UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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| In the Matter of | ) | |
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| PROGRESS ENERGY FLORIDA, INC. | ) | Docket Nos. 52-029 and 52-030 |
| | ) | |
| (Levy County Nuclear Power Plant, Units 1 and 2 | ) | ASLBP No. 09-879-050COL-BD01 |
| | ) | |

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 CONTENTION4A

**Q1. Please state your names, occupations, and by whom are you employed.**[1]

A1(a). (MAS) My name is Ms. Mallecia A. Sutton (MAS). I am employed as a Project Manager in Environmental Projects Branch 1, in the Division of New Reactor Licensing in the Office of New Reactors ("NRO"), U.S. Nuclear Commission ("NRC"). I am the NRC Project Manager for the environmental review associated with the application submitted on July 28, 2008, by Progress Energy Florida, Inc. ("PEF" or "Applicant") for Combined Licenses ("COLs") at the Levy Nuclear Plant ("LNP") Units 1 and 2 site in Levy County, Florida. A statement of my professional qualifications is attached as exhibit NRC002.

A1(b). (ALM) My name is Dr. Ann L. Miracle (ALM). I am employed as a Scientist in the Environmental Assessment Group, Earth Systems Science Division, Energy and Environment Directorate of the Pacific Northwest National Laboratory ("PNNL"). I am a technical reviewer for PNNL's contract with the NRC on aquatic resource issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. I am also the PNNL team lead for the environmental review. A statement of my professional qualifications is attached as exhibit NRC003.

[1] The initials before each answer indicate the portions for which each witness is responsible.

A1(c). (MTM) My name is Dr. Michael T. Masnik (MTM). I am employed as the Water and Ecology Team Leader in the Division of Site Safety and Environmental Analysis, NRO, NRC. I am also a technical reviewer for aquatic resource issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualifications is attached as exhibit NRC004.

A1(d). (JPD) My name is Mr. Joseph Peyton Doub (JPD). I am employed as an Environmental Scientist in the Division of Site Safety and Environmental Analysis, NRO, NRC. I am the lead technical reviewer for NRC on terrestrial ecology and wetland issues associated with the application submitted July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualification is attached as exhibit NRC005.

A1(e). (LMA) My name is Ms. Lara M. Aston (LMA). I am employed as a Scientist in the Coastal Ecosystem Research Group, Marine Sciences Laboratory, Energy and Environment Directorate of the Pacific Northwest National Laboratory ("PNNL"). I am a technical reviewer for PNNL's contract with the NRC on terrestrial and wetlands resource issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualifications is attached as exhibit NRC006.

A1(f). (DOB) My name is Mr. Dan O. Barnhurst. I am employed as a Hydrologist in the Division of Site Safety and Environmental Analysis, NRO, NRC. I am a technical reviewer for hydrological alterations, water use, and water quality issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualifications is attached hereto as exhibit NRC007.

A1(g). (LWV) My name is Mr. Lance W. Vail (LWV). I am employed as a Senior Research Engineer in the Hydrology Group, Environmental Technology Division, Energy and Environment Directorate of PNNL. I am a technical reviewer for PNNL's contract with the NRC on hydrological alterations, water use, and water quality issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualification is attached as exhibit NRC008.

A1(h). (RP) My name is Dr. Rajiv Prasad (RP). I am employed as a Scientist in the Hydrology Group, Environmental Technology Division, Energy and Environment Directorate of PNNL. I am a technical reviewer for PNNL's contract with the NRC on surface water alterations, water use, and water quality issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualifications is attached as exhibit NRC009.

A1(i). (VRV) My name is Mr. Vince R. Vermeul (VRV). I am employed as a Senior Research Engineer in the Environmental Systems Group, Earth Systems Science Division, Energy and Environment Directorate of PNNL. I am a technical reviewer for PNNL's contract with the NRC on groundwater alterations, use, and quality issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualifications is attached as exhibit NRC010.

A1(j). (KRQ) My name is Mr. Kevin R. Quinlan. I am employed as a Physical Scientist in the Division of Site Safety and Environmental Analysis, NRO, NRC. I am responsible for the technical review of the meteorology and air quality resource issues associated with the application submitted on July 28, 2008, by PEF for COLs at the LNP site in Levy County, Florida. A statement of my professional qualifications is attached as exhibit NRC011.

A1(k). (LKB) My name is Dr. Larry K. Berg. I am employed as a Research Scientist in the Atmospheric Chemistry and Meteorology Technical Group, Atmospheric Sciences and Global Change Division, Energy Directorate of PNNL. I am a technical reviewer for PNNL's contract with the NRC on meteorology and air quality resource issues associated with the application submitted on July 28, 2008, by PEF for COLS at the LNP site in Levy County, Florida. A statement of my professional qualifications is attached as exhibit NRC012.

