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September 7, 2012
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PROGRESS ENERGY FLORIDA, INC.	)	Docket Nos. 52-029 and 52-030
	)	
(Levy County Nuclear Power Plant, Units 1 and 2	)	
	)	

NRC STAFF PRE-FILED REBUTTAL TESTIMONY OF ANN L. MIRACLE, MICHAEL T. MASNIK, J. PEYTON DOUB, LARA M. ASTON, DAN O. BARNHURST, LANCE W. VAIL, RAJIV PRASAD, VINCE R. VERMEUL, KEVIN R. QUINLAN, LARRY K. BERG, AND GERRY L. STIREWALT CONCERNING CONTENTION 4A

I. INTRODUCTION

Q1. Please state your name

A1(a). (ALM) My name is Ann L. Miracle

A1(b). (MTM) My name is Michael T. Masnik

A1(c). (JPD) My name is J. Peyton Doub

A1(d). (LMA) My name is Lara M. Aston

A1(e). (DOB) My name is Dan O. Barnhurst

A1(f). (LWV) My name is Lance W. Vail

A1(g). (RP) My name is Rajiv Prasad

A1(h). (VRV) My name is Vince R. Vermeul

A1(i). (KRQ) My name is Kevin R. Quinlan

A1(j). (LKB) My name is Larry K. Berg

A1(k). (GLS) My name is Gerry L. Stirewalt

Q2. Have you provided testimony in this proceeding before?

A2. (ALM, MTM, JPD, LMA, DOB, LWV, RP, VRV, KRQ, LKB)Yes, we provided testimony in the "NRC Staff Testimony Of Mallecia A. Sutton, Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg Concerning Contention 4A" ("Staff Testimony"). In the Staff Testimony we described our experience and qualifications in Answers 1-3 of the Staff's, and our Statements of Professional Qualification were submitted as exhibits NRC002 through NRC012.

(GLS) No, I have not previously provided testimony in this proceeding.

Q3. Dr. Stirewalt, please state your name occupation and by whom you are employed.

A3. (GLS) My name is Gerry L. Stirewalt and I am the Senior Geologist in the Geosciences and Geotechnical Engineering Branch of the Division of Site Safety and Environmental Analysis in the Office of New Reactors at the U.S. Nuclear Regulatory Commission.

Q4. Dr. Stirewalt, please describe your responsibilities in relation to this review.

A4. (GLS) I was the lead geologist on NRC's review of the LNP Final Safety Analysis Report (FSAR) and the primary author of Sections 2.5.1 and 2.5.3 of the Safety Evaluation Report (SER).

Q5. Dr, Stirewalt, please describe your professional qualifications as they relate to this testimony.

A5. (GLS) Site characterization results are in question here. I have more than 40 years of experience in surface and subsurface geologic site characterization investigations in a wide variety of geologic and tectonic settings containing a broad range of rock types (i.e., igneous,

metamorphic, and sedimentary). I have worked at the NRC since March 2005, during which time I reviewed FSAR Sections 2.5.1 and 2.5.3 for 9 early site permit (ESP) or combined license (COL) applications. I was the review team lead for the Lee, Summer, and Levy County COLs and the Vogtle ESP. I provided expert witness testimony during hearings both Vogtle and Summer, both of which have been granted COLs. A statement of my professional qualifications is attached as exhibit NRC070.

Q6. Are there any documents you considered in preparing your rebuttal testimony that you did not consider in your direct testimony?

A6. (All) Yes. In addition to documents filed with our direct testimony, we also reviewed the Intervenors' and Applicant's testimony and exhibits. The Intervenors' testimony that we will discuss in this testimony are the corrected versions, filed on July 6, 2012, of the following:

- **"**Initial Pre-Filed Testimony of Tim Hazlett In Support Of Contention C-4 Regarding Environmental Impacts of Levy Units 1 and 2 on Water Resources and Ecology" (Hazlett Testimony).
- "Initial Pre-Filed Testimony of Gareth J. Davies In Support of Contention C-4 Regarding Environmental Impacts of Levy Units 1 And 2 on Water Resources and Ecology" (Davies Testimony).
- "Initial Pre-Filed Testimony of David Still In Support of Intervenors' Contention C4 Regarding Environmental Impacts of Levy Units 1 and 2 on Water Resources and Ecology" (Still Testimony).
- "Initial Pre-Filed Testimony of Dr. Sydney Bacchus In Support of Contention C-4 Regarding Environmental Impacts of Levy Units 1 and 2 on Water Resources and Ecology" (Bacchus Testimony).

We also considered the following documents:

- Excerpts from Scanlon, Bridget R., Robert E. Mace, Michael E. Barrett, and Brian Smith, "Can we simulate regional groundwater flow in a karst system using equivalent porous media models? Case study, Barton Springs Edwards aquifer, USA", *Journal of Hydrology* 276 137–158 (2003) (NRC071).
- Excerpts from Larocque, M., O. Banton, P. Ackerer, and M. Razack, "Determining Karst Transmissivities with Inverse Modeling and an Equivalent Porous Media", *Groundwater*, Vol 37, No. 6 (1999) (NRC072).
- Excerpts from U.S. Army Corps of Engineers Jacksonville District, "Draft Tarmac King Road Limestone Mine Environmental Impact Statement, Volume II (Appendixes A-H)" (May 2012) (NRC073).
- Minutes from the Levy County Planning Commission's April 2, 2012, Meeting (NRC074).
- Excerpts from Renard, Phillipe, Damian Glenz, and Miguel Mejias, "Understanding diagnostic plots for well-test interpretation", *Hydrogeology Journal*, 17, Issue 3, 589 – 600 (2009) (NRC075).
- Application for Combined License for Levy Nuclear Plant, Units 1 and 2, Part 2, Final Safety Analysis Report, Revision 3, portions of section 2.5.1 (2012) (NRC076).
- Excerpts from Easterbrook, Don J., Surface Processes and Landforms, Second Edition, Prentice Hall (1999) (NRC077).
- U.S. NRC, Advanced Final Safety Evaluation Report for Levy County, Units 1 and 2, Portions of Section 2.5.1 (2011) (NRC078).
- Long, A. J., "Benefits of Prescribed Burning" FOR 70. School of Forest Resources and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida (2006) (NRC079).
- U.S. Environmental Protection Agency, "AERMOD: Latest Features and Evaluation Results", EPA-454/R-03-003, (June, 2003) (NRC080).

- Letter from Miles M. Croom, National Marine Fisheries Service, to NRC, Providing Comments on the draft EIS and Essential Fish Habitat (Oct. 26, 2010) (NRC081).

II. DEWATERING RELATED REBUTTAL TESTIMONY

A. GROUNDWATER HYDROLOGY REBUTTAL

1. Groundwater Modeling

Q7. Throughout the Intervenors' testimony, shortcomings of the groundwater models were asserted that the Intervenors contend would preclude use of the models as a suitable tool for predicting how local wetlands will be affected by the proposed groundwater usage at LNP. Do you agree that PEF's groundwater models are not suitable for use in Staff's assessment?

A7. (VRV, DOB, LWV, RP) The Staff agree that model results alone are not suitable for making a definitive prediction of wetlands impacts. As stated several times in the Staff Testimony, given the complex site hydrologic conditions, including natural annual variability in recharge and groundwater level, model parameter uncertainties, and the relatively small water-level changes that have been shown in the literature to result in wetlands impacts, the Staff determined that the groundwater model alone was not sufficient for supporting a definitive assessment of the impacts on wetlands, and thus it was not the sole basis of the Staff's assessment. NRC001A at 2-29; Staff Testimony at A38, A42, A44, and A45. This determination is consistent with the State of Florida's groundwater-use permitting process that uses the model as a scoping-level assessment tool but relies on a State-mandated environmental monitoring program and mitigation plan to ensure no adverse impacts on wetlands. NRC001A at 2-29; Staff Testimony at A38, A42, A44, and A45. The Staff used results from the groundwater models, along with simplified volumetric calculations, to 1) assess whether the Applicant's proposed groundwater usage was plausible given the current understanding of site geohydrologic

conditions and 2) evaluate the magnitude of the proposed groundwater usage in relation to the local-scale hydrologic water balance. Staff Testimony at A44.

Q8. Are there any modifications or improvements that could have been made to the model that would allow the Staff to use it as the sole basis of its assessment?

A8. (VRV, DOB, LWV, RP) No. In addition to the model recalibration that the Staff requested in a RAI request to PEF, there are many other alternative conceptual models that one could have evaluated, including those involving increased model complexity and spatial/temporal variability. Staff Testimony at A31-35. However, evaluation of these alternative conceptual models would not change Staff's determination that the model is not a suitable tool for providing a definitive estimate of wetlands impacts and that adoption of a monitoring and adaptive management strategy for minimizing and mitigating wetlands impacts is prudent and is consistent with the approach taken by the Staff in this case.

Q9. Were there any groundwater model deficiencies identified by the Intervenors?

A9. (VRV, DOB, LWV, RP) Yes. The Intervenors alleged many groundwater model implementation deficiencies throughout their testimony, most of which can be lumped into two general categories: 1) use of an equivalent porous medium modeling approach, and 2) failure to incorporate additional hydrologic complexity. Models that utilize an equivalent porous medium approach assume a continuum of porous media instead of discrete fracture or dissolution channel networks within a porous matrix, which are commonly referred to as dual-porosity models. In an equivalent porous medium model, the hydraulic properties are assigned to be equivalent to the composite properties of the dual porosity system. Following are specific examples of Intervenor allegations and the associated Staff response.

Equivalent porous medium versus discrete fracture or dual porosity-based approach

Q10. In Mr. Davies' testimony at A.3, he states that "the FEIS does not adequately recognize that most of the flow in this area goes through preferential path-ways not through a porous medium." He further states that "[b]ecause these flow paths are currently unknown I do not believe that it is possible to rely upon the predictions in the FEIS that are based upon the assumption that the aquifers behave as though the flow travels evenly through the porous medium." At A.10 he states that a porous medium model would not be appropriate for simulating groundwater flow in the vicinity of the proposed LNP. Does Staff agree with these statements?

A10. (VRV, DOB, LWV, RP) No. This topic was discussed in detail in the Staff's Testimony at A33, A41, A42, A91, A145, and A151. The Staff does not dispute that preferential flowpaths are likely to exist within the Upper Floridan Aquifer (UFA). However, as indicated in Staff Testimony at A41, large interconnected and laterally extensive fracture networks and/or dissolution channels are not indicated for this portion of Levy County, and are not supported by site specific information. Equivalent porous-medium-based groundwater models can be used to simulate dual porosity systems, including the relatively extreme case represented by a well-developed karst system when applied at the appropriate scale (i.e., much larger than the scale/lateral extent of fractures and/or dissolution features). This is the approach adopted by the Southwest Florida Water Management District (SWFWMD) in their DWRM2 groundwater model and is a standard industry practice as described in the following published literature. NRC071 at 137-140, 155-156; NRC072 at 897, 902-903. Attempts to model discrete fractures or dissolution features (or networks of these features), in anything other than a stochastic sense (i.e., evaluation of a large number of randomly generated synthetic fracture/channel networks),

is technically infeasible over the distances encompassed by PEF's model domain. This is because, in order to develop realistic representations of the location, orientation, and hydrologic behavior of fracture/channel networks, one would need a high density of test wells in which aquifer tests are conducted to identify discrete preferential flow zones within each well as well as interwell tracer tests to determine connectivity. Because identifying, characterizing, and modeling discrete fractures or fracture networks would be a large effort that would result in an insignificant reduction in prediction uncertainty; such detailed modeling is uncommon except at a single well to small wellfield scale. As a result, characterization data are seldom available, and in this case not available, to support development of such a model.

As indicated in Staff Testimony at A44, given the complex site hydrologic conditions, including natural annual variability in recharge and groundwater level, model parameter uncertainties, and the relatively small water-level changes that have been shown in the literature to result in wetlands impacts, the Staff determined that the groundwater model alone was not sufficient for supporting a definitive assessment of the impacts on wetlands, and thus it was not the sole basis of the Staff's assessment. Although incorporation of discrete, high permeability channel features into a numerical model may result in a predicted increase in wetlands impacts, this in no way alters the Staff's position that the model alone would not be sufficient for supporting a definitive assessment of the impacts on wetlands, and thus inclusion of discrete preferential pathways as one of the evaluated conceptual models would not change the Staff's impact determination, which relied only in part on the model, and also on the requirements in the Florida Department of Environmental Protection (FDEP) Conditions of Certification (COC).

Q11. In Mr. Davies' testimony at A.3, he recommends "mapping of some of the major preferential flowpaths and use of a model that is more physically realistic" and makes a related recommendation regarding tracing experiments using fluorescent dyes at A.14. Mr. Still also mentions the need to map preferential flow paths at A.3. In Dr. Hazlett's testimony at A.5, he states that there "was not sufficient data available to allow accurate

calibration of the model" and he recommends running dye tracer studies. Does Staff agree with these statements?

A11. (VRV, DOB, LWV, RP) No. The amount of data collected by the Applicant was sufficient to meet the requirements of the SCA process, and these data were the site specific data available to the Staff to support its assessment. The FEIS accounts for the known geology of the region and the connection of the wetlands in the region to the Floridan aquifer. NRC001A at 4-31 to 4-35; 5-26 to 5-31. The potential for occurrence of preferential flowpaths beneath and immediately downgradient of the LNP site related to fractures and karst dissolution channeling is plausible and was considered in the Staff's assessment. These types of heterogeneous flow features do occur in limestone and other fractured bedrock aquifers and have been demonstrated over large portions of Florida. However, the relative impact of any formational heterogeneity on groundwater flow is related to the scale and interconnectivity of these feature(s). As indicated in Staff Testimony at A41, although the Upper Floridan aquifer in this area is productive, estimated transmissivities fall well below those that would be indicative of a well-developed karst system and thus, laterally extensive interconnected preferential flowpaths are not expected. Neither the U.S. Geological Survey (USGS) nor SWFWMD hydrogeologic interpretations indicate the presence of large-scale preferential flowpaths in the vicinity of the LNP site. Staff Testimony at A41. The wetlands may therefore not be as responsive to groundwater impacts as would be expected in well-developed karst systems containing large-scale fracture networks and/or dissolution channels in direct hydraulic connection with overlying wetlands. If springs or large-scale dissolution channels where conduit-dominated flow was known or expected to occur were present beneath the LNP site, the recommended tracing methods might be appropriate. However, given that no onsite sinkholes or large-scale preferential flow features have been identified, it is unclear how the recommended tracing experiments could be implemented under these site conditions. Based on this conceptual

understanding, available site specific characterization data was sufficient for Staff to make its determination,

Q12. In Mr. Davies' testimony at A.12, he states that results from hydraulic tests conducted by the Applicant "are only useful indicators of the properties of aquifers if those properties are relatively uniform, as is assumed for ideal porous media." Does Staff agree with this statement?

A12. (VRV, DOB, LWV, RP) No. Very few hydrogeologic settings are truly homogeneous in nature, even in unconsolidated porous medium aquifers. Although analytical well function models, like those used by the Applicant to analyze hydraulic test response data, all assume laterally homogeneous subsurface properties and infinitely extending aquifer domain, these well functions are routinely used to analyze hydraulic test response data under non-ideal test conditions. Analytical solutions have also been developed for dual porosity systems containing preferential flowpaths that dominate the test response, and diagnostic techniques are available to help identify when fracture/channel type flow is occurring. NRC075 at 1-3. Observed hydraulic test responses from hydraulic tests conducted at the LNP site did show spatial variability that would be indicative of formational heterogeneity but they were not consistent with a system dominated by fracture/dissolution channel flow. Therefore, the results from the Applicant's hydraulic tests were useful indicators for the Staff.

Q13. In Mr. Davies' testimony at A.12, he states "[o]ther indications that a porous medium was assumed are the numerous references to a single value hydraulic conductivity and transmissivity for each aquifer. Examples where these parameters are used as evidence in the FEIS are on page 2-26 where it somewhat confusingly states…." Does Staff agree with this statement?

A13. (VRV, DOB, LWV, RP) Mr. Davies' statement in A.12 of his testimony is confusing. An equivalent porous medium concept was used by the Applicant in its modeling effort, which is the modeling approach adopted by SWFWMD and FDEP for their water use permitting and Site Certification Application. It is unclear what Mr. Davies is referring to when he states "numerous references to a single value hydraulic conductivity and transmissivity for each aquifer." The Applicant's groundwater model incorporates a wide range of hydraulic conductivity and transmissivity values which were extracted from SWFWMD's regional model (DWRM2). PEF210 at 24, 26. Regarding Mr. Davies' apparent confusion on reported hydraulic conductivity values, as stated in the FEIS, the first cited range (15 to 20 ft/d) was the range specified in the Applicant's model within the boundary of the LNP site, the remaining hydraulic conductivity and transmissivity ranges were site specific hydraulic property estimates obtained from hydraulic tests. NRC001A at 2-26.

Q14. In Dr. Bacchus' testimony at A.15, she states that the FEIS "…fails to consider the periodic nature of water in the LNP environment." In Dr. Hazlett's testimony at A.7, he states that "recalibration is insufficient for an accurate modeling of the area because it does not address the seasonal or long term temporal variability in the natural system." Does Staff agree with these statements?

A14. (VRV, DOB, LWV, RP) No. The hydrologic assessment presented in the FEIS considers temporal variability in surface recharge and groundwater-level, it just does not attempt to model this complex behavior. Fitting the temporally and spatially variable water-levels over the spatial extent of the local-scale model, or even just within the boundary of the LNP site, would represent a technically challenging inverse problem. There is no guarantee that a reasonable fit to available site data, let alone historic trends, would be obtained. Even if an effective model calibration was realized, this more complex model still would not be a suitable tool for providing a definitive assessment of wetlands impacts for the same reasons listed in A7

above, especially given that hydraulic properties in the vicinity of the proposed wellfield have not been characterized and thus are relatively uncertain.

