis will be refined following preliminary modeling, as necessary, to ensure that the highest ambient impacts for each pollutant and averaging period have been identified using a receptor spacing of no more than 100 meters.

8.0 METEOROLOGICAL DATA

The EPA AERMET and AERSURFACE meteorological data preprocessing programs will be used to generate the meteorological data required by AERMOD.

The AERMET meteorological preprocessing program creates two files that are used by AERMOD (i.e., surface and profile files). The surface file contains boundary layer parameters including friction velocity, Monin-Obukhov length, convective velocity scale, temperature scale, convectively generated boundary layer (CBL) height, stable boundary layer (SBL) height, and surface heat flux. The profile file contains multilevel data of windspeed, wind direction, and temperature.

AERMET passes all observed meteorological parameters to AERMOD, including wind direction and speed (at multiple heights, if available), temperature, and, if available, measured turbulence. AERMOD uses this information to calculate concentrations in a manner that accounts for a dispersion rate that is a continuous function of meteorology. The current EPA-approved version of AERMET (Version 06341 – December 7, 2006) will be used in accordance with the latest version (November) (EPA, 2004c) of the *User's Guide for the AERMOD Meteorological Preprocessor (AERMET)*, addenda to the User's Guide (EPA, 2006c), and EPA's GAQM.

The AERMET meteorological processor requires the determination of three surface characteristics: surface roughness length (z_o), albedo (r), and Bowen ratio (B_o). Surface roughness length is related to the height of obstacles to the wind flow and is the height at which the mean horizontal wind speed is zero based on a logarithmic profile. Surface roughness length influences the surface shear stress and is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer. Albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio, an indicator of surface moisture, is the ratio of sensible heat flux to latent heat flux and, together with albedo and other meteorological observations, is used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux. The EPA AERSUR-

FACE program was developed to aid users in obtaining realistic and reproducible surface characteristic values, including albedo, Bowen ratio, and surface roughness length, for input to AERMET. The program uses publicly available national land cover datasets and look-up tables of surface characteristics that vary by land cover type and season. The current EPA-approved version of AERSURFACE (Version 08009 – January 9, 2008) will be used in accordance with the latest version (January 2008) of the *AERSURFACE User's Guide*, updates to the User's Guide, and EPA's GAQM.

The nearest source of surface meteorological data is the NWS site (Weather-Bureau-Army-Navy [WBAN] Station No. 12816) located at the Gainesville Regional Airport (GRA) approximately 10 miles southeast of the GREC site. The nearest source of upper air meteorological data is the NWS site (WBAN Station No. 13889) located at the Jacksonville International Airport (JIA) approximately 66 miles northeast of the GREC site. Due to the proximity of the GRA and JIA meteorological stations, and in accordance with FDEP guidance, the most recent 5 years (i.e., (2001 through 2005) of readily available surface and upper air meteorological data from the GRA and JIA airports will be used for the GREC air quality impact analysis.

Since surface characteristics influencing dispersion within 1 km of the GRA meteorological station differ from the GREC site, two sets of meteorological data will be used to determine maximum GREC PSD Class II air quality impacts. Each dataset will contain 5 consecutive years (i.e., 2001 through 2005) of GRA surface and JIA upper air meteorological data. The first set will use the surface characteristics of the GRA site, while the second set will employ the GREC site surface characteristics. Figures 8-1 and 8-2 provide aerial views of the GREC and GRA sites, respectively. Both 5-year sets of GRA/JIA meteorological data, in conjunction with the AERMOD dispersion model, will be used to determine maximum GREC air quality impacts.