**Q2. Please describe your responsibilities in relation to this review.**

A2(a). (MAS) As the NRC Project Manager for the environmental review of Progress

Energy Florida, Inc. ("PEF" or "Applicant") application for combined construction permits and operating licenses (combined licenses or COLs) at the Levy Nuclear Plant (LNP) site in Levy County, Florida, when I joined the project I was responsible , with the prior project manager, for overseeing the completion of NUREG-1941, the Final Environmental Impact Statement for Combined Licenses (COLs) for the Levy Nuclear Plant Units 1 and 2" dated April 2012 ("FEIS"). NRC001.

A2(b). (ALM) In my capacity as the aquatic biologist assigned to the Levy COL review, I wrote the descriptive information provided in Sections 2.4.2 (Aquatic Ecology), 4.3.2 (Aquatic Impacts from Construction), 5.3 (Aquatic Impacts from Operation), 7.3.2 (Aquatic Ecosystems-Cumulative Impacts), and 9.3 (Alternative Sites) of the FEIS. I worked under the technical oversight of Dr. Michael T. Masnik of the NRC. I also assisted with the final preparation of NUREG-1941.

A2(c). (MTM) As the aquatic ecology technical reviewer assigned to the Levy COL review, I provided technical oversight for the aquatic ecology review during the preparation of Sections 2.4, 4.3, 5.3, 7.3, and 9.3 of the FEIS.

A2(d). (JPD) As part of my official duties as the lead terrestrial ecology technical reviewer assigned to the Levy COL review, I was responsible for preparing the terrestrial ecology and wetlands portions of Sections 2.4, 4.3, 5.3, 7.3 and 9.3 of the FEIS.

A2(e). (LMA) In my capacity as a terrestrial and wetlands ecologist assigned to the Levy COL review, I contributed to Sections 2.4.1 (Terrestrial Ecology), 4.3.1 (Terrestrial and Wetlands Impacts from Construction), 5.3 (Terrestrial and Wetlands Impacts from Operation), 7.3 (Terrestrial and Wetlands Ecosystems- Cumulative Impacts), and 9.3 (Alternative Sites) of the FEIS.

A2(f). (DOB) In my duties as a hydrological technical reviewer assigned to the Levy COL review, I provided technical oversight for Sections 2.3 (Water), 4.2 (Water-Related Impacts from Construction), 5.2 (Water-Related Impacts from Operation), 7.2 (Water Use and Quality -

Cumulative Impacts), 9.3 (Alternative Sites) and 10.4 (Irreversible Commitments of Resources) of the FEIS.

A2(g). (LWV) In my responsibility as a hydrology technical reviewer assigned to the Levy COLs review, I am responsible for the analysis related to surface water, groundwater, and plant water systems documented in Sections 2.3, 4.2, 5.2, 7.2, 9.3 and 9.4 (System Design) of the FEIS.

A2(h). (RP) In my responsibility as the surface water hydrology technical reviewer assigned to the Levy COLs review, I am responsible for the analysis related to surface water and plant water systems documented in Sections 2.3, 4.2, 5.2, 7.2, 9.3 and 9.4 of the FEIS.

A2(i). (VRV) In my duties as the groundwater hydrology technical reviewer assigned to the Levy COLs review, I am responsible for the analysis related to groundwater in Sections 2.3, 4.2, 5.2, and 7.2 of the FEIS.

A2(j). (KRQ) In my responsibility as a meteorology and air quality technical reviewer, I provided technical oversight for meteorology and air quality during the preparation of Sections 2.9 (Meteorology and Air Quality), 4.7 (Meteorology and Air Quality Impacts from Construction), 5.7 (Meteorology and Air Quality from Operation), 7.6 (Air Quality – Cumulative Impacts), 9.3, and 10.4.

A2(k). (LKB) In my duties as a meteorology and air quality technical reviewer assigned to the Levy COLs review, I am responsible for the analysis related to meteorology and air quality documented in Sections 2.9, 4.7, 5.7, 7.6, 9.3 and 10.4.