The Staff's analyses related to surface water also consider the variability of water in the LNP environment. For example, the Staff considered temporal variations of flow components (from diurnal to seasonal scales) in the hydrologic characterization of the Cross Florida Barge Canal (CFBC)-Old Withlacoochee River (OWR) system. NRC001A at 5-10 to 5-14. The Staff also consider the temporal variations (interannual to monthly to daily) in rainfall near the LNP site in estimation of runoff salinity. NRC001A at 5-24; Staff Testimony at A198-200.

Q15. In Dr. Hazlett's testimony at A.3, he states that the "model has serious shortcomings because . . . it omitted salinity interactions with the nearby barge canal." He also makes a similar statement at A.7. Does Staff agree with this statement?

A15. (VRV, DOB, LWV, RP) No. The model was not used as the sole basis of the Staff's assessment. However, as explained in the Staff Testimony at A44, results from the groundwater models were used, along with simplified volumetric calculations, to 1) assess whether the Applicant's proposed groundwater usage was plausible given the current understanding of site geohydrologic conditions, and 2) evaluate the magnitude of the proposed groundwater usage in relation to the local-scale hydrologic water balance. Staff Testimony at A44. Incorporation of the subject salinity interactions into the model, which is not required by SWFWMD as a part of their water permitting process, was not evaluated. As a result, model predictions of salinity interactions are not available.

While groundwater withdrawals from the Upper Floridan aquifer have the potential to lower potentiometric surfaces and induce saltwater intrusion, as indicated in Staff Testimony at A158, due to the relatively small amount of groundwater usage for proposed LNP operations compared to the overall groundwater system water balance, and the relatively small drawdowns predicted for the LNP wellfield (NRC001A at 5-16), lateral saltwater intrusion from the CFBC is

unlikely. Moreover, simulation results indicate that groundwater will continue to discharge to the CFBC (although at a somewhat reduced rate) rather than the canal acting as a recharge boundary for the groundwater system. PEF210 at 28, 40. This groundwater discharge information was sufficient for the Staff to determine that pumping-related saltwater intrusion is unlikely. In addition, a wellfield water-quality monitoring program will be instituted to detect any detrimental impacts, and wellfield operations would be managed to mitigate any significant decreases in water quality. NRC001A at 5-17 to 5-18. Even if the Staff did follow Dr. Hazlett's proposal, and incorporated salinity transport into the model, which would introduce a whole new level of complexity and uncertainty, it would not result in a model capable of providing a definitive assessment of wetlands impact.

Q16. In Dr. Hazlett's testimony at A.11, he states that the impacts of groundwater usage at the Tarmac Mine site "should have been included in the predictive model, but they were not." A similar statement was made by Mr. Still in his testimony at A.25 and in Dr. Bacchus' testimony at A.3 she states that "[t]he FEIS also fails to analyze the cumulative effects of the proposed Tarmac mine, Knight Sand mine, and Adena Ranch on the environmental impacts of the proposed LPN." Dr. Bacchus makes similar statements in her testimony at A.11 and A.47. Does Staff agree with these statements?

A16. (VRV, DOB, LWV, RP) No. As indicated in Staff's testimony at A44, the determination that LNP groundwater usage is small (1.58 Mgd of 208 Mgd or 0.8 percent) relative to local-area groundwater flux is based on modeled and simplified volumetric water balance calculations. Proposed groundwater usage at Tarmac is estimated in the draft Tarmac EIS to be approximately 0.34 Mgd (NRC073 at 13) or approximately 20 percent of proposed LNP usage and 0.2 percent of local-area groundwater flux. Because the combined groundwater usage for LNP and Tarmac would still be about 1 percent of the local-area groundwater flux (1.92 Mgd of 208 Mgd), cumulative impacts of this usage would not be expected to be noticeable. Mr. Still

also mentions groundwater usage at Adena Springs Ranch and a proposed sand mine at Knight Farm, which is adjacent to the LNP site. Adena Springs Ranch is located approximately 50 miles northeast of the LNP site and on the other side of a groundwater flow divide (see INT370 at 60), and thus it was not considered in the Staff's assessment.

The only identified information available on the proposed Knight Farm Sand Mine includes: 1) a staff report from the Levy County Development Department documenting Special Exception No. SE 1-12 for a Major Mining Operation at Knight Farm Sand Mine (INT434); and 2) meeting minutes from a April 2, 1012 Levy county Planning commission meeting (INT437) where the board was petitioned for the subject special exception but voted to grant a continuance and no decision was made regarding SE 1-12. NRC074 at 3. The Staff did not assess the Knight Farm Sand Mine in the FEIS. While the Knight Farm Sand Mine was not discussed, its inclusion would not have changed the Staff's analysis because the information provided in the above Levy County Development Department document indicates that 1) the total depth of the excavation would be maintained at least two feet above the seasonal high groundwater elevation (INT434 at 8), and 2) no groundwater usage is planned. INT434 at 15. Even with the explicit inclusion of the Tarmac Mine and the Knight Farm Sand Mine in the groundwater model simulation, the model would still not be a suitable tool for providing a definitive assessment of wetlands impacts. Therefore, the Staff's approach of using both the model predictions and the FDEP COCs was reasonable.

Q17. In Dr. Hazlett's testimony at A.3, he states that "the first attempt at using the model failed because it did not meet the required calibration criteria." Does Staff agree with this statement?

A17. (VRV, DOB, LWV, RP) No. As indicated in the Staff's Testimony at A38, SWFWMD and FDEP granted a groundwater usage permit, with attached conditions of certification, as part

of the State of Florida's Site Certification Application ("SCA") process that was based on the Applicant's original model. Staff requested the recalibrated model to provide some indication as to the model's sensitivity to changes in the distribution of transmissivity values (and/or boundary condition changes) sufficient to better match observed water-levels in the vicinity of the LNP site.

Q18. In Dr. Hazlett's testimony at A.3, he states that "…the model has serious shortcomings because it cannot predict how changes will occur over time,..." Does the Staff agree with this statement?

A18. (VRV, DOB, LWV, RP) No. Although the model was calibrated under steady state conditions, and annual average values were used for boundary head elevations and surface recharge, forward predictions were made in the transient mode (i.e., the model was run to simulate aquifer conditions over time), which allows the model to determine how the extent of drawdown develops around the points of withdrawal (i.e., pumping wells) over time.

Q19. In Dr. Hazlett's testimony at A.3, he states that the model "assumes that the aquifers themselves are uniform." Does the Staff agree with this statement?

A19. (VRV, DOB, LWV, RP) No. Although the Applicant's groundwater model adopts an equivalent porous medium approach and thus does not attempt to model discrete, conduit dominated flow (which have not been indicated based on regional and site specific information), the model does incorporate a wide range of hydraulic conductivity and transmissivity values which were extracted from SWFWMD's regional model (DWRM2). PEF210 at 24, 26

Q20. In Dr. Hazlett's testimony at A.4, he states that "[d]ifferences between field-measured values of hydraulic properties and those same values used to eventually calibrate the model are a strong indication that the model is unable to simulate actual field conditions." Does the Staff agree with this statement?

A20. (VRV, DOB, LWV, RP) No. As stated the FEIS:

> There was good agreement in hydraulic property estimates for tests conducted at the proposed LNP Units 1 and 2 locations, with horizontal hydraulic conductivity values for the Upper Floridan aquifer ranging from 120 to 130 ft/d and transmissivity values ranging from 62,000 to 69,000 ft2/d (PEF 2009d). Comparison of these transmissivity estimates with values specified in a recalibrated version of the DWRM2 groundwater flow model (see model development discussion below) at this location (7900 to 250,000 ft2/d) confirms that values derived from hydraulic tests conducted at the LNP site fall within the range specified in the model. Results for the surficial aquifer indicate that, as expected, this aquifer is much less permeable than the Upper Floridan aquifer, with estimated horizontal and vertical hydraulic conductivity values of 13 and 9 ft/d, respectively. Comparison of these hydraulic conductivity estimates with horizontal hydraulic conductivity values specified in the recalibrated DWRM2 groundwater flow model (PEF 2009f) at this location (0.7 to 85 ft/d) confirms that values derived from hydraulic tests conducted at the LNP site fall within the range specified in the model."

NRC001A at 2-28.

Q21. In Dr. Hazlett's testimony at A.6, he comments on the large variation in hydraulic conductivities and transmissivities used in the model(s) and states that "[t]he high end of this range, for Florida, indicates karst conduit flow." Does the Staff agree with this statement?

A21. (VRV, DOB, LWV, RP) The Staff agrees that the high end of this range is consistent with the potential for well-developed karst conditions. However, the cited range in hydraulic conductivity and transmissivity are for the full spatial extent of the local-scale model domain (approximately 20 x 20 miles). The closest location where these high permeability conditions are indicated is south of Lake Rousseau, approximately 6 mi south of the southern boundary of the LNP southern parcel, with the largest area of high permeability located even further south. PEF210 at 26. There is no evidence for well-developed karst containing large-scale preferential flowpaths in the immediate vicinity of the LNP site.

Q22. In Dr. Hazlett's testimony at A.8, he states that the model provides poor constraint on SAS [Surficial Aquifer System] impacts from upper FAS [Floridan Aquifer System] drawdowns. Does Staff agree with this statement?

A22. (VRV, DOB, LWV, RP) No. As indicated in the FEIS, "[a]lthough no regional maps of the surficial aquifer phreatic surface appear to be available, the surficial aquifer is thin (approximately 50 ft in the vicinity of the LNP site) and is hydraulically connected to the Upper Floridan aquifer." NRC001A at 2-27. The FEIS also states that "[d]uring the March 2007 high water-table conditions, monitoring data from nested wells at the proposed LNP Units 1 and 2 locations indicate a slightly higher hydraulic head (0.03 to 0.57 ft) within the surficial aquifer than in the bedrock aquifer, indicating a slight downward vertical gradient. During lower recharge periods, the water table drops by as much as 5 ft and the horizontal gradient flattens across the LNP site. Nested wells at the LNP Units 1 and 2 locations continued to show slightly higher hydraulic head within the surficial aquifer when compared with the bedrock aquifer. The direction (always downward) and magnitude of vertical gradients measured between the surficial and bedrock aquifers remained relatively constant throughout the monitoring period." Id. at 2-28.

Q23. Both Mr. Davies and Dr. Bacchus make statements regarding the potential impact of groundwater use by LNP. In Mr. Davies' testimony at A.18, he states that "withdrawal of groundwater for consumption upgradient of any coastal area can encourage saline intrusion inland . . ." In Dr. Bacchus' testimony at A.12 she states that ". . . PEF proposes removing significant amounts of water . . . ," and at A.16 she states that "400,000 gpd is a significant volume . . ." that would result in a reduction in discharge to the Lower Withlacoochee River and Lake Rousseau watersheds. Does Staff agree with these statements?

A23. (VRV, DOB, LWV, RP) In general terms, the Staff agrees that the removal of "significant amounts of water" could affect hydrological resources. However, the degree of impact is relative to the amount of water that is available. In the Staff's Testimony at A44, regional groundwater extraction by LNP, all currently permitted users, and projected future

users, were considered in Staff's assessment. Modeled and simplified volumetric water balance calculations indicate that LNP usage is small relative to the regional and local-scale groundwater flux. The LNP groundwater withdrawal during operations, 1.58 Mgd, is 0.8 percent of the total regional water flux of 208 Mgd passing through the local-scale model domain. NRC001A at 5-8. The LNP groundwater withdrawals are estimated to decrease the surficial and Upper Floridan discharge to the surface water bodies by approximately 0.4 Mgd or 2 percent of the groundwater discharge to rivers and lakes. Id. As also described in A44 of the Staff's Testimony, the Staff performed simplified calculations to corroborate the model water balance calculations. The simplified calculations were based on surface recharge estimates extracted from the regional DWRM2 model. These surface recharge values were multiplied by land surface area to compute a volumetric rate, which was then compared with the proposed LNP groundwater usage. These calculations show that surface recharge from rainfall (4 to 9 in./yr) from within the footprint of the LNP site boundary (3105 acres) would result in an annual average groundwater recharge rate of 0.9 to 2.0 Mgd, or approximately 57 to 126 percent of the proposed LNP usage. If the southern LNP property where the wellfield is to be located is included in the calculation (total area of about 4,900 acres), the recharge estimate would increase to between 1.4 and 3.2 Mgd, or between approximately 89 and 200 percent of the proposed LNP usage. Staff Testimony at A44. As discussed in the FEIS and Staff's Rebuttal Testimony above, due to the relatively small amount of groundwater usage and other factors such as small predicted drawdowns at the LNP wellfield, the distance from sources of saline water (CFBC, deeper aquifers and the Gulf) and low permeability of confining units within the Floridan aquifer, saltwater intrusion is not likely. NRC001A at 5-16; Staff Rebuttal Testimony at A15.

With regard to discharges to the Lower Withlacoochee River and Lake Rousseau watersheds, the reduction of 0.4 Mgd in groundwater discharge is minor relative to the 37-year

recorded average daily discharge of 687 Mgd through the bypass channel to the lower Withlacoochee River. NRC001A at 5-8. The reduction of 0.4 Mgd is only 0.06 percent of the average daily discharge and is therefore unnoticeable.

Q24. In Mr. Still's testimony at A.25, he states that the FEIS determines current groundwater usage by "looking at the number of well permits (which are also known as Consumptive Use Permits- CUPs). There was no attempt to do a spatial analysis of where these uses occurred." Does Staff agree with this statement?

A24. (VRV, DOB, LWV, RP) No. As indicated in the FEIS, groundwater usage of all currently permitted users is included in the model, which takes into account the spatial location of these users. Id. at 2-33.

2. Karst and Preferential Pathways

Q25. Do you agree that characterization data and research, such as that performed by the Florida Geological Survey (FGS), has indicated that the "whole area including the LNP site is a karst terrain" as indicated on page 9 of Davies' testimony?

A25. (GLS, VRV, DOB, LWV, RP) No. While there are karst related-features in the vicinity of the site, the Staff disagrees that the aquifer system in the LNP site is a well-developed, interconnected karst system with conduits capable of significantly enhancing groundwater flow rates and volumes. As discussed in the FSAR, Florida Geological Survey scientists Sinclair and Stewart show the LNP site to be located in a region where limestone is bare or thinly covered and sinkholes are few, generally shallow, broad, and developed gradually. NRC076 at Figure 2.5.1-237. While there are karst features, deep collapse sinkholes and subsurface voids and caverns are not indicted by Sinclair and Stewart or by characterization data from the site location. Field observation and data reveal shallow, broad, surficial dissolution features that host cypress swamps (wetlands) in the site area. As pointed out in Section 2.5.1.2.1.3.2.1 of

the FSAR, such shallow dissolution features are floored by silts and clays that seal the subsurface from further infiltration of ground water, actually leading to formation of wetland areas. NRC076 at 2.5-73. That is, the wetlands themselves indicate a lack of connectivity with the subsurface.

Q26. In Mr. Davies' testimony he states that "carbonate rocks underlie the LNP site . . . Carbonate rocks are readily soluble . . ." (A.4) and that because of this "most flow in this area goes through preferential path-ways" created by dissolution of these carbonate rocks. Davies Testimont at A3. Does the Staff agree with these statements?

A26. (GLS, VRV, DOB, LWV, RP) No. Staff disagrees with the premise of this testimony, which is that because the site is underlain by carbonate rocks, which are prone to dissolution and formation of karst features, the aquifers within this carbonate rock must also contain a well developed karst system of interconnected conduits and caverns that greatly increase transmissivity (i.e. preferential pathways). Studies by Miller, a retired hydrogeologist for the USGS, cited in Randazzo and Jones 1997 (NRC019 at 85) and the USGS Professional Paper of Miller 1986 (NRC020 at B49, B76) were commonly referenced in the Staff's review to provide a general description of the hydrogeology of Florida, and they indicate that the LNP site does not occur in a region of well-developed karst dissolution features although some of the wetlands at the site location are associated with minor surficial dissolution. NRC001A at 2-25; Staff Testimony at A41. Further, borehole, geophysical, and hydrogeologic data derived from characterization of the LNP site did not reveal the presence of well-developed interconnected karst features (e.g., sinkholes or extensive subsurface dissolution cavities or caverns) at the site. NRC016 at 2.5-97. The Avon Park Formation is the uppermost bedrock unit underlying the LNP site and is comprised of dolomitized limestone [$CaMg(CO_3)_2$]. NRC078 at 2-100. As a result, karst features would develop at a much slower rate than in pure limestone made up of calcium carbonate ($CaCO_3$) because dolomitization is known to decrease the rate of dissolution

and limit void development. A study discussed by Easterbrook documented that about 60 percent $CaCO_3$ is necessary to form karst and around 90 percent may be required to fully develop karst. NRC077 at 194. Samples collected from the Avon Park Formation at the LNP site contained less than 50 percent $CaCO_3$, indicating a high degree of dolomitization that would decrease the rate of dissolution and permeability of the Avon Park and limit the formation of a well-developed karst system. NRC078 at 2-100. As stated in A41 of the Staff's Direct Testimony, although the Upper Floridan aquifer in the vicinity of the LNP site is productive, estimated transmissivities (62,000 to 69,000 ft2/d) fall well below those that are indicative of a well-developed karst system the threshold for which is placed in the 250,000 to 1,000,000 ft2/d range. NRC018 at 14.