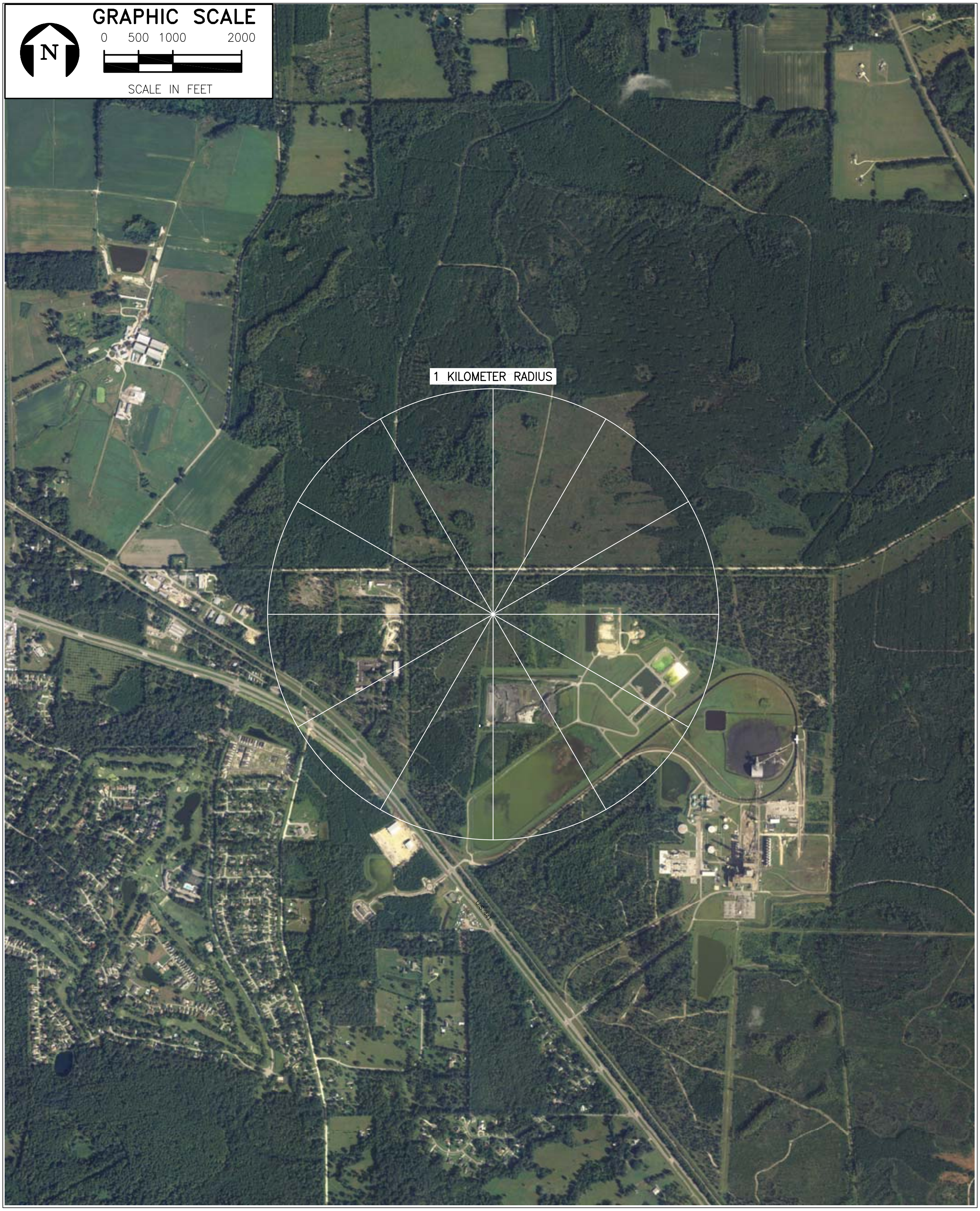

FIGURE 8-1.

GREC SITE AERIAL

Sources: SJRWMD, 2007; ECT, 2009.

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FIGURE 8-2.

GAINESVILLE REGIONAL AIRPORT AERIAL

Sources: SJRWMD, 2007; ECT, 2009.

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9.0 CLASS I AREA ANALYSES

GREC will be located within 300 km of five PSD Class I areas. The nearest PSD Class I area is the Okefenokee National Wildlife Refuge (NWR) located approximately 93 km (58 miles) north of the project site. The remaining Class I areas located within 300 km of the GREC site include:

- Chassahowitzka NWR, located 110 km (68 miles) south-southeast of the project site.
- St. Marks NWR, located 159 km (99 miles) west-northwest of the project site.
- Bradwell Bay NWR, located 211 km (131 miles) west-northwest of the project site.
- Wolf Island NWR, located 202 km (126 miles) northeast of the project site.