Q27. In Mr. Davies' testimony at A.11, he states the following:

> **The FEIS p.2-25 merely says that "some of the wetlands onsite may reflect karst development" and that "few sinkholes occur near the LNP site" and that the "regional transmissivity of the Upper Florida aquifer in the area is less than would be expected for well-developed karst (USGS 2000)." The FSAR, however, contradicts the FEIS by stating that: " Surface morphology and subsurface data indicate that there has been a long period of erosion and karst development in the site location (FSAR Subsection 2.5.1.2.1.3). The LNP site surface morphology is consistent with that of an eroded, older (paleo) karst landscape mantled by several feet to tens of feet of sand (i.e., a mantled epikarst subsurface formed over a denuded karst). (FSAR Rev. 2 p. 2.5-203) (Exhibit INT006).**

Does Staff agree with this statement?

A27. (GLS, VRV, DOB, LWV, RP) The Staff does not agree that the FEIS contradicts the FSAR because both documents acknowledge that dissolution features related to karst development occur. The FSAR also states: "The LNP site stratigraphy and surface morphology are consistent with expected characteristics of a developed paleokarst landscape mantled by several meters of sand (i.e., a mantled epikarst subsurface). NRC016 at 2.5-97. There are no recognized sinkholes in the State of Florida sinkhole database within 2 km(1.28 mi.) of the LNP site (NRC076 at Figure 2.5.1-244), and no deep sinkholes were observed at the land surface

during site investigations and reconnaissance within the LNP site. Shallow dissolution features at the site are floored by silts and clays that limit hydrologic connectivity with the subsurface and result in depressional wetlands. NRC076 at 2.5-73. Examination of core from site borings revealed very few small dissolution voids in the upper 150+ m (500 ft.) of the Avon Park Formation. NRC016 at 2.5-97. Because both documents explain the presence and development of karst features in the region and also address the apparent absence of well-developed karst characteristics near the LNP site (such as sinkholes, connected voids, or high transmissivity) the karst-related discussion provided in the FSAR is consistent with the FEIS.

Q28. In Mr. Davies' testimony at A.11, he states that "[a]lthough the FEIS implies that the karst at the LPN site is not "well-developed," the key properties of the Upper Floridan aquifer in the area are actually very similar to well-known karst areas." He further states that "[t]here is no clear distinction between a well[-]developed karst setting and any other." Davies Testimony at A.11. In Dr. Bacchus' testimony at A.20 she states that "[u]nderlying karst features such as relict sinkholes, fractures, faults, swallets and other karst conduits that can serve as preferential flow paths connecting wetlands in the vicinity of the LNP, have not been considered and accurately identified." Does Staff agree with these statements?

A28. (GLS, VRV, DOB, LWV, RP) No. The Staff's assessment in the FEIS was based on 1) USGS interpretations of regional transmissivity distributions, 2) site specific transmissivity estimates from pumping tests and inspection of core samples collected from the site, and 3) geologic descriptions provided in the FSAR. In situ transmissivity measurements obtained from pumping test provide a means of obtaining a clear indication of extremely high permeability conditions, which can be an indication of large interconnected fracture networks and/or dissolution channels. Although porosity and transmissivity are related, porosity varies over a relatively small range compared with transmissivity, which can range over many orders of

magnitude. Analytical well function models like those used by the Applicant to analyze its hydraulic test response data all assume laterally homogeneous and infinite acting conditions. However, well functions like those used by the Applicant are routinely used to analyze hydraulic test response data under non-ideal test conditions. Analytical solutions have also been developed in the industry for dual porosity systems containing preferential flowpaths that dominate the test response, and diagnostic techniques are available to help identify when fracture/channel type flow is occurring. NRC075. If large-scale karstic features are present in the vicinity of the proposed LNP wellfield location, they should be reflected in the transmissivity estimate obtained during the pump testing program required as part of the COCs. However, as indicated in the answers above, transmissivity data for the site are less than that expected for a well-developed karst system. NRC018 at 14. Also, geologic observations noted depressional wetlands floored by silts and clays that limit hydrologic connectivity with the subsurface (NRC076 at 2.5-73), and very few small dissolution voids were found in the upper 150+ m (500 ft.) of the Avon Park Formation. NRC016 at 2.5-97. Furthermore, chemical evaluation of the Avon Park Formation onsite indicates a high degree of dolomitization, which decreases rate of dissolution and permeability. NRC078 at 2-100. These factors indicate that a well-developed karst system of interconnected subsurface conduits does not exist in the groundwater system at the site.

Q29. In Mr. Davies' testimony at A.11, he states that "Levy County and the LNP site are within an area described in many published documents as being karst (the Ocala Karst Plain or District) . . . ." Does Staff agree with this statement?

A29. (GLS, VRV, DOB, LWV, RP) When considered on a regional basis, yes. However, the Ocala Limestone is not present beneath the LNP site; the uppermost carbonate formation is the Avon Park and it is overlain by 10's of feet of surficial sediments. NRC016 at 2.5-97. Miller (NRC020) refers to the Avon Park as a dolomitized limestone, which is less susceptible to

dissolution channeling than where pure calcium carbonate limestone is present (e.g., the Ocala formation), as discussed above in A26.

Q30. Do you agree with Dr. Bacchus' testimony at A.21 that ". . . Vernon (1951, Exhibit INT369), and Faulkner (1973, Exhibit INT370) identified linear features representative of fractures and faults that coincide with the proposed LNP and surrounding vicinity of the proposed LNP, as shown in my Figures 1 through 4 and described in the accompanying description of those figures?"

A30. (GLS, VRV, DOB, LWV, RP) While Vernon (1951) and Faulkner (1973) did identify lineaments, no evidence exists to equate all lineaments with faults even if they may represent fractures. The Staff's Advanced Final Safety Evaluation Report (AFSER) discusses more current Florida Geologic Survey (FGS) interpretations that did not show any data documenting the presence of surface or subsurface faults in the site vicinity. NRC078 at 2-97. Site characterization data discussed in AFSER Section 2.5.1.4.2.5.1 indicated that karst features, including dissolution-enlarged fractures capable of enhancing groundwater flow, do not exist at the site location. Id. at 2-98. The density of identified linear features is generally consistent with the USGS interpretation of regional transmissivity distribution (NRC018 at 14) which, through comparison with the cited exhibits, shows the highest transmissivity values do reside within some of the areas where increased density of linear features have been identified. Although the Upper Floridan aquifer in the vicinity of the LNP site is productive, estimated transmissivities throughout this portion of Levy County (50,000 to 100,000 ft2/d), fall well below those that would be indicative of a well-developed karst system, the transmissivity threshold for which is placed in the 250,000 to 1,000,000 ft2/d range. NRC018 at 14. The density of identified linear features in the cited Intervenor exhibits is generally consistent with this transmissivity distribution, showing a lower density in the vicinity of the LNP site. The Staff used more recent studies than those identified by Dr. Bacchus to characterize the nature of the linear features identified near the site

and their potential affect on the groundwater system and the observations in these studies are supported by site characterization data.

Q31. Dr. Bacchus at A.25 states that karst features, and the associated preferential pathways for groundwater flow, will extend the adverse effects of dewatering over a greater area than if no preferential pathways existed. Does the Staff agree with this statement?

A31. (GLS, VRV, DOB, LWV, RP) The Staff does not agree that this conceptual model would result in a more conservative prediction of wetlands impacts. As discussed in Staff Testimony at A33, preferential flowpaths associated with fractures and dissolution channels would represent a conservative conceptual model from a pathways analysis standpoint, which is conducted as part of the safety review. However, this type of high permeability aquifer system may not provide a conservative assessment of wetlands impacts because the highly transmissive aquifer conditions would result in a smaller overall radial extent of groundwater drawdowns of sufficient magnitude to impact wetlands. It should be noted that, although no large-scale preferential flow features are thought to exist at the LNP site, groundwater usage in formations containing preferential flowpaths can result in larger impacts to portions of the wetland system if large-scale fracture networks or dissolution channels are in direct hydraulic connection with a wetland feature.

Q32. Dr. Bacchus presents a conceptual model of pond-cypress wetlands in her testimony at A.12 referencing Exhibit INT359 and raised concerns about preferential flow between UFA and depressional wetlands resulting in increased impacts to wetlands in A.22. Is this conceptual model consistent with that adopted by the Staff and was it considered in their assessment?

A32. (GLS, VRV, DOB, LWV, RP) Yes. While the Staff acknowledges that a localized increase in hydraulic connection between the UFA and wetlands in these depressional wetlands areas is possible, Staff disagrees that such depressions are indicative of a well-developed, interconnected karst system with conduits capable of increasing impacts to wetlands in the site vicinity. Exhibit INT359 includes two representative geologic cross sections of depressional pond-cypress wetlands in west-central Florida, showing infilling of relict karstic features with fine sands, silts, and clays. INT359 at 509. This conceptual model is consistent with that adopted by Staff in its assessment because it is characteristic of the type of solution features which were found to be most common in the LNP site area. NRC076 at 2.5-73 and Figure 2.5.1-237. This infilling likely limits infiltration and indicates a lack of significant connectivity with the Avon Park Formation of the UFA which was found to have very few small dissolution voids as discussed in A25 and A28 above. This is inconsistent with Intervenor testimony regarding conduit-type preferential flow providing a direct hydraulic connection between the UFA and wetlands. Therefore, while Dr. Bacchus' conceptual model presented in her testimony at A.12 does not contradict the Staff's assessment, and a localized increase in hydraulic connectivity between the UFA and wetlands could occur, site studies indicate that wetlands like those in INT359, should not be equated with preferential flow in well-developed karst in the vicinity of the site.

3. Other General Inaccuracies or Misconceptions Related to Groundwater Testimony

Q33. Dr. Bacchus at A.40 and Mr. Still at A.4 express concerns about a fifth permitted water supply well regarding 1) the location of this well and 2) that the FEIS does not address the adverse and cumulative impacts of groundwater usage from this well. Is the identified well permitted as a water supply well and does it represent an increase in groundwater usage not accounted for in the FEIS?

A33. (VRV, DOB, LWV, RP) No. As indicated in PEF005A at 41, the additional well is permitted as a temporary construction well to provide for construction-related groundwater usage and would not be permitted as a permanent production well. Inclusion of this temporary well in the permit does not increase the total allowable groundwater usage over that accounted for in the FEIS.

~~**Q34. In Mr. Still's testimony at A.16, he contends that the FEIS does not adequately analyze alternatives for fresh water supply. Does Staff agree with this statement?**~~

~~A34. (VRV, DOB, LWV, RP) No. The FEIS identifies possible alternative water supplies (NRC001B at 9-249 to 250) and, if the COC-required monitoring programs indicate that any adverse impacts to wetlands are occurring, PEF would be required to mitigate the impact through changes in groundwater usage and/or development of an alternative water supply. Mr. Still does acknowledge in subsequent testimony that some alternatives were considered on page 9-249 of the FEIS. Still Testimony at A.16.~~

Q35. In Mr. Still's testimony at A.16, he states that "[t]he bibliography on FEIS page 2-217 indicates that the SRWMD [Suwannee River Water Management District] Water Supply Assessment was accessed on June 23, 2011, and also on FEIS p. 2-148, it admits using "[e]stimates from the two water districts for 1985–1990." In 2011, the current 2010 Water Supply Assessment was also available for use and that data should have been used because by the time the FEIS was issued, the 1990 data were obsolete." Does Staff agree with this statement?

A35. (VRV, DOB, LWV, RP) No. As explained in FEIS Sections 2.3.2.2 (NRC001A at 2-21) and 2.5.2.6 (id. at 2-148) the data mentioned by Mr. Still was used along with more recent data to support the Staff's hydrological assessments. A discussion of district-wide current and projected future groundwater usage is provided in Section 7.2.1.2 of the FEIS. Id. at 7-14. A

related discussion of estimated baseline and projected groundwater usage within the footprint of the local-scale groundwater model is discussed in Section 2.3.2.2 of the FEIS. Id. at 2-31. Current groundwater use near the LNP site was identified in three ways: using the SWFWMD and SRWMD well permitting database, using the FDEP's Source Water Assessment and Protection Program database, and performing a land-use survey. PEF used these data sources to define baseline (i.e., pre-construction) conditions and provide a basis for making predictions of future usage. Based on these data sources, groundwater use by all permitted users within the boundary of the local-scale groundwater flow model was specified as 3.51 Mgd in 2001. Id. The 2001 data were selected to represent baseline conditions so that PEF-collected monitoring data fell within the simulated period. Projected future groundwater use by all permitted users within the boundary of the local-scale groundwater flow model was also estimated by PEF based on population projections from the 2000 U.S. Census. This approach assumes that increases in permitted groundwater usage will be proportional to increases in population. Between 2001 and 2078, which is the anticipated LNP closure date (assuming startup in 2018, and 60 years of operation), the population increase was projected to be 293 percent. Given this population increase, projected future usage (not including the proposed LNP) would be expected to increase from 3.51 Mgd to 10.3 Mgd." Id. The Staff did not base its assessment on the 2001 data alone, but on projected usage through 2078.

Q36. In Mr. Still's testimony at A.25, he states that "the FEIS does not address the regional nature of Florida surface and groundwater . . . ." Does Staff agree with this statement?

A36. (VRV, DOB, LWV, RP) No. Staff's groundwater assessment took into account the regional hydrologic system and was based in part on a local-scale (i.e., approximately 20 X 20 miles) model developed by PEF, which is a submodel of SWFWMD's district wide (i.e., regional) model. Staff Testimony at A45. The district wide model incorporated data and parameters from

the regional hydrologic system, including the regional nature of surface and groundwater flow, and hydrologic basin boundaries. Since the Staff's analysis was performed on a recalibrated sub-model developed by PEF, the regional characteristics were considered in the Staff's assessment.

B. SURFACE-WATER HYDROLOGY REBUTTAL

Q37. Do you agree with Dr. Bacchus' description of freshwater springs along the Withlacoochee Canal in her testimony at A.17 and her assertion at A.18 that "[t]he locations of the springs that I identified along the Withlacoochee Canal are shown as blue triangles, in discharging along the Withlacoochee Canal to cease flowing?"

A37. (RP, VRV, DOB, LWV) Dr. Bacchus states that she identified locations of freshwater springs along the Withlacoochee Canal. The Staff does not have access to this data nor to any description to ascertain the quality and reliability of this data. From a preliminary inspection of the figure Dr. Bacchus references, it seems that these locations are along the south bank of the CFBC. Dr. Bacchus does not provide any qualitative or quantitative basis for her conclusion that these alleged springs would cease flowing. The location of the springs Dr. Bacchus refers to, on the south side of the CFBC, would indicate that they would likely be more strongly affected by Lake Rousseau and the OWR than by LNP groundwater usage.

Q38. What is your assessment of salinity data that Dr. Bacchus collected and described in her testimony at A.42? Does this data indicate "a complex, anisotropic karst aquifer system" as Dr. Bacchus claims?

A38. (VRV, DOB, LWV, RP) Dr. Bacchus does not cite an exhibit number (either in her original direct testimony or in her corrected direct testimony) for the salinity data that she collected in January 2012. The Staff's review of the Intervenors' exhibits seems to indicate that she is referring to Intervenors' Exhibit INT343, not the INT419 that is referenced in the

paragraph immediately preceding the paragraph where the salinity data is described in Dr. Bacchus' testimony at A.42. The Staff does not have access to this data nor to any description to ascertain the quality and reliability of this data. The Staff is also unable to evaluate how the data were collected and what impacts sampling network design or collection methodologies had on measured salinity values.

It appears that Dr. Bacchus, based on the distribution of salinity values along the approximately "S" shape of the sampling locations, concludes that saline water intrusion from the Gulf of Mexico occurs along karstic preferential pathways. Based on the Staff's limited review of these salinity data, there is no indication that salinity values signify the presence of conduit-dominated preferential flow extending between the gulf and the LNP site. On the middle and southern portions of the "S" shape, salinity values decrease as the sampling points move farther inland as indicated by red indicators (24.01-30 ppt) changing to orange (21.01-24 ppt) to light blue (5.01-14 ppt) and dark blue (0.01-5 ppt). INT343. There is some heterogeneity in the salinity distribution along the "S" shape, but that does not indicate clearly that saline water pushes in through karstic preferential pathways—if that were the case, reds and oranges would occur in a linear or curvilinear pattern extending inland from the Gulf of Mexico. Id. The salinity distribution in Dr. Bacchus' data can also be explained by heterogeneity of subsurface characteristics. On the far north end of the "S" shape, there is a curvilinear pattern evident along the orange and green crosses. Id. However, it appears that these sampling locations are along a stream which may be influencing the salinity in the subsurface. In absence of detailed maps of these sampling locations and collection methodologies, the Staff is unable to make an accurate assessment. However, the salinity data alone, presented by Dr. Bacchus in her testimony at A.42, does not indicate saline water intrusion along karstic preferential pathways. Further, borehole, geophysical, and hydrogeologic data derived from characterization of the LNP site as well as independent studies (all of which are discussed in A25 through A32 above) did not reveal the presence of well-developed interconnected karst features (e.g., sinkholes or

extensive subsurface dissolution cavities or caverns) which would create preferential pathways at and near the site.

1. Responses to Intervenors' general hydrology-related testimony

Q39. Do you agree with Dr. Bacchus' testimony at A.16 that the FSAR contradicts the surface runoff description in the FEIS?

A39. (RP, DOB, LWV, VRV) No. Portions of the LNP site are located in Spring Run, Direct Runoff to Gulf, and Withlacoochee River Basin. NRC001A at 2-18, Figure 2-8. The FEIS states that runoff from the site generally drains to the southwest toward the lower Withlacoochee River and the Gulf of Mexico. Id. at 2-22. Therefore, currently, the surface runoff from the LNP site does contribute to the three drainage areas although the relative contributions to the three drainages may not be substantial. The FSAR states that the general direction of overland flow is to the southwest toward the lower Withlacoochee River and the Gulf of Mexico. INT365 at 2.4.2-3. The FSAR statement that Dr. Bacchus cites is describing the post-construction conditions when the LNP facilities including the stormwater management system would be in place. Id. The FSAR statement is also referring to flood conditions when the stormwater system may be blocked because of debris carried with large floods. In this scenario, the stormwater overflowing the ponds would release on the floodplain and would contribute to the three drainages as they do now. Therefore, there is no contradiction between the FEIS and the FSAR regarding surface runoff near the LNP site.

Q40. Do you agree with Dr. Bacchus' testimony at A.16 that "[t]hese excerpts from the FEIS confirm that during low flow periods, more than 122 Mgd (190 cfs) of fresh water that previously discharged into the estuary, would be withdrawn by the LNP Intake System for cooling?"

A40. (RP, DOB, LWV, VRV) No. The text that Dr. Bacchus quotes from the FEIS at 5-11 states that freshwater inflow into the CFBC-OWR system consists of two sources: (1) combined discharge of leaked freshwater from Inglis Lock and freshwater spring inflow just downstream of Inglis Lock and (2) seepage of freshwater into the OWR below the Inglis Dam in the form of a spring. NRC001A at 5-11. The freshwater spring flow consists of an estimated combined discharge of 50 cfs for the first source and a United States Geological Survey (USGS) estimated discharge of 70 cfs for the second source. Because the freshwater discharge over the Lake Rousseau spillway only occurs during flood conditions, the estimated minimum average freshwater discharge into the CFBC-OWR system is 120 cfs. The FEIS shows that the 190 cfs withdrawn by the LNP cooling water intake system would consist of freshwater and saline Gulf waters, not just freshwater as Dr. Bacchus alleges. NRC001A at 5-10 to 5-11, Figures 5-3 and 5-4.

Q41. Do you agree with Dr. Bacchus' testimony at A.17 that "the FEIS describes freshwater contributions from springs "near" the Inglis Lock with no more detailed analysis?"

A41. (VRV, DOB, LWV, RP) No. The FEIS states that freshwater influence into the CFBC comes from seepage around the Inglis Lock, freshwater springs in the CFBC near the Inglis Lock, and discharge from Lake Rousseau over the Inglis Dam via the OWR to the CFBC. NRC001A at 2-93. The FEIS also states that the flow components that contribute to the hydrology of this system are the incoming and outgoing tides from the Gulf of Mexico, freshwater spring inflow into the CFBC near the base of the Inglis Dam and just below the Inglis Lock, some leakage of Lake Rousseau from the Inglis Lock, and periodic spillway discharge from the Inglis Dam. NRC001A at 5-11. Therefore, contrary to Dr. Bacchus' claim, the FEIS used details of flow components, including springs near the Inglis Lock, in its analysis of the entire CFBC-OWR system.

Q42. Dr. Bacchus, in her testimony at A.26, states that the FEIS assumes maximum daily usage conditions will last for only one week and does not account for the annual dry seasons and periods of drought. Also, Dr. Bacchus, in her testimony at A.40, states that "[t]he permit does not constrain these withdrawals during times of drought, nor does the permit impose a maximum withdrawal per day." Do you agree with Dr. Bacchus' testimony?

A42. (VRV, DOB, LWV, RP) No. Peak groundwater usage would only be maintained for short durations because the Applicant must adhere to the annual average usage of 1.58 Mgd. NRC001A at 3-30; INT215 at 1. The maximum withdrawal per day is 5.85 Mgd. Id. The FDEP COCs state:

> The average day, peak monthly, and maximum daily, if applicable, quantities for District ID No(s) 1, 2, 3, 4, 5, Licensee ID No(s) PW-1, PW-2, PW-3, PW-4, CW-1, shown above in the production withdrawal table are estimates based on projected distribution of pumpage, and are for water use inventory and impact analysis purposes. The quantities listed in the table for these individual sources are not intended to dictate the distribution of pumpage from the withdrawal sources. The Licensee may make adjustments in pumpage distribution as necessary up to 125 percent on an average basis, up to 125 percent on a peak monthly basis, so long as adverse environmental impacts do not result and other conditions of this certification are complied with. In all cases, the total average annual daily withdrawal and the total peak monthly daily withdrawal are limited to the quantities set forth above. (Emphasis added.)

PEF005A at 48-49. Therefore, the longer the Applicant pumps at the maximum rate, the more it will have to reduce usage during other times to meet total average annual daily withdrawal of 1.58 Mgd. Consequently, contrary to Dr. Bacchus's statement, the Applicant's withdrawals are subject to constraints, including with respect to average daily withdrawals.

2. Responses to Intervenors' salinity-related testimony

Q43. Dr. Bacchus, in her testimony at A.17 states that "[t]he FEIS appears to have addressed increased salinity only within the Withlacoochee Canal," and at A.19 that "the

Withlacoochee Canal would become saline and inputs of freshwater to the coastal waters would be reduced or eliminated." Do you agree with Dr. Bacchus' testimony?

A43. (RP, DOB, LWV, VRV) No. The FEIS describes changes in salinity in the entire CFBC-OWR system. The Staff concluded that during operation of the LNP units, the CFBC would experience elevated salinity slightly more frequently (89 percent of the time) than it currently does (86 percent). NRC001A at 5-10 to 5-14. The Staff also concluded that the upper reaches of the OWR would experience a slight increase in salinity. Id. Dr. Bacchus does not acknowledge this analysis nor present any reason why the analysis may be flawed. The springs, contributing 120 cfs, are not the only source of freshwater inflow into the CFBC. The discharges over the Inglis Dam spillway vary from 70 to 6,030 cfs. NRC001A at 5-10. The FEIS states that because of the freshwater discharge over the Inglis Dam spillway, the whole OWR can essentially become a body of freshwater. NRC001A at 5-12 to 5-13. Measurements of salinity in the OWR support this conclusion. Id. at 5-13. The freshwater discharges over the Inglis Dam spillway flow into the CFBC via the OWR. The FEIS acknowledges that some of the freshwater inflow into the CFBC will be captured by the cooling water intake structure (CWIS). Id. at 5-7. Therefore, while some of the freshwater inflow into the CFBC will be captured by the CWIS, Dr. Bacchus' claim that the CFBC will become saline and inputs of freshwater to the coastal waters will be eliminated is not correct.

Q44. Do you agree with Dr. Bacchus' statement at A.17 that "[s]imilarly, the salinity of runoff and the effect of evaporation on the salinity of runoff is discussed on page 5-16, paragraph 3 of the FEIS (Section 5.2.3.2), without regard to impacts on seasonal or any other hydroperiod components?"

A44. (RP, DOB, LWV, VRV) No. The Staff's runoff salinity estimation is described in FEIS Section 5.3.1.1 (NRC001A at 5-24) and more fully in Staff's Testimony at A198-A200. The Staff

considered monthly data from 13 weather stations near the LNP site. The Staff selected the lowest mean monthly precipitation from among these stations' data. Therefore, the analysis did consider seasonal variations. Because the analysis showed that the conservatively estimated onsite and offsite runoff salinity would be substantially below the salinity of brackish waters, the impact would be unnoticeable regardless of season. Staff's Testimony at A199-200.

Q45. Dr. Bacchus, in her testimony at A.18 states that (1) she has collected data regarding the lens of freshwater overlying the saltwater wedge in the tidally influenced Withlacoochee Canal/CFBC, Withlacoochee River and tidal creeks, (2) proposed withdrawals would eliminate the lens of freshwater overlying the saltwater wedge, and (3) inadvertent groundwater withdrawals from the Withlacoochee Canal/CFBC via permitted supply wells, would result in that water body becoming saline and would reduce the input of freshwater to the coastal waters. Do you agree with Dr. Bacchus' testimony?

A45. (RP, DOB, LWV, VRV) The Staff does not have access to the data collected by Dr. Bacchus nor to any description to ascertain the quality and reliability of this data. The freshwater in the CFBC comes from a leak in the Inglis Lock, a spring that discharges into the CFBC right below the Inglis Lock, a spring that discharges below the Inglis Dam in the OWR, and discharge from Lake Rousseau over the Inglis Dam spillway. NRC001A at 5-5, 5-10. The FEIS acknowledges that some of the freshwater spring discharge into the CFBC will be captured by the CWIS. Id. at 5-7. The FEIS also states that there is intermittent but larger freshwater discharge over the Inglis Dam's spillway. Id. at 5-10 to 5-12. Freshwater discharge into the CFBC via the OWR that comes from discharge over the Inglis Dam's spillway during flood conditions is not influenced by groundwater conditions. During these flood discharges, freshwater discharge to the CFBC varies from 70 to 6,030 cfs. Id. at 5-10. The tidal influence in the CFBC is diurnal. The Staff analyzed the conditions in the CFBC-OWR system accounting for tidal influence as well as influences from flood discharges over Inglis Dam's spillway. Id. at

5-10 to 5-14. The FEIS states that currently the average flow into and out of the CFBC during a tidal cycle exceeds the freshwater discharge into the CFBC 86 percent of the time and during this (86 percent) time, the CFBC experiences elevated salinities. Id. at 5-11. With the LNP withdrawal from the CWIS, the CFBC will experience elevated salinities 89 percent of the time. Id. at 5-12. However, during the rest of the time, the CFBC would have lower salinity approaching that of freshwater when the discharge over the Inglis Dam exceeds the tidal flow plus the CWIS intake flow. Id. Dr. Bacchus does not provide any indication why the Staff's analysis is flawed, and she does not mention the variability of freshwater and tidal flows that was considered by the Staff. Dr. Bacchus likewise does not provide any support for her assertion that the "lens of freshwater" will be destroyed.

Dr. Bacchus' statement that LNP production wells will withdraw water from the CFBC, inadvertently or otherwise, is also not supported. The LNP groundwater withdrawals are estimated to decrease the surficial and Upper Floridan discharge to the surface water bodies by approximately 0.4 Mgd or 2 percent of the groundwater discharge to rivers and lakes. NRC001A at 5-8; Staff Testimony at A158. Therefore, while the discharge of freshwater (groundwater) to the nearby surface water bodies would reduce, the reduction is minor and would not result in noticeable saltwater intrusion. Id.

Q46. Do you agree with Dr. Bacchus' testimony at A.42 that "[t]he FEIS does not address the adverse cumulative impacts from construction and operation of the proposed LNP on saltwater intrusion and other increases in salinity of ground water and surface water"?

A46. (VRV, DOB, LWV, RP) No. The potential for saltwater intrusion is discussed in the FEIS. NRC001A at 2-39, 2-150, 4-27, 5-16, and 7-20. Water balance calculations and simulated surficial aquifer water-levels indicate that proposed groundwater usage during operation of the LNP units is unlikely to result in significant saltwater intrusion. Id. at 5-16.

Groundwater withdrawals from the Upper Floridan aquifer do have the potential to lower potentiometric surfaces and induce saltwater intrusion. However, due to the relatively small amount of groundwater usage for proposed LNP operations compared to the overall groundwater system water balance, and the relatively small drawdowns (less than 2.5 ft at the wells and progressively less drawdown farther away from the wells) predicted for the LNP wellfield, lateral saltwater intrusion from the CFBC is unlikely. Id. at 5-16. Simulation results indicate that groundwater will continue to discharge to the CFBC (although at a somewhat reduced rate) rather than the canal acting as a recharge boundary for the groundwater system. PEF210 at 28, 40. A wellfield water-quality monitoring program will be instituted to detect any detrimental impacts, and wellfield operations would be managed to mitigate any significant decreases in water quality. NRC001A at 5-16. Because groundwater usage during building of the LNP facilities will be smaller than that during operations, building-related groundwater use is also unlikely to induce saltwater intrusion. Id. at 4-27. Cumulative effects on groundwater quality, including the effects of saltwater intrusion, are described in the FEIS, and the Staff found that cumulative impacts on the quality of groundwater would be SMALL. Id. at 7-20.

3. Responses to Intervenors' dewatering-related testimony

Q47. Do you agree with Dr. Bacchus' testimony at A.28 that "[t]he FEIS additionally fails to address the impact of excavating and then filling with concrete, the nuclear islands?"

A47. (VRV, LWV, DOB, RP) While the FEIS did not explicitly address the impact of excavating and filling the nuclear islands, these actions were considered as part of the Staff's analysis of impacts from building the LNP. The Staff determined that the primary concern associated with the building activities would be the potential for dewatering. While the Staff acknowledges that the grouting will result in permanent impervious plugs in the subsurface

environment underlying the nuclear island, the Staff determined that the groundwater flow would immediately adjust with slight increases in the upgradient water table elevation allowing the water to pass around the structures and would return to the water table elevations that would have existed downgradient of the plugs in a short distance. Given the negligible impact of these plugs with regard to impacts from building the LNP, it was appropriate for the Staff to not explicitly discuss them in the FEIS.

Q48. Do you agree with Dr. Bacchus' testimony at A.28 that "…the proposed excavations and dewatering of the approximately 100-foot deep pits under the two proposed nuclear islands for the considerable time of "two to four years" (FEIS Vol 1. p.4-34) will dewater all of the remaining wetlands on the proposed LNP and surrounding wetlands, resulting in the death of all of the pond-cypress trees…?"

A48. (VRV, LWV, DOB, RP) No. In Section 4.2.1 of the FEIS, the Staff specifically discusses hydrological alterations due to excavation of the nuclear islands. NRC001A at 4-21 to 4-22. Dewatering impacts would be mitigated by the installation of grout barriers to lateral and upward flow. Id. Dewatering impacts would be limited to the water that would seep through the grout into the excavation. Because the grout would prevent significant groundwater drawdown outside of the grouted region, the Staff does not expect the seepage into the excavation to noticeably alter the regional groundwater flow.

Q49. Dr. Bacchus, in her testimony at A.29, states that (1) the FEIS fails to account for evaporative dewatering from stormwater ponds and (2) the excavated stormwater ponds cannot compensate for altered historic sheet-flow and natural hydroperiods because by their very nature, they will be passively dewatering the local area. Do you agree with Dr. Bacchus' testimony?

A49. (RP, DOB, LWV, VRV) With respect to her first assertion, the Staff disagrees with Dr. Bacchus. The FEIS states that the unlined retention/detention facilities (the stormwater ponds) would allow for aquifer recharge of stormwater via infiltration. NRC001A at 5-26. As explained further in Staff's Testimony at A53, the bottom of these ponds would be at the same elevation as the seasonal high groundwater level. The Staff's Testimony at A55 explains that during normal years, the bottom of the stormwater ponds would be above the groundwater table for most of the year and equal to the groundwater table during the wettest season. The Staff concluded that most of the time during a normal year the stormwater ponds would recharge the surficial aquifer. During the rest of the year (the wettest season), groundwater would rise to the bottom of the stormwater ponds but not significantly above it and therefore the driving head difference (the difference in the standing water level in the pond and the adjacent groundwater table) will be small. Therefore, during the wettest season of a normal year, seepage from groundwater into the stormwater ponds would be minimal and any consequent evaporative dewatering will also be minimal.

The Staff also disagrees with Dr. Bacchus regarding her second assertion. As stated above, during the wettest season of a normal year, seepage from groundwater into the stormwater ponds would be minimal and during rest of the normal year, the ponds would recharge the aquifer because the groundwater table would be below the bottom of the ponds. Therefore, the stormwater ponds would not dewater the aquifer; consequently, Dr. Bacchus' assertion regarding historic sheet flow and natural hydroperiods is incorrect.

Q50. Do you agree with Dr. Bacchus' characterization in her testimony at A.46 that the normal seasonal variability of groundwater levels in the vicinity of the LNP site should be less than 8 ft?

A50. (VRV, DOB, LWV, RP) No. As stated, in Section 2.3 of the FEIS:

> Water levels were also obtained from two nearby wells monitored by the USGS and having longer periods of record. These water levels were compared to the 1 year of LNP water-level data to assess any differences in longer-term trends. These wells are

> designated as USGS 290230082412501 Romp 125 Well at Crackertown, FL and USGS 290112082371101 CE 5 USGS OBSER WELL CE 5 NR INGLIS, FL. Both are completed in the Upper Floridan aquifer. Water levels were obtained from the USGS (USGS 2008b). Given the connectivity between the Upper Floridan and surficial aquifers at this site, the range in water levels should be comparable.
>
> For the monitoring period encompassing the LNP pre-application field investigation (March 2007 through March 2008), water-level elevations in LNP wells varied by as much as 5.0 ft. During this same time period, water-level elevations in wells CE 5 and Romp 125 varied by as much as 4.0 and 4.1 ft, respectively. Over the expanded monitoring period provided by CE 5 (January 1968 through October 2008) and Romp 125 (August 1979 through October 2008), water-level elevations in these wells varied by as much as 6.5 and 7.7 ft, respectively. These longer-term data indicate that over a 30-to-40-year time frame, water levels in the vicinity of the proposed LNP wellfield can be expected to vary by as much as 7 to 8 ft due to normal seasonal climatic variability. NRC001A at 2-28.

Further, no significant change in the observed average or range of water-level variability was observed over the 40 years of data available at well CE5. Dr. Bacchus relies on Exhibit INT429 to support her testimony and mentions several peer reviewed studies that she authored on the subject of stresses resulting from hydroperiod alteration. However, it is unclear to the Staff how or from what location Dr. Bacchus derived the information used to create the graphs displayed in Exhibit INT429. Additionally, the photographs were taken at a location within a wellfield at Jay B. Starkey Wilderness Park. This park is located in southwest Pasco County, approximately 60 mi south of the LNP site. It is unclear to the Staff from Dr. Bacchus' testimony how this location and any data from it are relevant to the LNP vicinity. In the absence of more detailed information, none of these assesrtions by Dr. Bacchus provides a basis to contradict the information in the FEIS quoted above.