Figure 9-1 depicts the locations of these PSD Class I areas and the GREC site.

In accordance with current Federal Land Manager (FLM) and FDEP guidance, assessment of Class I area impacts will be required. ECT will provide this modeling protocol to the U.S. Fish and Wildlife Service (USFWS) and seek guidance regarding the need to conduct Class I area air quality impact analyses for the more distant PSD Class I areas using FLM-recommended screening procedures.

The following sections discuss the dispersion models and programs, meteorological data, receptor grids, and modeled emission sources proposed for the GREC PSD Class I air quality impact analyses.

9.1 MODEL SELECTION AND USE

For those PSD Class I areas that require air quality impact assessments, the required analyses will be conducted using the GAQM approved California Puff (CALPUFF) suite of modeling programs, including CALMET, CALPUFF, POSTUTIL, and CALPOST. These programs will be used in accordance with the recommendations contained in the *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report*

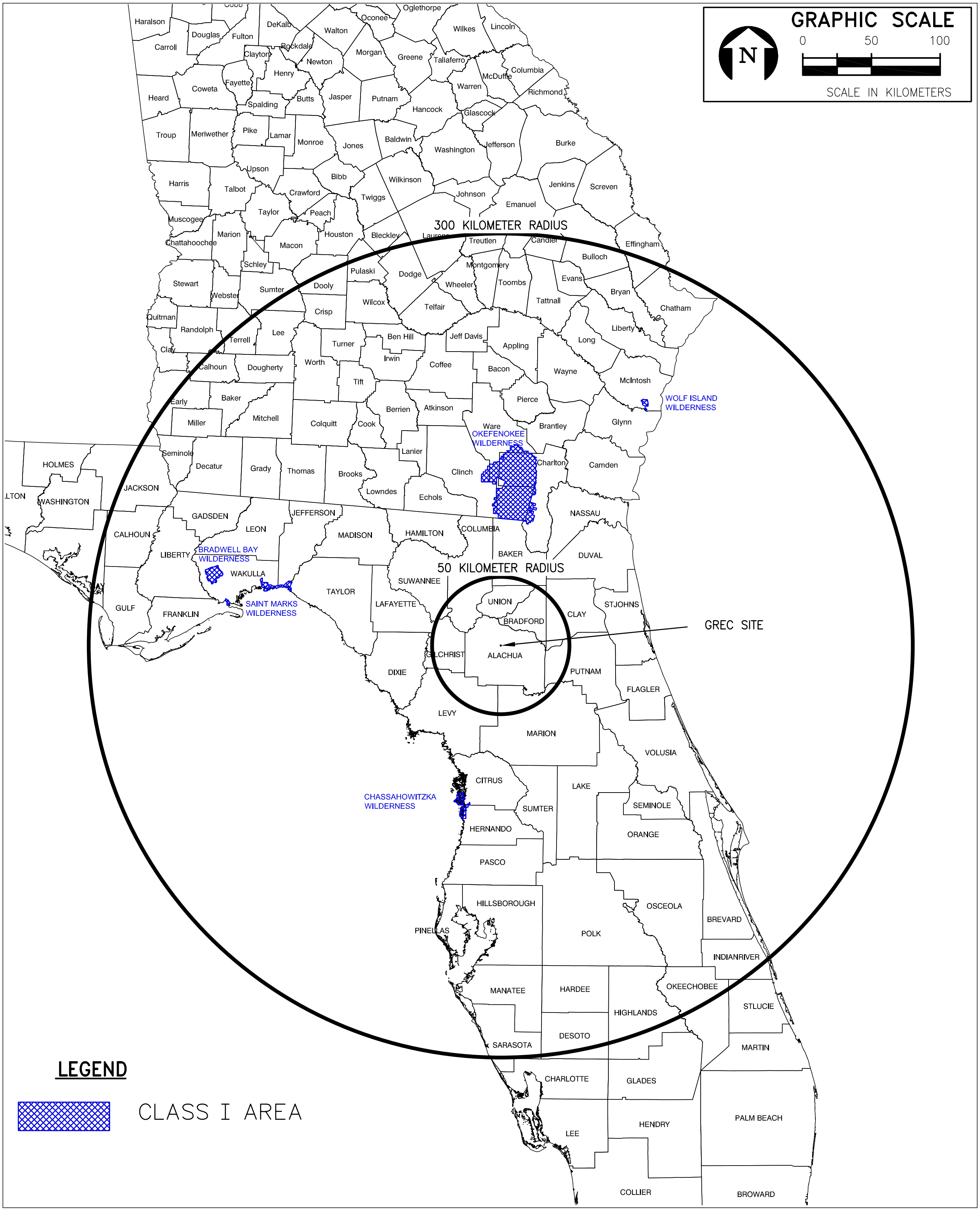

FIGURE 9-1.

CLASS I AREAS WITHIN 300 KM OF THE GREC SITE

Sources: FWS, 2007; USFS, 2007; NPS, 2007; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

and Recommendations for Modeling Long Range Transport Impacts dated December 1998 (with respect to PSD Class I increment analyses), and the *Federal Land Managers' Air Quality-Related Values Workgroup (FLAG) Phase I Report* dated December 2000 (with respect to regional haze and deposition analyses). The EPA-approved CALPUFF modeling suite is comprised of the following programs:

- CALMET Version: 5.8 Level: 070623
- CALPUFF Version: 5.8 Level: 070623
- POSTUTIL Version: 1.56 Level: 070627
- CALPOST Version: 5.6394 Level: 070622

These programs will be used to assess PSD Class I increments, regional haze, and nitrogen and sulfur deposition impacts.

CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modeling domain. The meteorological file produced by CALMET for use by CALPUFF also includes two-dimensional parameters such as mixing height, surface characteristics, and dispersion properties.