4. Responses to Intervenors' global climate change-related testimony

Q51. Do you agree with Dr. Bacchus' testimony at A.42 that "[s]altwater intrusion occurs with sea-level rise, but the magnitude in extent and severity increases with withdrawals of groundwater and surface water?"

A51. (LWV, VRV, RP, DOB) Yes. In Section 7.2.2.2 of the FEIS the Staff states that climate-change induced sea-level rise may induce saltwater intrusion. NRC001B at 7-20. Consumptive use of surface water and groundwater can also contribute to saltwater intrusion. The uncertainty in the forecasts of future conditions, such as sea level rise, does not allow accurate predictions of the magnitude and extent of saltwater intrusion. Hydrologic uncertainties such as this demonstrate the utility of adopting the monitoring, testing, and adaptive management strategies included in the FDEP COCs If future sea-level rise creates an environment where the operational withdrawal of groundwater at the LNP site results in increasingly significant impacts, the FDEP COCs would provide the State resource management agencies the authority to require the Applicant to reduce or completely eliminate consumptive use of groundwater by adopting an alternative water supply or supplies.

Q52. Do you agree with Dr. Bacchus' testimony at A.45 that "the FEIS fails to address the cumulative impacts of the construction and operation of the proposed LNP combined with the impacts of climate change?"

A52. (LWV, VRV, RP, DOB) No, the Staff addressed the cumulative impacts from climate change in the FEIS. Id. at 7-12 to 7-15, 7-18 to 7-20. Uncertainties associated with climate change provide one example of a good reason for adopting the monitoring, testing, and adaptive management strategies included in the FDEP COCs. If future sea-level rise creates an environment where the operation of the LNP site results in increasingly significant impacts, the FDEP COCs would provide the state resource management agencies the authority to require the Applicant to reduce or completely eliminate consumptive use of groundwater by adopting an alternative water supply or supplies.

C. TERRESTRIAL ECOLOGY IMPACTS

Q53. Throughout much of her testimony, Dr. Bacchus asserts that the FEIS does not analyze the role of hydroperiods in the ecological health of wetlands and other terrestrial habitats in the region, and that for this reason the analysis of ecological impacts was deficient. Do you agree?

A53. (JPD, LMA) No. Although the FEIS does not often use the word "hydroperiod" directly, it thoroughly evaluates hydrological impacts to wetlands from construction and operation of the LNP. Dr. Bacchus in A.13 of her testimony describes "hydroperiod" as "natural fluctuations of the water table." She describes three important aspects to hydroperiod: depth to water table or depth of surface water, duration of water level at each stage of fluctuation, and the periodicity or seasonality of each stage. Bacchus Testimony at A.13. All three of Dr. Bacchus's elements of hydroperiod are contained within the concept of wetland hydrology, which is discussed in detail in Sections 4.3.1 and 5.3.1 of the FEIS, as discussed below, and in the Staff's Direct Testimony.

Section 4.3.1, which addresses impacts from LNP construction and preconstruction on wetlands and other terrestrial habitats, states that "Impacts on wetlands from project development activities on the LNP site would include filling, erosion, sedimentation, alterations to hydrology, and clearing of vegetation." NRC001A at 4-31 (emphasis added.). "Alterations to hydrology" encompasses changes in hydroperiod. Section 4.3.1 acknowledges that "Temporary, localized dewatering impacts on wetlands could occur during excavation of the powerblocks for proposed LNP Units 1 and 2." Id. at 4-32. "Dewatering impacts" refers to the lowering of the water table, which because of the lack of a confining layer between the surficial aquifer and most wetlands in the area would cause a shortening of those wetlands' hydroperiod.

However, after independent review of the Applicant's proposed measures for rendering the excavations impermeable and directing surface and groundwater flow away from the excavations (described on pages 4-32 and 4-34 of the FEIS), the review team concluded that "No long-term changes to local groundwater levels or wetland functions are expected as a consequence of the dewatering (i.e., groundwater is expected to return to pre-disturbance levels after dewatering ceases)". Id. at 4-34. Section 4.3.1 of the FEIS also acknowledges that "Temporary, localized dewatering of wetlands would also be necessary to install the blowdown and makeup pipelines and some other facilities" but concludes that "because of the short duration of dewatering, the shallow depth of the excavations, and the groundwater recharge achieved through groundwater mounding, no long-term impact on wetlands, including wetland functions, are expected from pipeline installation." Id. at 4-34.

Potential effects of operation of the LNP on wetlands are addressed in Section 5.3.1 of the FEIS, which acknowledges that "Because the surficial aquifer that supports local wetlands is hydrologically connected to the Floridan aquifer system, groundwater withdrawal from the Floridan aquifer system could affect wetlands on and around the LNP site." NRC001A at 5-19. Although it reiterates information first presented in Section 2.3.1.2 of the FEIS suggesting that the LNP site and surrounding lands do not possess well developed karst, Section 5.3.1 still acknowledges that "the cypress dome wetlands on site may represent karst development and likely provide for preferential recharge between the surface and groundwater." Id. at 5-26. These and other statements in the FEIS acknowledge that groundwater withdrawals from operation of the LNP could affect the hydroperiod of overlying or nearby wetlands.

However, Section 5.3.1 then provides support for the conclusion that elements of LNP operation, including stormwater management and active operation of the proposed LNP water production wells, would not destabilize the condition and function of wetlands in the surrounding lands. Regarding stormwater, Section 5.3.1 notes that, based on the Staff's review of the Applicant's proposed stormwater management facilities, operation of the LNP is not expected to

adversely affect wetlands outside of the developed LNP area. NRC001A at 5-26. Section 5.3.1 does however acknowledge potential effects on wetlands from active dewatering associated with operation of the proposed LNP water production wells. The FEIS presents the results of a quantitative analysis performed by the Staff whereby water table drawdown levels projected using the conservatively recalibrated DWRM2 groundwater model were overlain onto regional wetland maps. Id. at 5-26 to 5-31. The Staff used the projected drawdown levels to determine potential effects on wetlands, including wetland hydroperiod, using information from a comprehensive scientific literature review on the topic developed for use in Florida by the South Florida Water Management District in 1995. NRC041. The authors of the literature review stated in their conclusions section that "at least six of the studies [considered in the literature review] indicated that an extended modeled drawdown of from 0.6 to 1.0 foot, within seasonally to semipermanently flooded wetlands, corresponded to significant changes in plant community composition and structure." Id. at 27. Based on the Staff's analysis, the FEIS acknowledges that "up to 2092.9 ac of wetlands could be adversely affected over 60 years of groundwater pumping to support the LNP project." NRC001A at 5-27.

Section 5.3.1 of the FEIS also notes that "The wellfield site [locations for the four proposed LNP water production wells] was chosen to reduce drawdown levels in both the Upper Floridan and surficial aquifers compared to siting wells in other feasible locations." Id. at 5-26. Visual inspection of Figure 2-15 (id. at 2-43) indicates that wetlands appear to be generally less extensive in the lands directly south of the LNP site, where the production wells would be sited, than in areas to the west, north, or east.

The FDEP COCs recognize the potential for hydrological effects on wetlands from operation of the wells and include a requirement for the Applicant to monitor the wetlands and either cease operation of the wells or perform appropriate additional mitigation to ensure that the hydrology of regional wetlands are not adversely affected. Although the COCs provide that PEF could apply to discontinue wetland monitoring after five years of monitoring groundwater usage

exceeding 1.25 mgd, the Staff concluded that five years is sufficient time for monitoring to reveal some detectable evidence of adverse wetland impacts. See PEF005A at 42. The Applicant would therefore be required to take necessary action to head off early adverse impacts that could potentially lead to destabilizing wetland impacts in the long term. The Staff's review of the COCs is discussed in A105 of the Staff's direct testimony, and the role of the COCs in the Staff's conclusions is discussed in A106 of the Staff's direct testimony. Even though the monitoring requirements should prevent operation of the wells from causing more than minimal wetland impacts, the Staff recognizes that adverse wetland impacts might ensue before the monitoring effort is capable of initially detecting the effects. The FEIS therefore conservatively concludes that the overall impacts from LNP operation on terrestrial resources, including wetlands would be SMALL to MODERATE. NRC001A at 5-47.

Q54. In A.11 and elsewhere in her testimony, Dr. Bacchus claims construction and operation of the LNP would result in irreversible wetland impacts not analyzed in the FEIS. Do you agree?

A54. (JPD, LMA) No. In its discussion of irreversible and irretrievable commitments of resources (Section 10.4), the FEIS acknowledges that building the LNP would result in "localized permanent loss of habitat associated with the construction footprint" of the LNP. NRC001B at 10-15. Table 4-5 of the FEIS quantifies the permanent wetland loss due to dredge and fill activities at approximately 411 ac and wetlands permanently altered due to tree clearing only at approximately 110 ac, for a total of approximately 521 ac of permanent wetland impacts for the entirety of the LNP project. Id. at 4-32.

The Staff recognizes that Dr. Bacchus's concern extends beyond irreversible permanent physical impacts to wetlands lying in the proposed LNP construction footprint to encompass potentially irreversible impacts to the hydroperiod of wetlands lying outside of the construction footprint. However, the Staff did evaluate how building the proposed LNP could hydrologically

affect wetlands outside of the construction footprint in Section 4.3.1 of the FEIS. NRC001A at 4-31 to 4-35. The analysis focused primarily on the effects of temporary water table drawdowns needed to excavate 75-ft pits to build the two proposed LNP power blocks and temporary linear excavations needed to install pipelines. Id. at 4-32, 4-34. As indicated in the FEIS, the Staff found that the effects on wetlands remaining on the LNP site and the surrounding landscape would only be temporary. Id. at 4-34. This conclusion is supported in the FEIS by an explanation of how the potentially affected wetlands "are adapted to a range of seasonal and annual variability in groundwater levels, including periodic drought" and how the area's abundant rainfall "would help limit any temporary stress trees and other wetland flora and fauna could experience during dewatering." Id. at 4-34. The Staff therefore does not consider the building impacts to wetlands to be irreversible.

Impacts to the hydroperiod of wetlands caused by operation of the LNP water production wells would be permanent over the operational life of the LNP and may be at least partially irreversible. However, the Staff's conclusions in Section 5.3.1 rely in part on the FDEP COCs imposed on the Applicant. Section 5.3.1 states "In accordance with SWFWMD's review criteria, groundwater withdrawal cannot cause unacceptable adverse impacts on wetlands or other surface waters." NRC001A at 5-30. The State established specific "performance review standards" that must be met, including the following:

- Wet season water levels shall not deviate from their normal range.
- Wetland hydroperiods shall not deviate from their normal range and duration to the extent that wetlands plant species composition and community zonation are adversely affected.

- Wetland habitat functions, such as providing cover, breeding, and feeding areas for obligate and facultative wetland animals, shall be temporally and spatially maintained and not adversely affected as a result of withdrawals.

- Habitat for threatened or endangered species shall not be altered to the extent that use by those species is impaired.

Id. at 5-30. The Staff concluded that if these performance standards are met, no irreversible wetland impacts would occur, contrary to Dr. Bacchus' claim. If any changes to wetland hydroperiod are noticed in the course of performing the required monitoring, PEF would be required to immediately take action to prevent further degradation, in time to prevent the impacts from becoming LARGE or irreversible.

Q55. In A.11 of her testimony, Dr. Bacchus asserts that the FEIS did not analyze hydroperiod impacts within the projected 3 mi range of modeled drawdowns, which would have resulted in a LARGE impact determination. Do you agree?

A55. (JPD, LMA) No. Figure 5-5 in Section 5.3.1 of the FEIS maps wetlands within areas projected by the recalibrated DWRM2 to experience greater than 0.5 ft of drawdown during operation of LNP's water production wells, and Table 5-2 quantifies those wetlands using descriptors developed for the Florida Land Use, Cover, and Forms Classification System (FLUCFCS). NRC001A at 5-28 and 5-29. Evaluating drawdown is a means of evaluating change in hydroperiod; because wetlands in the vicinity of the proposed LNP site are in direct connection to the underlying surficial aquifer system with no intervening layers, drawdown of the water table directly decreases the wetlands' hydroperiod. The Staff estimated that operation of the wells over a 60-year period would draw down the water table by more than 0.5 feet under approximately 2093 acres of wetlands. Id. at 5-27. As noted above in our response A53, a conservative interpretation of information contained in a comprehensive scientific literature

review on the topic developed for use in Florida by the South Florida Water Management District in 1995 (NRC041) indicates that these 2093 ac of wetlands could be subject to potential adverse effects. The interpretation presented in the literature review is conservative and relevant because it was extracted from a comprehensive literature search and because most of the literature reviewed was from Florida. NRC041 at 3-4. As indicated in A107 of the Staff's Direct Testimony, "There were no spatial boundaries to the analysis; it extended as far from the proposed well locations as the hydrological modeling revealed possible effects on water table depth."

Although Section 5.3.1 of the FEIS acknowledges that the results of the recalibrated DWRM2 modeling indicate that approximately 2093 ac of wetlands might be adversely affected, it also notes that operation of the wells would be subject to the FDEP COCs. NRC001A at 5-30. As noted in A54 above, the wells may continue to be operated only as long as specific performance standards continue to be met, including the following:

- Wet season water levels shall not deviate from their normal range.
- Wetland hydroperiods shall not deviate from their normal range and duration to the extent that wetlands plant species composition and community zonation are adversely affected.
- Wetland habitat functions, such as providing cover, breeding, and feeding areas for obligate and facultative wetland animals, shall be temporally and spatially maintained and not adversely affected as a result of withdrawals.
- Habitat for threatened or endangered species shall not be altered to the extent that use by those species is impaired.

Id. at 5-30. Although altering the hydroperiod of approximately 2093 ac of wetlands might be regionally destabilizing and could warrant a LARGE conclusion, the Staff expects the requirement to meet the performance standards established under the COCs to prevent such an extent of impact from ever occurring. Even though the FDEP COCs should prevent operation of the wells from causing more than minimal (SMALL) impacts on regional wetlands, the Staff recognizes that noticeable wetland impacts could potentially occur before the monitoring program is capable of predicting detects adverse impacts, thereby triggering the COCs requirement for responsive action by the Applicant. This is why the FEIS concluded that the overall impacts from LNP operation on terrestrial resources, including wetlands would be SMALL to MODERATE. Id. at 5-47. The FEIS states that adverse effects on wetlands that might result before preventive action can be taken would be "temporary and localized." Id. at 5-47.

Q56. In A.13 of her testimony, Dr. Bacchus asserts that a perturbation of water levels during the active growing season of even a single year could result in irreversible impacts to wetland vegetation. Do you agree?

A56. (JPD, LMA) No. Section 4.3.1 of the FEIS notes that "Wetlands in the LNP vicinity are adapted to a range of seasonal and annual variability in groundwater levels, including periodic drought" and that "monitoring conducted by PEF documented that groundwater levels on the LNP site fluctuate by as much as 5 ft over the course of 1 year (March 2007 to March 2008), and long-term data from nearby wells suggest seasonal groundwater fluctuations of as much as 7 to 8 ft. NRC001A at 4-34. Most if not all of the vegetation in the subject wetlands must therefore be capable of surviving substantial short-term irregular fluctuations in hydroperiod on a scale that might be expected based on episodic natural random climatic variations such as droughts, which can extend from a few weeks or months to even a few years. Wetland vegetation experiencing temporary fluctuations in hydroperiod would not likely be affected

differently whether the fluctuations are random natural fluctuations or caused by man-made activities.

Pond cypress is the dominant tree species in many of the forested wetlands on the LNP site and surrounding landscape. It is widely recognized that pond cypress (like the similar bald cypress) requires fluctuating water levels to complete its life cycle, including extended periods of unflooded soil for seed germination. As Dr. Bacchus notes in one of her papers, pond cypress in Florida has experienced a long history of cyclical droughts and possesses effective mechanisms for conserving water during such droughts. INT359 at 510. This suggests that pond cypress is not normally adversely affected by temporary periods of drier soil as might occur during development of the LNP power blocks and other facilities. It is also widely recognized that pond cypress and many other wetland plants can, once well established, tolerate temporary periods of unflooded soil. Annual or short-lived herbaceous plants in the groundcover might become temporarily displaced by upland species during extended dry periods but can be expected to return once flooded conditions resume. The Staff therefore concluded in the FEIS that wetlands on the LNP site and surrounding landscape would not be irreversibly altered by temporary hydroperiod perturbations of one or even a few years. NRC001A at 4-34.

Q57. In A.15 of her testimony, Dr. Bacchus asserts that plant and animal species around the proposed plant are not accustomed to manmade hydroperiod alterations. In A.13 and A.15 of her testimony, Dr. Bacchus asserts that many species reproduce during the spring when water availability is lowest, and that groundwater withdrawals during these period would impact many species, such as frogs, in ways not captured by the FEIS. Do you agree?

A57. (JPD, LMA) No. As explained in our response A53 above, the FEIS describes how the hydroperiod effects on wetlands from building the proposed LNP facilities would be temporary, localized, and minor, and compliance with performance review standards established in the FDEP COCs would limit the potential for hydroperiod effects on wetlands from operation of the LNP production wells. The effects on wildlife species that rely on those wetlands can therefore also be expected to be minor. Two of the performance review standards specifically address protection of vegetation and wildlife species. They include (with emphasis added):

- Wetland hydroperiods shall not deviate from their normal range and duration to the extent that wetlands plant species composition and community zonation are adversely affected.

- Wetland habitat functions, such as providing cover, breeding, and feeding areas for obligate and facultative wetland animals, shall be temporally and spatially maintained and not adversely affected as a result of withdrawals.

NRC001A at 5-30. The State's requirements are therefore protective not only of the hydroperiod of wetlands potentially affected by the wells, but also of the plant and animal species that depend on those wetlands.

Q58. In A.36 and A.37 of her testimony, Dr. Bacchus asserts that the DEIS does not consider impacts to terrestrial ecosystems caused by catastrophic wildfires originating from hydroperiod alteration. She asserts that impacts to wetlands from such wildfires could include vegetation destruction, increased soil erosion, and increased nutrient runoff. Do you agree?

A58. (JPD, LMA) No. As explained in A53 above, the potential effects on wetland hydroperiod from the permanent and temporary excavations needed to build the proposed LNP

facilities would be temporary, localized, and minimal. The effects on wetland hydroperiod from LNP operations, including operation of the proposed LNP water production wells, are also expected to be limited because of the requirements imposed on the Applicant by the FDEP COCs to monitor wetlands and ensure that no adverse wetland impacts occur. Despite these conclusions, Section 5.3.1 specifically addresses the possible increased wildfire threat that could result based on the recalibrated DWRM2 groundwater modeling if the Applicant continued to operate the wells without taking preventive action to ensure no adverse effects from the wells on wetlands. NRC001A at 5-31. Section 5.3.1 explains that the hydrological effects would be limited to an area of about 7300 ac of wetlands and uplands. Id. at 5-31. It goes on to explain how the fire risk would be reduced by the Applicant's proposed onsite wetland mitigation, which would include efforts to reduce fuel loads conducive to preventing the spread of uncontrolled wild fires, and how rapid fire response would be expected for any wild fires that occur on or close to an industrial facility such as the LNP. Id. Therefore, contrary to Dr. Bacchus' claim, the FEIS does address the potential risk of wildfire caused by dewatering for the LNP.

Q59. Dr. Bacchus asserts, in A.37, that attempts to restore a natural fire regime and to conduct controlled burns, as proposed in the Applicant's Wetland Mitigation Plan, have not been successful. She asserts that the FEIS's reliance on such measures in drawing conclusions regarding the possible effects of wildfires is therefore not justified. Do you agree?

A59. (JPD, LMA) No. The Staff agrees that it will not be possible to restore a natural fire regime to onsite lands proposed for wetland mitigation associated with the LNP. Indeed, the existing vegetation on the LNP site, including the proposed wetland mitigation lands, is the result of decades of active forest management and suppression of the historical fire cycle. But the Applicant's proposed Wetland Mitigation Plan does not call for restoring a natural fire regime; rather it calls for "land preservation, thinning of pines to more natural densities, targeted

plantings of native species to improve species diversity, hydrologic restoration (e.g., culvert removal, ditch plugging, and planting bed removal), control of invasive species, and establishment of a prescribed fire regime." NRC001A at 4-58 (emphasis added). A prescribed fire, or a controlled burn, is a fire purposefully set by land managers to a vegetated area under environmental conditions conducive to management and control of the fire. Prescribed fires are not of natural origin and are not part of a natural fire regime. However, prescribed fires can still be used to help prevent the buildup of dense understory vegetation capable of fueling catastrophic uncontrolled wild fires of either natural or man-made origin. The Florida Cooperative Extension Service promotes prescribed fire for restoring and improving natural forest conditions. It states that prescribed fires can promote seed germination and resprouting for many native species and prevent the accumulation of undergrowth capable of fueling catastrophic wild fires. See NRC079 at 1-2.

The FEIS states that the controlled burns would result in "a more natural fire regime (emphasis added)" and that they "would act to reduce fuel loads in upland and wetland areas on and around the LNP site." NRC001A at 5-31. Prescribed fires set at intervals roughly corresponding to what is known about the natural fire cycle that historically occurred in a vegetated area prior to initial human disturbance can be used to simulate the historical fire cycle, although the ability to match historical conditions is limited by incomplete knowledge of what that historical fire cycle was. Even if the prescribed fires are not conducted in close accordance with the historical fire cycle, they can still be used to reduce fuel loads to prevent the rapid spread of catastrophic fires. Other elements of the proposed wetland mitigation such as plugging ditches, removal of planting beds, and control of invasive species would also reduce the likelihood of wildfire. Plugging ditches and removing planting beds would help restore pre-development hydrological conditions, and many non-native invasive plants are more flammable than the native vegetation that is adapted to frequent but low-intensity ground fires. The Staff therefore believes that, contrary to Dr. Bacchus' claim, consideration of how the proposed

wetland mitigation activities might reduce the probability of catastrophic wildfire is justified and supports the Staff's conclusion that "it is unlikely these hydrological alterations would contribute to an increased risk of wildfire in the LNP vicinity". NRC001A at 5-31.

Q60. In A.39 of her testimony, Dr. Bacchus asserts that because of the FEIS's inadequate consideration of hydroperiod effects, the process of consultation under Section 7 of the Endangered Species Act completed in tandem with the FEIS should be reinitiated. Do you agree?

A60. (JPD, LMA) No. As described above in our response A53, the Staff is confident that the FEIS adequately considered possible impacts from building and operation of the LNP on wetland hydroperiods. As detailed in A244 of the Staff's direct testimony, the Staff involved the U.S. Fish and Wildlife Service (USFWS) throughout the entire process of planning and preparing the EIS. The USFWS was therefore thoroughly familiar with the LNP site, site plan, and contents of the draft EIS before it issued its Biological Opinion, presented in pages F-195 through F-221 of the FEIS. In that Biological Opinion, the USFWS concluded that there would likely be adverse effects on only one species, the Florida scrub jay. The adverse effects are attributable to clearing of specialized upland habitat to build portions of the transmission lines, not to groundwater drawdown. Staff Testimony at A244-246.

The Staff informed the USFWS of the potential hydrological effects on wetlands from building and operating the LNP. The biological assessment (BA) that the Staff submitted to the USFWS, presented in pages F-119 through F-194 of the FEIS, discusses the hydrological impacts to wetlands in a manner similar to the FEIS. The temporary, localized dewatering impacts to wetlands expected from building the proposed facilities on the LNP site are described in Section 4.1 of the BA. NRC001C at F-139. This description is a condensed version of the description of those impacts in pages 4-32 through 4-35 of the FEIS. The possible impacts to wetlands caused by salt drift from operation of the LNP cooling towers and the groundwater

drawdown impacts caused by operation of the proposed LNP production wells are described in Section 4.2 of the BA. Id. at F-144. This description is a condensed version of the description of those impacts at pages 5-19 through 5-26 of the FEIS (for salt drift impacts) and pages 5-26 through 5-31 of the FEIS (for groundwater withdrawal impacts). The USFWS also had access to the expanded impact descriptions in the draft EIS. The Staff had submitted the draft EIS and the BA to the USFWS before the USFWS issued the Biological Opinion. After the USFWS issued the Biological Opinion, the Staff subsequently provided the USFWS with the FEIS once it was completed in April 2012. The USFWS did not respond with any questions or comments on the FEIS.

Q61. In A.39 of her testimony, Dr. Bacchus asserts that the FEIS has not adequately considered the effects of hydroperiod alterations on nearby habitat for the Federally-listed red-cockaded woodpecker, indigo snake, and Florida scrub jay. Do you agree?

A61. (JPD, LMA) No. As we explain above in A63, the Staff has strived to keep the USFWS informed throughout the EIS planning and preparation process, including providing information on the potential hydrological effects of the LNP on wetlands. The BA submitted by the Staff to the USFWS, presented in pages F-119 through F-194 of the FEIS, discusses hydrological impacts to wetlands in a manner similar to that of the FEIS. The temporary, localized dewatering impacts to wetlands expected from building the proposed facilities on the LNP site are described in Section 4.1 of the BA. NRC001C at F-139. This description is a condensed version of that in pages 4-32 through 4-35 of the FEIS. The possible impacts to wetlands caused by the groundwater drawdown impacts caused by operation of the proposed LNP production wells are described in Section 4.2 of the BA. Id. at F-144. This description is a condensed version of that in pages 5-26 through 5-31 of the FEIS.

The letter accompanying the Biological Opinion issued by USFWS concluded that the LNP "may affect" but is "not likely to adversely affect" the red-cockaded woodpecker and the eastern

indigo snake. NRC001C at F-196 and F-197. According to the letter, the only known red-cockaded woodpecker locations potentially affected by the LNP are in Goethe State Forest lands proposed by the Applicant for wetland mitigation work. Id. at F-198. The letter states that USFWS believes that the proposed wetland mitigation in those lands would benefit the red-cockaded woodpecker. Id. at F-198 and F-199. The letter does, however, direct that "all active [red-cockaded woodpecker] clusters within the restoration [wetland mitigation] areas should be avoided and any restoration activities should be conducted outside of the [red-cockaded woodpecker] nesting season (May-July)." Id. at F-199.

The letter states that the LNP "may affect" and is "likely to adversely affect" the Florida scrub jay. NRC001C at F-196. However, as indicated in A244 of the Staff's direct testimony, the Biological Opinion indicates that the direct effects of the LNP on the Florida scrub jay are limited to the possible loss of habitat along the Levy to South Central Florida transmission line (id. at F-213), one of multiple offsite transmission lines that the Applicant proposes to build to transport power generated by the LNP. It indicates that possible indirect effects are limited to minor increase in vehicle collisions, no interrelated or interdependent effects are expected, and possible cumulative effects would have little effect on regional populations of the species. Id. at F-213 and F-214. The Biological Opinion does not identify potential hydrological effects from the LNP as a source of direct or indirect effects. Additionally, the Florida scrub jay has specific habitat requirements comprising "oak-dominated scrub or xeric oak scrub" that is "adapted to nutrient-poor soils, periodic drought, high seasonal rainfall, and frequent fires." Id. at F-203. This description suggests upland habitat that is not sensitive to a lowered water table.

Q62. In A.40 through A.42 of her testimony, Dr. Bacchus asserts that the FEIS has not considered how vegetation might be affected by saltwater intrusion caused by regional water drawdown from the LNP and other regional activities. In A.43, Dr. Bacchus

presents photographs and asserts that regional drawdowns have already killed wetland vegetation in the area. Do you agree, and how do you interpret her photographs?

A62. (JPD, LMA) No. As explained in our response A53 above, the Staff concluded that the potential effects of building and operating the LNP on the surficial aquifer responsible for the hydroperiod of most wetlands in the landscape on and surrounding the LNP site would be minimal or limited by the requirements imposed on the Applicant in the FDEP COCs. The conclusions presented in A53 are supported by the discussions on the limited potential hydrological effects from building the LNP described in Section 4.3.1 of the FEIS (NRC001A at 4-32 to 4-34) and discussions of the potential hydrological effects of operating the LNP described in Section 5.3.1 of the FEIS. Id. at 5-26 to 5-31. Because of the limited potential for building and operating the LNP to affect the water table and associated surficial aquifer, the Staff does not expect the LNP to substantially contribute to the inland movement of brackish water into the surficial aquifer where it could harm inland vegetation adapted to fresh groundwater. The FEIS additionally states that "However, due to the relatively small amount of groundwater usage for proposed LNP operations compared to the overall groundwater system water balance, and the relatively small drawdowns (less than 2.5 ft) at the wells and progressively less farther away from the wells) predicted for the LNP wellfield, . . . lateral saltwater intrusion from the CFBC is unlikely." NRC001A at 5-16. The Staff therefore does not expect the LNP to noticeably contribute to saltwater intrusion and its effects on overlying wetlands in the surrounding landscape.

Dr. Bacchus provides in her testimony a series of photographs (INT304 through INT330) of dead or declining trees in the Gulf Hammock Wildlife Management Area and along the lower Withlacoochee River east and southeast of the LNP site. Bacchus Testimony at A.43. The Gulf Hammock Wildlife Management Area comprises about 25,000 acres of swamps and low-lying uplands immediately east (landward) of the tidal marshes of the Gulf of Mexico. Wetlands in the

Gulf Hammock Wildlife Management Area and along the Lower Withlacoochee River are influenced by both tidewater from the Gulf of Mexico and freshwater from surface and groundwater sources. Wetlands in these areas are therefore potentially subject to salinity changes as the relative composition of freshwater versus saltwater inflow changes. The Staff does not dispute that the photographs show dead and declining trees, and the Staff agrees with Dr. Bacchus that at least some of the depicted trees may have died from saltwater intrusion into formerly freshwater swamps. Section 5.3.1 of the FEIS discusses a long-term study conducted at the Waccasassa Bay Preserve State Park, located west of the LNP Site, between 1992 and 2005 that attributed increased tree mortality and declining tree regeneration in the park to salinity stress from sea-level rise and a La Nina-associated drought. NRC001A at 5-23. Dr. Bacchus's photographs do not however offer proof that the trees were killed by saltwater intrusion let alone provide evidence regarding the possible cause of the postulated saltwater intrusion. Although wetlands in the region may currently be experiencing stress from saltwater intrusion, the Staff's analyses in Sections 4.3.1 and 5.3.1 of the FEIS suggest that building and operating the LNP would not substantially contribute to that stress.

Section 5.3.1 of the FEIS does address the potential for saltwater intrusion into the former Cross Florida Barge Canal, referred to as the Withlacoochee Canal in Dr. Bacchus's testimony, caused by the intake of makeup water for the LNP cooling system using a proposed intake structure built on the north shore of the canal south of the LNP site. Section 5.3.1 states:

> However, it is anticipated that higher-salinity water from the estuarine portions of the nearshore Gulf of Mexico would be slowly drawn up the CFBC toward the intake structure during operations. These water-quality changes could result in minor changes to shoreline vegetation along the CFBC, perhaps causing establishment of brackish water vegetation in some areas presently supporting freshwater vegetation.

Id. at 5-33. However, the FEIS explains that the potential impacts to terrestrial habitats would be negligible because of the sparse emergent wetland vegetation that borders the canal downstream of the intake structure. Id.

Q63. In A.40 of her testimony, Dr. Bacchus notes the absence of a monitoring plan in the FEIS for detecting "adverse impacts" (referring to the FDEP COCs). She also asserts that the FEIS cannot rely on a number of plans called for in the FDEP COCs that have not yet been completed. Do you agree?

A63. (JPD, LMA) No. It is true that the Applicant has not yet prepared the Environmental Monitoring Plan called for in the FDEP COCs. The Staff understands that the Applicant cannot effectively prepare this plan until the final stages of project design, which are typically not completed until after issuance of an NRC license. The FDEP COCs requires the Applicant to prepare the plan "no less than 3 years prior to any production well use in excess of 100,000 gallons per day (annual average) for production purposes." PEF005A at 42. This requirement will ensure that the Applicant collects a minimum of three years of baseline data prior to initiating substantial production water withdrawals. The contents of the plan will have to be reviewed and approved by the SWFWMD. Section 5.3.1 of the FEIS explains that "In accordance with SWFWMD's review criteria, groundwater withdrawal cannot cause unacceptable adverse impacts on wetlands or other surface waters." NRC001A at 5-30. Section 5.3.1 explains that the plan would have to meet four specific performance review standards established by SWFWMD. They include:

- Wet season water levels shall not deviate from their normal range.
- Wetland hydroperiods shall not deviate from their normal range and duration to the extent that wetlands plant species composition and community zonation are adversely affected.
- Wetland habitat functions, such as providing cover, breeding, and feeding areas for obligate and facultative wetland animals, shall be temporally and spatially maintained and not adversely affected as a result of withdrawals.

- Habitat for threatened or endangered species shall not be altered to the extent that use by those species is impaired.

NRC001A at 5-30. Considering that the FDEP COCs are enforceable under Florida law, and considering the specificity of the SWFWMD performance review standards, the Staff considers it reasonable to rely on the effective development and implementation of the Environmental Monitoring Plan.

The Staff's evaluation of wetland and other terrestrial ecology impacts also relied on several other plans not yet prepared by the Applicant but known to be required to comply with the FDEP COCs. The Staff understands that the Applicant cannot effectively prepare these plans until the final stages of project design, which are typically not completed until after issuance of an NRC license. Examples include a stormwater management plan and avian protection plan. However, the agencies responsible for approving each of these plans have established specific requirements regarding required content, similar to the requirements in the FDEP COCs for developing and implementing the plan for monitoring wetland impacts prior to and during operation of the groundwater production wells (see A54 and A55, above). For example, the FDEP COCs state that "Any storm water discharges associated with construction activities on the [LNP] Site shall be in accordance with all applicable provisions of Chapter 62-621, F.A.C." PEF005A at 8. The FDEP COCs state that "the Licensee will coordinate with the FWC [Florida Fish and Wildlife Conservation Commission] in the development of an Avian Protection Plan" and refers the licensee to the guidelines for an Avian Protection Plan on the USFWS website. Id. at 58. The Staff is familiar with those guidelines and therefore generally knows what to expect in the plans. Therefore the Staff finds it reasonable to consider the plans when drawing conclusions regarding potential environmental impacts.

Q64. In A.41 of her testimony, Dr. Bacchus asserts that the FEIS does not adequately evaluate wildlife habitat fragmentation, especially wildlife habitat fragmentation caused by hydroperiod alteration by the LNP. Do you agree?

A64. (JPD, LMA) No. As Dr. Bacchus notes in the second sentence of A41 of her testimony, Section 4.3.1 of the FEIS addresses in multiple places wildlife habitat fragmentation caused by building the LNP; Section 7.3 addresses the issue from a cumulative perspective in the surrounding landscape as well. However, those discussions focus on direct fragmentation caused by clearing habitat to accommodate site development. The Staff interprets Dr. Bacchus's concerns as focused on fragmentation of existing contiguous wetland areas through establishment of intervening upland bands resulting from a lowered water table. However, as explained in our response A56 above, Section 4.3.1 of the FEIS demonstrates that the hydrological effects of building the LNP would be temporary, localized, and minor, and Section 5.3.1 of the FEIS demonstrates that the hydrological effects of operating the LNP would be minor and limited by the Applicant's compliance with the FDEP COCs. Fragmentation of wetland habitats due to hydroperiod alterations would therefore also be minor and limited.