CALPUFF is a transport and puff model that advects puffs of material from an emission source. These puffs undergo various dispersion and transformation simulation processes as they are advected from an emission source to a receptor of interest. The simulation processes include wet and dry deposition and chemical transformation. CALPUFF typically uses the gridded meteorological data created by the CALMET program. CALPUFF generates output files consisting of hourly concentrations, deposition fluxes, and data required for visibility assessments for each receptor. These CALPUFF output files are subsequently processed by the POSTUTIL and CALPOST programs to provide impact summaries for the pollutants and averaging periods of interest. Key CALPUFF model options that will be used for the GREC PSD Class I impact assessments are as follows:

- CALPUFF domain configured to include the GREC project and all Class I receptors with a minimum 50-km buffer in all directions.
- 4-km spacing meteorological and computational grid.

- Class I receptors as defined by the National Park Service (NPS).
- Modeling of SO_2, sulfite, NO_x, nitric acid (HNO_3), nitrate, and appropriate PM size fractions for biomass-fired BFB boilers.
- Use of the MESOPUFF II chemical mechanism module.
- IWAQM default guidance, including Pasquill-Gifford dispersion coefficients.
- 2001 through 2003 ozone data from the Clean Air Status and Trends Network (CASTNet) and Atmospheric Infrared Sounder (AIRS) stations.
- Background ammonia concentration of 0.5 part per billion (ppb).
- Integrated puff-sampling methodology.
- No consideration of building downwash.

The current EPA-approved version of the CALPUFF dispersion model (Version 5.8, Level 070623) will be employed to develop estimates of GREC impacts for PSD Class I increments, regional haze, and deposition.

POSTUTIL is a postprocessing program used to process the concentrations generated by CALPUFF. POSTUTIL will be used recompute the HNO_3/nitrate concentration partition, develop visibility PM component emission rates (i.e., elemental and organic carbon PM fractions), consolidate the PM_{10} impacts (i.e., impacts due to PM_{10} fractions and primary sulfate), consolidate the wet and dry nitrogen and sulfur fluxes, and convert sulfate and nitrate fluxes to total sulfur and total nitrogen fluxes. The current EPA-approved version of the POSTUTIL program (Version 1.56, Level 070627) will be used for the GREC PSD Class I impacts analyses.

CALPOST is a post-processing program used to process the concentration, deposition, and visibility files generated by CALPUFF. The CALPOST program was formulated to average and report pollutant concentrations or wet/dry deposition fluxes using the hourly data contained in the CALPUFF output files. CALPOST can produce summary tables of pollutant concentrations and depositions for each receptor for various averaging times and can develop ranked lists of these impacts. For visibility-related modeling (e.g., regional haze), CALPOST uses the CALPUFF-generated pollutant concentrations to calculate extinction coefficients and other related indicators of visibility. The various CALPOST program options are implemented by means of a control file. CALPOST options selected for the GREC PSD Class I area impact assessments will conform to the recommendations contained in the IWQAM Phase 2 and FLAG Phase 1 reports and NPS guidance. The current EPA-approved version of the CALPOST program (Version 5.8, Level 070623) will be used for the GREC PSD Class I impacts analyses.

Because GREC will be located at a distance greater than 50 km from the nearest PSD Class I area, nearfield coherent plume visibility impacts are not required. For distant regional haze assessments, the CALPUFF, POSTUTIL, and CALPOST models will be used in accordance with the FLAG Phase 1 report recommendations.

9.2 METEOROLOGICAL DATA

The Visibility Improvement State and Tribal Association of the Southeast (VISTAS) has developed a 3-year (2001 through 2003) CALMET dataset for a fine, 4-km, subregional domain that covers all of Florida and the adjacent Class I areas of interest to Florida. The VISTAS 2001 to 2003 meteorological data was reprocessed by the U.S. Fish and Wildlife Service (USFWS) using the current EPA regulatory version of CALMET (i.e., Version 5.8, Level 070623). This reprocessed fine-grid CALMET dataset (containing more than 250 gigabytes [GB] of data) was obtained from FDEP and will be used for the GREC PSD Class I impact assessments.

9.3 RECEPTOR GRIDS

For those PSD Class I areas requiring air quality impact assessments, the discrete receptors identified by NPS for each Class I area will be evaluated. The Class I receptor locations, which are provided by NPS in geographic (latitude and longitude) coordinates, will be converted to Lambert Conformal Conic (LCC) coordinates consistent with the VISTAS fine 4-km CALMET grid parameters (i.e., two matching parallels, latitude/longitude of the projection origin, and coordinate datum) using the NPS Class I areas conversion program.

9.4 MODELED EMISSION SOURCES

The GREC project modeled emission source will include only the biomass-fired BFB boiler operating at 100 percent of its design capacity. The BFB boiler is the primary GREC emission source. The remaining GREC emission sources (i.e., the biomass fuel, sand, bottom ash, and fly ash material receiving, handling, and storage systems; the mechanical draft cooling tower; and the emergency diesel engines) will operate intermittently and will have minor emission rates and low release heights.

10.0 MODEL RESULTS

10.1 PRESENTATION OF MODEL RESULTS

The primary objective of the GREC ambient impact analysis is to demonstrate that emissions from the proposed project will not cause or significantly contribute to a violation of any NAAQS or PSD increment. As previously discussed in Section 4.0, refined modeling will be performed to determine maximum GREC air quality impacts. It is anticipated that maximum GREC project impacts will be below the PSD Class I and II SILs for all PSD pollutants.

Refined modeling results obtained from the AERMOD modeling system will be summarized in tabular format. For the PSD *de minimis* and Class II SIL analyses, the model result tables will indicate, for each pollutant, the year of meteorology, applicable averaging period, and magnitude and location of the maximum modeled impact. If an NAAQS analysis is necessary, the model results tables will indicate, for each pollutant, the year of meteorology, applicable averaging period, magnitude and location of the maximum modeled impact, background concentration, and total impact. For the PSD Class II increment analysis (if necessary), the same data will be presented with the exception of background concentrations. The summary tables will include the PSD *de minimis* and Class II SILs, NAAQS, and PSD Class II increments, as appropriate, for comparison purposes.

PSD Class I area modeling results obtained from the CALPUFF modeling suite will also be summarized in tabular format. For the PSD Class I significant impact analyses, model result tables will indicate, for each pollutant, the year of meteorology, applicable averaging period, and magnitude and location of the maximum modeled impact. For the PSD Class I increment analysis (if necessary), the same data will be presented. The summary tables will include the PSD Class I SILs and PSD Class I increments, as appropriate, for comparison purposes. The Class I area impact analyses will also include tabular results of the visibility and deposition assessment results.