Q65. In A.51 of her testimony, Dr. Bacchus claims that the onsite wetland mitigation locations proposed by the Applicant are not suitable for mitigation because they are in the areas of highest cumulative stress from the proposed LNP and other projects. She also asserts that the FEIS has not considered several indirect impacts associated with the Wetland Mitigation Plan, such as its requirements for quarried limerock and sand. Do you agree?

A65. (JPD, LMA) No. It is true that the locations selected for the onsite wetland mitigation activities, like all parts of the LNP Site, have experienced substantial baseline stress resulting from decades of active forest management. NRC001A at 2-42. However, the mitigation seeks

to restore higher quality ecological conditions; if the selected locations already supported high quality habitat, the mitigation would serve no purpose. The onsite areas selected for ecological restoration in the Applicant's proposed Wetland Mitigation Plan (NRC048R) are located in close proximity to where LNP facilities would be built. Although the Staff considers the likelihood of substantial adverse impacts to those areas from the LNP to be low, as with other areas on the LNP and surrounding landscape, the Wetland Mitigation Plan calls for at least five years of monitoring to determine whether the wetland is developing in accordance with the expectations of the plan with respect to the plant community, wildlife utilization, hydrological conditions (which includes hydroperiod), absence of invasive or exotic species, and other management parameters. NRC048R at 98. The Wetland Mitigation Plan calls for collection of specific data to evaluate these objectives, including:

- total coverage and survivorship of desirable planted species and any other dominant species;
- the presence of naturally recruited trees present within each stratum;
- the presence and overall coverage of any listed invasive/exotic species;
- success of any previously recommended treatment methods and any future methods proposed;
- any areas of mortality of natural species;
- current hydrologic conditions, water depths, and hydric soils observed;
- any evidence of wildlife presence or utilization;
- any maintenance needs in regard to stabilization, erosion, vandalism etc. and suggested corrective actions.

Id. at 99. If the cumulative adverse effects from the LNP and other human activities in the region become too great to achieve the objectives of the Wetland Mitigation Plan, the Staff expects that the monitoring outlined above will so indicate. The Staff expects that state and federal agencies responsible for ensuring the success of the wetland mitigation—specifically, the SWFWMD and USACE—would require the Applicant to rectify whatever conditions are preventing successful wetland mitigation.

D. AQUATIC ECOLOGY

Q66. In A.3, A.33, and A.47 of her testimony, Dr. Bacchus lists the Withlacoochee and the Waccasassa Rivers as example of Outstanding Florida Waters. Does the Staff agree with this identification?

A66. (ALM, MTM) The Staff agrees in part with Dr. Bacchus' examples of Outstanding Florida Waters. As explained in A157 of the Staff's Testimony, according to Section 62-302.700 of the Florida Administrative Code the Withlacoochee River is an Outstanding Florida Water as part of the Withlacoochee Riverine and Lake System, but the Waccasassa River is not considered an Outstanding Florida Water. Fla. Admin. Code r. 62-302.700 (2012). Only the Waccasassa Bay, as part of the Waccasassa Bay State Preserve, is considered an Outstanding Florida Water. Id.

Q67. Do you agree with the concerns expressed by Dr. Bacchus in her testimony at A.18 regarding the potential for increasing salinity to adversely affect essential fish habitat?

A67. (ALM, MTM) No. Dr. Bacchus provides an incomplete quote regarding essential fish habitat (EFH). The full quote in the FEIS is as follows: "Estuarine and marine essential fish habitats have been designated by the NMFS in the CFBC and immediate nearshore Gulf of Mexico near the CREC discharge and CFBC for species listed in Table 2-15. There are no habitat areas of particular concern near the CREC discharge area or the CFBC." NRC001A at

2-123. The Staff concluded that effects on EFH from building and operating LNP, and the incremental impacts from NRC-authorized activities to cumulative effects, would be minimal. Id. at F-52 to F-59. The Staff consulted with NMFS regarding environmental effects to EFH as a result of building and operating LNP, including, cumulative effects. Id. at C-19. The Staff prepared an assessment of the effect of LNP on essential fish habitat, included that assessment in Appendix F of the DEIS, and forwarded a copy of the DEIS to NMFS in August 2010. A reprint of the essential fish habitat assessment appears in Appendix F of the FEIS. Id. at F-5. Many of the life stages for aquatic species with habitat requirements managed under the EFH are euryhaline, tolerating a wide range of changing salinity conditions. Id. at F-8 to F-9. In a response dated October 26, 2010, NMFS provided comments on the Staff's assessment and expressed concern for EFH related to LNP intake and discharge effects and dredging. NRC081. NMFS did not, however, express concern regarding the potential impacts that may result from salinity fluctuations within the CFBC or at the mouth of the CFBC or any issues related to passive or active dewatering. Id.

Q68. Do you agree with the concerns expressed by Dr. Bacchus in her testimony at A.19 regarding the assertion that the increase in salinity in the CFBC will negatively affect vegetation important to manatees and green sea turtles?

A68. (ALM, MTM) No. Dr. Bacchus makes an assumption that sufficient freshwater aquatic vegetation exists within the CFBC to provide a significant food source for manatees. The Staff finds this assertion unsubstantiated. Submerged aquatic vegetation in sufficient quantity to serve as a valuable food source for manatees has not been documented in the CFBC despite sampling. NRC042 at 17. Therefore the assumptions made that any food source for manatees would be affected by salinity changes from the LNP are not supported. One of Dr. Bacchus' exhibits, INT383, states in Finding of Fact 63 (page 8) that "Manatee use the waters of the Greenway Canal [CFBC] and the Upper Withlacoochee [OWR]. The Greenway Canal [CFBC] is not, however, considered particularly good habitat for manatee. It has relatively deep water,

steep banks, little freshwater and little vegetation of interest to manatee." INT383 at 8. INT383 Finding of Fact 66. states that "The [Citrus County] Manatee Protection Plan does not identify the Greenway Canal [CFBC] as essential manatee habitat."

Dr. Bacchus also asserts that freshwater contributions to coastal waters would be reduced as a result of increasing salinity within the CFBC, which she asserts would also be detrimental to vegetation consumed by green sea turtles. Bacchus Testimony at A19. The Staff finds this assertion unsubstantiated, and in error. Green sea turtles are herbivores that feed primarily on seagrasses and macroalgae. NRC001C at F-90. The preferred seagrass species for consumption is *Thalassia testudinum*, or turtle grass. Id. Turtle grass thrives in coastal waters at higher salinities, and does not tolerate influxes of freshwater. NRC045 at 20. Therefore, any change or reduction in freshwater flow to the coastal regions surrounding the CFBC would likely be advantageous to growth of turtle grass.

Q69. Do you agree with the concerns expressed by Dr. Bacchus in her testimony at A.34 that water quality changes to Outstanding Florida Waters are not adequately addressed in the FEIS with regard to federally threatened and endangered aquatic species?

A69. (ALM, MTM) No. Dr. Bacchus reiterates the assertion that manatees will be adversely affected by any water quality changes to Outstanding Florida Waters (OFW). Manatees have been reported below Lake Rousseau in the Lower Withlacoochee, the Old Withlacoochee and the Cross Florida Barge Canal (CFBC). The Staff acknowledges that the Lower Withlacoochee River and Old Withlacoochee River are likely important manatee habitat; however, the building and operation of the LNP should have no measureable effect on the water quality of these Outstanding Florida Waters. NRC001C at F-167, F-168. A change in water quality, specifically salinity, is expected in some portions of the CFBC during LNP operation. Id. at 5-11 to 5-14. Dr. Bacchus cites INT383 as supporting her conclusion with respect to manatees. INT383, states in Finding of Fact 65 (page 8) that "Manatee use the waters of the Greenway Canal

[CFBC] and the Upper [Old] Withlacoochee. The Greenway Canal [CFBC] is not, however, considered particularly good habitat for manatee. It has relatively deep water, steep banks, little freshwater and little vegetation of interest to manatee." Based on aerial overflights the CFBC is not considered an important nursery or habitat area for manatees. NRC060. Finally, the CFBC is not considered an Outstanding Florida Water. Therefore, the Staff has adequately addressed the potential effects on federally threatened and endangered aquatic species from water quality changes to the CFBC and the Withlacoochee Outstanding Florida Waters.

Q70. Do you agree with Dr. Bacchus' assessment that federally listed species are not adequately assessed in the FEIS?

A70. (ALM, MTM) No. As described in A251 of the Staff's testimony, the NRC Staff followed the consultation process provided in the Endangered Species Consultation Handbook published jointly by the FWS and the NMFS. NRC066. Further, as stated in A250 of the Staff's testimony, the Staff included an analysis of impacts to federally listed species in sections 4.3.2.3, and 5.3.2.3, and 7.3.2. In developing the analysis in the FEIS, the NRC Staff requested from the FWS and the NMFS (the Services) a list of Federally protected species that could be affected by the building and operation of the LNP. NRC001C at C-3, C-4. Upon receipt of the list of species from each Service the Staff conducted a thorough assessment of the potential for impacts related to the building and operation of LNP. The assessments were documented in two separate Biological Assessments (BAs) that were published in the August 2010 Draft EIS for the LNP. A copy of the Draft EIS, with copies of the BAs in Appendix F, was forwarded to the Services. The review team attended several meetings with each Service to discuss the conclusions in the BAs. In a letter dated November 26, 2010, NMFS found that for the smalltooth sawfish, Gulf sturgeon, loggerhead, green, hawksbill, and Kemp's ridley sea turtle, the proposed action may affect, but is not likely to adversely affect, these species. NRC061. For the leatherback sea turtle NMFS determined that LNP would have no effect on this species. The November 26, 2010 letter stated that our consultation responsibilities under the

Endangered Species Act were concluded. In a letter dated December 1, 2011, the FWS concurred with the review team's conclusion contained in the BA for FWS, finding that the LNP may affect, but is not likely to adversely affect, the Florida manatee and the Gulf sturgeon. NRC001C at F-195. The letter states that formal consultation for this action (building and operation of LNP) is concluded. By concluding consultation with both Services and, including the review team's detailed assessment in the Appendix F of the FEIS, the review team adequately assessed Federally protected species that potentially could be affected by the building and operation of LNP.

Q71. Do you agree with Dr. Bacchus' response to Q.39 in her testimony, which states that the FEIS fails to provide the status of the smalltooth sawfish and fails to address how this species will be affected by the direct, indirect, and cumulative impacts of the proposed LNP?

A71. (ALM, MTM) No. Section 2.4.2.3 of the FEIS provides a brief discussion of the smalltooth sawfish in the vicinity of the LNP site and the FEIS also discussed impacts to the smalltooth sawfish from building and operations. NRC001A at 2-120, 4-77, 5-60. Additional information on this species is found in the BA published in Appendix F of the FEIS. NRC001C at F-65. Section 5.3 of the BA provides life history information, habitat requirements, status and distribution, factors contributing to the decline in population and occurrence and status in the project area for the smalltooth sawfish. Id. The effects of the proposed action, building and operation of the LNP, are found in Section 6 of the BA and cumulative effects are covered in Section 7. Id. The review team concluded that the building and operation of the LNP may affect, but is not likely to adversely affect the smalltooth sawfish. Id. at F-106.

III. SALT DRIFT

A. METEOROLOGY IMPACTS FROM SALT DRIFT AND DEPOSITION

Q72. In Bacchus Testimony at A.38, Dr. Bacchus stated that the Staff used data from Tampa to determine wind speeds for purposes of analyzing salt drift and deposition rates. Is this accurate?

A72. (KRQ) No, as stated in Section 5.7.2 of the FEIS and as explained in the Staff Testimony at A87-88, the Staff relied on surface meteorological data collected at the National Weather Service observation station at Gainesville, Florida Regional Airport (GNV). NRC001A at 5-86. The Staff conducted a comparison of wind speed and wind direction between the onsite observations at the LNP site and GNV. From this comparison, the meteorologists found that when comparing wind speeds greater than 1.5 meters per second (m/s), the two stations showed little variation from each other.

The atmospheric conditions at GNV and the LNP site, while similar, are not identical. NRC038 at 1-2. GNV does not record wind speeds less than 1.5 m/s. In contrast, the onsite meteorological observation tower at the LNP site records wind speeds as small as 0.5 m/s. Due to this difference in starting wind speed, a comparison of the two stations depicts a larger amount of calm winds at GNV (27.5%) versus LNP (17.6%) during 2008. Wind speeds less than 1.5 m/s occur at a predictably higher frequency at LNP since they are below the GNV recording threshold. When comparing wind speeds higher than 1.5 m/s, the two stations showed little variation from each other. The GNV wind speeds averaged about 4% higher than the LNP observations for wind speeds between 3 m/s and 8 m/s. At wind speeds greater than 8 m/s, the stations were nearly identical.

Wind direction measurements between GNV and LNP were generally similar for 2008. The largest difference in wind direction occurs when winds were out of the northeast, east-northeast, and east. Winds at LNP from these directions occurred an average of 4% more often than at

GNV. Gainesville recorded slightly more frequent winds (1-2%) out of the west-northwest through north sectors (when rotating clockwise). The winds at the LNP site are bimodal, with the wind generally blowing from the east-northeast or from the west. NRC001A at 2-181. Such a pattern is typical in a location near the coast that experiences regular sea and land breezes. Depictions of the wind speed and wind direction comparisons between the observations at LNP and GNV are found in Exhibit NRC038.

Q73. In Bacchus Testimony at A.38, Dr. Bacchus states that the Staff did not consider measurements of salt concentration for the LNP or any other site. Did the Staff consider this? If not, why?

A73. (LKB) Dr. Bacchus criticizes the Staff's analysis presented in FEIS section 5.7.2 because it does not take into account measurements of salt concentration over the LNP site. NRC001A at 5-85. The Staff's analysis, however, was reasonable and accruate because it follows the protocol described in the Environmental Standard Review Plan NUREG-1555, Section 5.3.3.2, in which the impacts of the heat dissipation systems are to be considered. NRC013 at 5.3.3.2-4-5. NUREG-1555 states that the analysis should "use maps of the site and vicinity showing drift isopleths that were produced by a recognized drift-dispersion model." Id. As stated in the Staff Testimony at A86, we relied on the AERMOD dispersion model, which is regularly used in air quality permit applications, including the dispersion of particulates. Utilization of measurements from other sites can be speculative because the meteorological conditions at any other site would not necessarily be representative of the conditions at the LNP site. The advantage of using a recognized drift dispersion model is that such models are carefully verified using data from a wide range of detailed field studies. NRC080 at 29-34. Thus, use of such models alone can be used to anticipate dispersion of gases and/or particles associated with the operation of any facility. In the case of our analysis conducted for the FEIS, the AERMOD model was used to estimate the salt deposition in lieu of direct observations.

NRC001A at 5-86. The Staff's analysis is consistent with the process described in NUREG-1555.

Q74. In Bacchus Testimony at A.38, Dr. Bacchus contends that the Staff did not consider the background salt concentration at the LNP site. Does the Staff agree with Dr. Bacchus' claim?

A74. (LKB) No. The Staff did consider the background salt concentration. Although the background salt concentration is not mentioned in the FEIS, during the Staff's analysis, we considered two factors relative to the background salt concentration. First, the naturally occurring salt deposition is part of the background environmental state of the LNP Site and the construction and operation of the LNP would not have an impact on the salt deposition because it would not change the general meteorological conditions that transport the naturally occurring salt to the site. Second, as described in the Staff Testimony at A197 the concentration of sea-salt decreases rapidly with distance from the coast, so that the naturally occurring salt deposition is also expected to be small at the LNP site. NRC054 at 76. Based on these two factors, our analysis presented in the FEIS provides an accurate and sufficient analysis of the likely salt deposition at the site. NRC001A at 5-86.

Q75. In Bacchus Testimony at A.38, Dr. Bacchus asserts that location of maximum salt deposition as presented in the FEIS is inaccurate. Is the FEIS's description of the location of maximum salt deposition accurate?

A75. (LKB) Yes. In the FEIS, the Staff predicted the location of the maximum salt deposition associated with the operation of the LNP by using AERMOD. NRC001A at 5-86. This result is consistent with the wind directions observed at Gainesville over a five-year period of 2001-2005. Id. As stated in the Staff Testimony at A87, the LNP data collected during 2008 does have an increased frequency of winds from the northeast, east-northeast, and east compared to the same one-year period at Gainesville. NRC038 at 1-2. Dr. Bacchus argues that, given the prevailing wind direction during that single year of data collected at the LNP site, the location of

the maximum salt deposition should be to the southwest, rather than west of the cooling towers. However, the winds measured at both Gainesville and the LNP Site can have a significant amount of year-to-year variability leading to changes in the location of the peak salt deposition from year-to-year. The Staff relied on the five years of meteorological data from Gainesvillle in order to minimize the impact of the year-to-year variability on our analysis. The Staff's analysis is thus accurate because of our application of a recognized dispersion model and wind data that are representative of the LNP site.

Q76. In her testimony at A.38, Dr Bacchus states that (1) the onsite winds indicate that significant amounts of salt drift would be deposited to the southwest and (2) because the supply wells are located south of the nuclear islands, induced recharge resulting from supply wells-caused dewatering would increase groundwater contamination by infiltration of more saline water from the salt deposition pattern. She asserts that the resulting salinity would adversely affect the ecology of wetlands, floodplains, and other habitats on and surrounding the LNP site. Do you agree with Dr Bacchus' analysis?