The ambient impact analysis will include all methods and data used in conducting the dispersion modeling study. All building downwash, dispersion model input and output, and meteorological data files will be provided (on magnetic media) with the analysis.

10.2 ADDITIONAL IMPACT ANALYSES

The additional impact analysis will discuss GREC project impacts pertaining to associated growth, soils and vegetation, and visibility impairment.

Project impacts due to associated growth will evaluate, in qualitative terms, potential air quality impacts resulting from project construction, affects on local fuel markets, increase in vehicle miles traveled resulting from GREC construction and operation, and any secondary growth. An evaluation of the change in regional air quality since 1977 due to growth will also be provided.

The soils and vegetation analysis will be conducted by comparing projected ambient concentrations for the pollutants of concern with applicable susceptibility data from the air pollution literature. For most types of soils and vegetation, ambient air concentrations of criteria pollutants below the NAAQS will not result in harmful effects. If sensitive vegetation is determined to be present, a more extensive assessment of potential adverse effects will be conducted.

No visibility impairment at the local level is expected due to the types and quantities of emissions projected for the GREC project. Visibility impairment will be evaluated based on an assessment of GREC project emissions and applicable FDEP requirements pertaining to visible emissions.

REFERENCES

Earth Tech, Inc. 1997. Addendum to ISC3 User's Guide, The PRIME Plume Rise and Building Downwash Model. Concord, Massachusetts.

U.S. Environmental Protection Agency (EPA). 1985. Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations [Revised]). EPA-450/4-80-023R. Research Triangle Park, North Carolina.

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———. 2004a. User's Guide for the AMS/EPA Regulatory Model - AERMOD. EPA-454/B-03-001. Research Triangle Park, North Carolina.

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———. 2004c. User's Guide for the AERMOD Meteorological Preprocessor (AERMET). EPA-454/B-03-002. Research Triangle Park, North Carolina.

———. 2006a. Addendum User's Guide for the AMS/EPA Regulatory Model - AERMOD. EPA-454/B-03-001. Research Triangle Park, North Carolina.

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———. 2006d. Guideline on Air Quality Models (GAQM) (Revised). (Appendix W, 40 CFR 51).

U.S. Forest Service, National Park Service, U.S. Fish and Wildlife Service. 2000. Federal Land Managers' Air Quality-Related Values Workgroup (FLAG) Phase I Report.

Tom Davis

From: Holladay, Cleve [Cleve.Holladay@dep.state.fl.us]
Sent: Wednesday, August 05, 2009 4:12 PM
To: Tom Davis
Subject: EPA Comments on GRU Modeling Protocol
Attachments: Alternate Procedure for Determining Class I Impacts When FLM Doesn't Request ARQV Analysis.doc.docx

The following are Stan Krivo's review comments on the above referenced air quality modeling protocol for the proposed construction and operation of a 100-megawatt biomass-fired electric generating facility. GREC will be located on leased land from Gainesville Regional Utilities. These comments are provided for your use in reviewing this protocol.

Proposed Project – The following comments are associated with the proposed project description.
- It appears that the existing Deerhaven Generating Station (DGS) and the proposed GREC are owned and operated by different entities. The relationships (e.g., ownership, contractual, etc.) between DGS and GREC should be provided. If other facilities are located within the Gainesville Regional Utilities property they should be identified along with any relationships (e.g., owners, shared resources, business contracts, etc.).
- Although the emission estimates for the proposed GREC were not provided, the PSD applicable pollutants were indicated to be SO2, CO, VOC, NOx, PM, PM10 and sulfuric acid (H2SO4). The basis for the project emission estimates should be provided in the application.
- PM2.5 emissions were not considered in the protocol. Estimates of PM2.5 emissions from the project should be provided.
- The non-ambient air for GREC dependents on the amount of land leased and the existence of barrier(s) to public access. The relationship between other facilities within Gainesville Regional Utilities may also affect this GREC non-ambient air determination. [22 June 2007 Steve Page Memorandum "Interpretation of "Ambient Air" in Situations Involving Leased Land Under the Regulations for Prevention of Significant Deterioration (PSD)" at http://www.epa.gov/region07/programs/artd/air/nsr/nsrmemos/leaseair.pdf]
- The biomass fuel brought to the site in trucks will have been chipped, ground, and reduced in size. It is assumed that this biomass pre-treatment will occur at other offsite locations by facilities not owned or under the control of GREC.
- The protocol indicates the emergency generators and firewater pump diesel engines will operate 100 hours/year but they will not be included in the modeling. It is suggested that their emissions be included at least in the short-term modeling.

Assessment of PM2.5 Impacts – The USEPA PM10 surrogate policy will be used to assess PM2.5 impacts. Because this surrogate policy is currently under review it is suggested that the appropriateness of this policy for this project be addressed (e.g., the characteristics of the project PM2.5 emissions are such that meeting the PM10 PSD and NSR program requirements will be protective of the PM2.5 ambient air quality). Otherwise the impacts of PM2.5 project emissions should be addressed.

Receptor Grids – Receptors are proposed along the property fence line of Gainesville Regional Utilities. As indicates in comment 1 above, the non-ambient air for GREC appears to be the land leased and controlled by GREC with the existence of barrier(s) to public access. The guidance provided in the 22 June

2007 Steve Page Memorandum "Interpretation of "Ambient Air" in Situations Involving Leased Land Under the Regulations for Prevention of Significant Deterioration (PSD)" should be used to define GREC non-ambient air.
[http://www.epa.gov/region07/programs/artd/air/nsr/nsrmemos/leaseair.pdf]

Meteorological Data – The Gainesville Regional Airport surface and Jacksonville International Airport upper air meteorological data for the period 2001 through 2005 were selected for this analysis. These data will be processed through AERMET twice – once with the Gainesville Regional Airport surface characteristics and once using the project location surface characteristics. The specific procedures (e.g., number of sectors, radii used for roughness, albedo, and Bowen ratio, etc.) were not provided. This information should be contained in the PSD permit application.

Land Use Analysis – The protocol indicates an analysis of the land use characteristics about the project location resulted in rural dispersion coefficients for the impact analyses. The resultant distribution of land use characteristics within the 3 km radius should be provided in the application to support this conclusion.

Inventory of Additional Emission Sources – The procedures propose for the development of NAAQS and PSD inventories of other sources have not been included in the protocol because no significant impacts are expected. If cumulative NAAQS and PSD increment compliance modeling are needed, the development of inventories of other emission sources should be done in coordination with FDEP. The application should describe the procedure used to develop the initial inventories and screen out sources from the modeling.

PSD Class I Area Analysis – The FLM's procedure to assess the need to perform AQRV modeling analyses may not be appropriate for PSD increment assessment. The application should address the project's expected impact on the PSD Class I increments. The emissions and exit stack parameters associated with the worst-case impact scenario should be modeled for this assessment. The procedures used to assess the project's impact on the PSD Class I area increment should be developed in consultation with FDEP and EPA. I am attaching an alternate procedure for Class I increment modeling suggested by Stan Krivo if an AQRV analysis is not requested by the federal land manager.

Additional Impact Analyses – The following comments are associated with the proposed additional analyses.
- A qualitative assessment is proposed for the impacts associated with project related growth. Depending on the expected type of grow and the expected emissions, the growth related impacts can be included in a quantitative impact assessment.
- The soils and vegetation analysis should be performed by comparing the anticipated ambient concentrations after project operation with the applicable susceptibility data. The use of project only impacts are not appropriate for this comparison.
- The need for visibility assessment within the PSD Class II area depends on the size of the significant impact area (SIA) and the location of visibility sensitive receptors. If there are no project SIA or visibility sensitive receptors within the SIA, then no additional visibility impact assessment is needed.

Please let me know if you have any questions.
Cleve
850-921-8986

The Department of Environmental Protection values your feedback as a customer. DEP Secretary Michael W. Sole is committed to continuously assessing and improving the level and quality of services provided to you. Please take a few minutes to comment on the quality of service you received. Simply click on this link to the DEP Customer Survey. Thank you in advance for completing the survey.