A76. (RP, VRV, DOB, LWV, JPD) No. The Staff's Rebuttal Testimony at A78 describes that the analysis of the salt deposition pattern in the FEIS is accurate because a multi-year (2001-2005) dataset was used to account for year-to-year variability in wind directions. NRC001A at 5-86. The Staff's estimate of surface water salinity on the LNP onsite and offsite areas used the maximum areal salt deposition rate of 10.75 kg/ha/mo. NRC001A at 5-24; Staff Testimony at A198-200. Because the Staff conservatively used the maximum areal salt deposition rate on onsite as well as offsite areas for surface water salinity estimation, consideration of the variation in the salt deposition pattern was not necessary. As described previously in the Staff's Testimony, the surface water salinity estimate is conservative because it used the maximum salt deposition rate on LNP onsite and offsite areas during a one-month dry period which was subsequently dissolved in the lowest mean monthly precipitation. Staff Testimony at A198-200.

Even using these conservative assumptions, the Staff's estimation of surface water salinity of 0.026 ppt is much smaller than the salinity rate that is commonly used for brackish water (1 ppt). Therefore, the impact from this surface water running off and mixing with freshwater within nearby surface water bodies or infiltrating into and mixing with groundwater would be minimal.

(JPD) From an ecological perspective, wetland flora and fauna would be expected to respond to water with a salinity of 0.026 ppt as if it were fresh water and not display adverse effects caused by exposure to salinity. Natural water (not distilled water) has a salinity level greater than zero. As noted in the FEIS, fresh water is commonly regarded as water with a salinity of less than 1 ppt. NRC001A at 5-24. Even considering a conservative salinity threshold of 0.5 ppt for possible adverse effects to the most sensitive of floral or faunal receptor species, the estimated salinity of the surface water would have to be concentrated by nearly 20 times before even affecting the ecology of wetlands on the LNP site. The species composition and ecological functions of wetlands potentially affected by cooling tower drift are therefore unlikely to be adversely affected even under the conservative assumptions described above.

(RP, JPD, VRV, DOB, LWV) Because the conservatively estimated surface water salinity, 0.026 ppt, resulting from a low rainfall amount dissolving all salt deposited during a preceding dry period does not approach salinity of brackish water, 1 ppt, we conclude that Dr Bacchus' claims of adverse effects to the ecology of wetlands, floodplains, and other habitats on and surrounding the LNP site are unfounded.

B. TERRESTRIAL ECOLOGY IMPACTS FROM SALT DRIFT AND DEPOSITION

Q77. In A.38 of her testimony, Dr. Bacchus asserts that the conclusions regarding the impact of salt drift on vegetation in the FEIS are flawed because they are based on experience with saltwater cooling towers located on the coast, not inland like the LNP cooling towers. Do you agree?

A77. (JPD, LMA) No. As stated in A204 of the Staff's testimony, the CREC report did not form the primary basis of the Staff's conclusions; rather it provided supplemental evidence to help inform the Staff's determination. As described in Section 5.3.1 of the FEIS, the Staff based its conclusions primarily on several factors other than the CREC report (NRC001A at 5-19 to 5-23), including:

- an independent quantitative analysis of habitat types that could potentially be affected by salt drift deposition during normal operations determined by overlaying salt deposition data (AERMOD model output) and FLUCFCS data for the site and surrounding area (NRC001A at 5-20 to 5-22);
- a review of relevant scientific literature presented in the NRC's Generic EIS (GEIS) for License Renewal of Nuclear Plants (NRC057 at 4-42 to 4-45) that summarizes vegetation monitoring studies that were conducted at various sites throughout the U.S. regarding effects of salt deposition on relatively sensitive vegetation; and

As noted in the Staff's Testimony at A204, the CREC report (NRC058) was also considered because it provided Staff with "the geographically closest recorded observations of possible salt drift injury to vegetation relative to the LNP site." Staff Testimony at A204. Additionally, although species composition is not identical at the CREC facility and the LNP property, a comparison of FLUCFCS data and information provided in the report showed that similar habitats are present on both the CREC and LNP sites (e.g. coniferous plantations (FLUCFCS 441), wetland swamps (mixed wetland hardwoods FLUCFCS 617, cypress FLUCFCS 621, wetland forested mixed FLUCFCS 630), and freshwater marshes (FLUCFCS 641). NRC001A at 5-23.

As stated in the FEIS, NRC guidance (NRC013 at 5.3.3.2-5) "indicates thresholds for visible leaf damage in the range of 10 to 20 kg/ha/mo during the growing season." NRC001A at 5-21. The Staff's salt deposition modeling (using AERMOD) estimated maximum deposition rates of

10.75 kg/ha/mo for onsite areas and 6.81 kg/ha/mo for offsite areas. Id. at 5-20. These estimates were conservatively based upon the most conservative year (2004) for climatological conditions for a five-year period extending from 2001 through 2005. Id. at 5-21. The offsite area of maximum estimated deposition is situated at the property boundary west of the cooling towers. Id. at 5-20. The Staff acknowledges in Section 5.3.1 of the FEIS that modeling suggests there could be salt damage to some onsite plants in some years; however, since the offsite deposition rate is lower than the lower threshold for visible leaf damage and would decrease significantly with increasing distance from the proposed plant site, no adverse impacts to vegetation in areas outside the LNP site are expected to occur. Id. at 5-21.

Q78. Dr. Bacchus asserts in A.38 of her testimony that using published data regarding the response of corn to salt drift is not relevant to an analysis of potential salt drift effects on the native vegetation surrounding the proposed LNP cooling tower locations. Do you agree?

A78. (JPD, LMA) No. There is limited published scientific literature and data regarding plant response to salt drift from cooling towers. Section 4.3.4.2 and 4.3.5.1.2 of the License Renewal GEIS summarizes results from salt deposition monitoring studies that were conducted at 18 power plants from various locations throughout the United States over several years. NRC057 at 4-39 to 4-44. Visible vegetation damage from salt drift was observed at only three of the power plants, and most of the damage occurred within 150 m (approximately 492 ft) of the cooling towers. Id. at 4-43. For several relatively sensitive cultivated species (including but not limited to corn, soybeans, cotton, and alfalfa) and several relatively sensitive native species (including but not limited to flowering dogwood, red maple, white pine, chestnut oak, and witch hazel), Table 4-2 of the License Renewal GEIS presents threshold salt deposition rate values (above which injury is expected) that are commonly used in analyzing and determining potential impacts of salt drift deposition on plant species present on and/or near operating (or proposed)

cooling towers. Id. at 4-37. The information contained in the License Renewal GEIS concerning the responses of plants to salt drift was used in the Staff's independent analysis because it is the best available data for analyzing the effects of salt drift on cultivated and native vegetation in many different geographic areas and therefore could be applied to the LNP site.

The Staff is not aware of any data in the scientific literature for responses to salt deposition for the plant species actually occurring on and near the LNP. The plant species considered in the scientific literature review on salt drift presented in the License Renewal GEIS (NRC057) serve as indicator species. Using responses of indicator species to estimate the possible response of other species to exposure to stressors such as salt is a common practice in ecotoxicology (the study of how plant and animal species respond to exposure to chemical stressors). As shown in Table 4-2 of the License Renewal GEIS, corn is one of the most sensitive species with respect to salt drift. NRC057 at 4-37. Use of corn as one of the indicator species for estimating the response of vegetation to salt drift is therefore consistent with the conservative approach used by the Staff in the FEIS to assess potential salt drift impacts. NRC001A at 5-21.

Q79. Dr. Bacchus asserts in A.38 of her testimony that the FEIS conclusions regarding the effects of salt drift on vegetation rely heavily on salt drift monitoring reports for the Crystal River Energy Complex (CREC) that are not based on an adequate number of years of operational monitoring. She also contends that the FEIS conclusions rely too much on the CREC study that pertains to a coastal setting substantially different from that of the LNP. Do you agree?

A79. (JPD, LMA). No. As indicated above in A77, the analysis of potential salt drift impacts on terrestrial and wetland habitats in the FEIS relies mostly on the results of the Staff's effort to overlay the AERMOD salt deposition modeling results, which are calculated based on conservative meteorological conditions, on terrestrial vegetation maps. NRC001A at 5-20 to 5-

21. These results indicate a maximum offsite deposition rate (6.83 kg/ha/mo) that is lower than the threshold value for visible leaf damage (10 kg/ha/mo) used by NRC (NRC013 at 5.3.3.2-5), and the modeled maximum deposition rate decreases sharply with increasing distance from the proposed plant site. NRC001A at 5-20 to 5-21.

As stated in Section 5.3.1 of the FEIS, the CREC report includes monitoring data that was collected over a 14-year period and "vegetation was assessed monthly and quarterly for plant damage that could be attributed to salt-induced injury." Id. at 5-23. Results of the monitoring were reported to the FDEP, and based on the findings of the multi-year monitoring the FDEP "terminated the requirement for salt-drift monitoring at the CREC in 1996." Id. The FDEP believed that 14 years of operational monitoring of salt drift was adequate.

As described in A77 above, although the landscape settings are different (coastal versus inland) the LNP site shares many of the same plant communities that are present on the CREC site. CITE. Specifically, the CREC monitoring report indicated that minor salt drift damage to individual plants included some species that are present at both sites (including but not limited to red maple, live oak, sweetgum, wax myrtle, Dahoon holly, and grape vine). NRC001A at 5-23. As stated in A14, the CREC report provided the Staff with "the geographically closest recorded observations of possible salt drift injury to vegetation relative to the LNP site," and the Staff only used it as supplemental evidence in our analysis. Staff Testimony at A204.

Q80. Dr. Bacchus asserts in A.38 of her testimony that the Staff's analysis of cumulative impacts from salt drift in the FEIS does not consider the effects on vegetation from introduction to the soil of salt originating from LNP cooling tower drift. Do you agree?

A80. (JPD, LMA) No. While the analysis of cumulative impacts from salt drift in the FEIS does not specifically discuss introduction to the soil of salt originating from the LNP cooling tower drift, it does state that there would be no overlap of the CREC cooling tower drift and the

predicted LNP site cooling tower drift. NRC001B at 7-24. Furthermore, the FEIS indicates that there are no similar projects planned in the geographic area of interest that would contribute to cumulative effects of cooling tower drift. Id. The Staff did, however, consider the potential effects on vegetation from soil salinization. Section 5.3.1.1 of the FEIS discusses potential impacts on vegetation from soil salinization at the LNP site and states:

> Adverse impacts on vegetation from soil salinization are not expected to be an issue on or near the LNP site because sufficient rainfall would be received to leach salts from the predominately sandy soil profile. Mean annual precipitation for the region that includes the LNP site is approximately 53 in./yr (see Section 2.3.1.1 of the EIS); total rainfall recorded over a 1-year period (February 1, 2007 through January 31, 2008) at the LNP meteorological monitoring station was 43.0 in. (PEF 2009a). A review of salt deposition effects on soils by the NRC concluded that potential soil salinization problems at energy facilities are generally limited to arid regions with lower rainfall (NRC 1996). In humid environments such as Levy County, these effects were found to be transitory to undetectable. The projected changes in precipitation patterns for southwest Florida over the next 70 to 80 years, as reported by the U. S. Global Change Research Program (GCRP 2009), are for a decline in rainfall of between 20 to 25 percent in the spring and an increase of between 15 to 20 percent in the fall. Precipitation changes within these ranges would not be expected to alter the conclusion regarding the effects of soil salinization on vegetation (i.e., adverse effects would remain unlikely).

NRC001A at 5-22. The Staff determined that because of the region's mean annual precipitation of approximately 53 in./yr (id.) and because no current or reasonably foreseeable projects involving cooling towers are planned in the geographic area of interest (id. at 7-24), adverse cumulative impacts to vegetation from soil salinization would be unlikely.

C. HYDROLOGICAL IMPACTS FROM SALT DRIFT AND DEPOSITION

Q81. Do you agree with Dr. Bacchus' testimony at A.33 referencing FEIS at 5-24 that "this FEIS statement is misleading because it discusses increases in salt concentrations based on average precipitation, ignoring significantly greater salt concentrations that will result during the dry season and periods of drought, and immediately following the dry season and droughts when the first rain events flush the concentrated salt deposited via salt drift into surrounding Outstanding Florida Waters and other surface waters and the aquifer?"

A81. (RP, DOB, LWV, VRV) No. The rainfall and runoff event following a dry period of salt accumulation postulated by Dr. Bacchus is very similar to what the FEIS analyzed. A more detailed explanation of the Staff's runoff salinity estimation is provided in Staff's Testimony at A198-200.

Q82. In her testimony at A.33, Dr. Bacchus contends that the FEIS discusses increases in salt concentrations based on average precipitation. Dr. Bacchus goes on to describe the variability of rainfall data in Levy County. Do you agree with Dr. Bacchus' testimony at A.33 related to variability of rainfall in Levy County? How did the Staff account for the rainfall variability in its analysis presented in the FEIS?

A82. (RP, DOB, LWV, VRV) The Staff agrees with Dr. Bacchus regarding variability of rainfall at and around the LNP site. In addition to county-level data published by the SWFWMD (and referenced by Dr. Bacchus in her testimony at A.33), the Staff also analyzed precipitation data for 13 stations available from the Southeast Regional Climate Center (SERCC). NRC001A at 2-21. The Staff's analysis in the FEIS accounted for variability in rainfall. Because of the variability in rainfall near the LNP site, the Staff analyzed dry periods in the monthly precipitation data from SERCC for several climate stations near the LNP site to perform the runoff salinity estimate in a conservative manner. As described in the FEIS (id. at 5-24) and the Staff's Testimony at A198-200, the Staff's analysis uses a dry period during which salt accumulates followed by a low rainfall event to conservatively estimate runoff salinity.

Q83. Do you agree with Dr Bacchus' testimony at A.38 related to "…improper assessment of hydroecological impacts from salt drift and salt deposition during construction...?"

A83. (RP, DOB, LWV, VRV) No. Because the LNP units will not be operational during construction, they would not contribute to salt drift or deposition.

Q84. Do you agree with Dr Bacchus' testimony at A.38 that "[i]ndirect contamination of the aquifer with salt from aerial deposition also will occur via infiltration of the deposited salt following rainfall events"?

A84. (RP, DOB, LWV, VRV) No. As stated in the FEIS, the conservatively estimated runoff salinity from onsite and offsite areas is 0.026 ppt. NRC001A at 5-24, 5-16. Staff's Testimony at A198-200 provides more details of the runoff salinity analysis. If the water falling as precipitation and dissolving the accumulated salt were to infiltrate instead of running off, it would essentially add freshwater (i.e., a salinity of 0.026 ppt) to the groundwater because the commonly used threshold for brackish water is 1 ppt, more than 38 times the potential salinity of infiltrating water. Therefore, Dr. Bacchus' claim regarding indirect contamination of the aquifer is incorrect.

Q85. Does this conclude your testimony?

A85. (All) Yes.

July 31, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
	)	
PROGRESS ENERGY FLORIDA, INC.	)	Docket Nos. 52-029 and 52-030
	)	
	)	
(Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2)	)	

AFFIDAVIT OF ANN L. MIRACLE
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Ann L. Miracle, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

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Executed at Richland, WA
this 31st day of July 2012

July 31, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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AFFIDAVIT OF MICHAEL T. MASNIK
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Michael T. Masnik, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

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Executed at Rockville, MD
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AFFIDAVIT OF J. PEYTON DOUB
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, J. Peyton Doub, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

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AFFIDAVIT OF LARA M. ASTON
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Lara M. Aston, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

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July 31, 2012

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AFFIDAVIT OF DAN O. BARNHURST
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Dan O. Barnhurst, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

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this 31st day of July 2012

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AFFIDAVIT OF LANCE W. VAIL
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Lance W. Vail, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

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this 31st day of June 2012

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AFFIDAVIT OF RAJIV PRASAD
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Rajiv Prasad, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

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AFFIDAVIT OF VINCE R. VERMEUL
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Vince R. Vermeul, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

Vince R. Vermeul
Sr. Research Engineer
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Executed at Moab, UT
this 31st day of July 2012

July 13, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
	)	
PROGRESS ENERGY FLORIDA, INC.	)	Docket Nos. 52-029 and 52-030
	)	
	)	
(Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2)	)	

AFFIDAVIT OF KEVIN R. QUINLAN
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Kevin R. Quinlan, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

Kevin R. Quinlan
Physical Scientist
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Executed at Rockville, MD
this 13th day of July 2012

July 31, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
	)	
PROGRESS ENERGY FLORIDA, INC.	)	Docket Nos. 52-029 and 52-030
	)	
	)	
(Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2)	)	

AFFIDAVIT OF LARRY K. BERG
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Larry K. Berg, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

Larry K. Berg, Ph.D.
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Executed at Richland, WA
this 31st day of July 2012

July 21, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
	)	
PROGRESS ENERGY FLORIDA, INC.	)	Docket Nos. 52-029 and 52-030
	)	
	)	
(Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2)	)	

AFFIDAVIT OF GERRY L. STIREWALT
CONCERNING PREFILED REBUTTAL TESTIMONY ON CONTENTION 4A

I, Gerry L. Stirewalt, do declare under penalty of perjury that my statements in the "Prefiled Rebuttal Testimony of Ann L. Miracle, Michael T. Masnik, J. Peyton Doub, Lara M. Aston, Dan O. Barnhurst, Lance W. Vail, Rajiv Prasad, Vince R. Vermeul, Kevin R. Quinlan, Larry K. Berg, and Gerry L. Stirewalt Concerning Contention 4A" and my statement of professional qualifications (Exhibit NRC070) are true and correct to the best of my knowledge and belief.

Executed in Accord with 10 CFR § 2.304(d)

Gerry L. Stirewalt
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Executed at Rockville, MD
this 21st day of July 2012