**Q3. Please describe your professional qualifications as they relate to this testimony.**

A3(a). (ALM) I have extensive knowledge of this region of Florida from almost 6 years of graduate study, and 4 years of employment with the Florida Marine Research Institute (now part of FDEP) and the University of South Florida. While attending the University of Florida in Gainesville, I studied Gulf sturgeon in the Suwannee River for my Master's thesis, and have cave and cavern diving experience in the springs and caves that are common across northern Florida. As a resident of St. Petersburg, I worked for the Florida Marine Research Institute conducting research and population surveys for important commercial and recreational aquatic species such as stone crab, blue crab, snook, and redfish. I completed my doctorate at the University of South Florida in Tampa and was involved in research to examine population dynamics and development of cartilaginous fish, including sharks and skates in Gulf coastal waters.

A3(b). (MTM) I have been assessing the impact of nuclear power on aquatic biota for over 35 years, and during this time have been involved in periodic environmental assessments at all three of Florida's nuclear power plant sites.. In the 1990s I was the lead technical reviewer for an assessment of impact from CREC Unit 3 operation on Federally protected sea turtles. I worked closely with National Marine Fisheries Service Southeastern Regional Office (NMFS SERO) to develop an incidental take statement and terms and conditions that was protective of the species affected by Crystal River Energy Ccmplex (CREC) Unit 3 operation. I was the Environmental Project Manager for the Saint Lucie Nuclear Plant Units 1 and 2 license renewal effort that culminated in the renewal of its license in 2003. I have had a long association of over 25 years assessing impacts to marine threatened and endangered species at the St. Lucie station working closely with NMFS in protecting listed species. I also have had a continuing involvement in the assessment of impact to American crocodiles (*Crocodylus acutus*) for over 30 years at the Turkey Point Nuclear Plant Units 3 and 4 near Homestead, Florida. I was appointed the Environmental Project Manager for the Turkey Point license renewal effort in 2001 and issued the FSEIS for that project in 2002. I have had extensive experience in assessing impact to marine and estuarine ecosystems along the east coast and have provided assessments for a number of plants from Maine to Florida. I have been involved with the assessment of impact to aquatic ecology related to the building and operation of the LNP for over 5 years beginning with the August 2007 pre-application audit of the LNP site and visiting the proposed alternative sites. I have a B.S. in Conservation from Cornell University and a M.S. and Ph.D. in Zoology with an emphasis on Ichthyology and impact assessment to aquatic resources from Virginia Polytechnic Institute and State University.

A3(c). (JPD) I am a Professional Wetland Scientist (PWS) and Certified Environmental Professional (CEP) with over 25 years of professional experience in mapping, characterizing, and evaluating possible impacts to terrestrial habitats, especially wetlands. My work has encompassed sites throughout most of the mid-Atlantic and southeastern states, including Florida. In 1995 and 1996, I served as the lead wetland scientist on a project team contracted to map land use and land cover throughout the Suwannee River Water Management District situated north of the LNP site. In 2003, I performed a wetland delineation, using both Federal and Florida state wetland delineation methodologies, of a roughly 100-acre contaminated Installation Restoration site on the former Naval Air Station Cecil Field near Jacksonville. I assessed the functions and values of six wetland occurrences on the site using Florida's Wetland Rapid Assessment Procedure (WRAP) and completed a Joint Permit Application for wetland disturbances necessary to clean up the site. Also in 2003, I contributed wetlands expertise to a team contracted to select a route for a proposed Florida Power and Light transmission line crossing Broward County. In 2002, I was the lead scientist for an environmental baseline survey (EBS) report documenting existing environmental conditions on the former Harry S. Truman Animal Import Center in Key West. In 1993, I was the lead biologist on an environmental assessment (EA) prepared by the U.S. Department of Energy to consolidate non-nuclear manufacturing activities, including those formerly conducted at the Pinellas Plant in Pinellas County, to centralized locations. I earned a BS in the plant sciences from the Cornell University School of Agriculture and Life Sciences in 1982 and an MS in plant physiology from the University of California at Davis in 1984.

A3(d). (LMA) I am employed as a research scientist at Pacific Northwest National Laboratory's Marine Sciences Lab in the Coastal Ecosystem Research group and I have over

12 years of professional experience in ecological assessment, characterization, and restoration of terrestrial and wetland systems. My education includes a bachelor's degree in Environmental Science and a master's degree in Environmental Science with a focus on restoration ecology. Since 2008, I have been the Principal contractor terrestrial and wetlands ecologist for several COLs in the Southeast Atlantic region of the U.S. in support of the siting and/or operation of new nuclear reactors for the U.S. Nuclear Regulatory Commission (NRC). I have also served as Technical Reviewer and lead author of terrestrial and wetlands ecology sections of Environmental Impact Statements (EISs) and Biological Assessments.

A3(e). (DOB) I am a licensed Professional Geologist (PG) with around 12 years of experience in hydrogeological areas including hydrogeochemistry; aquifer characterization; numerical modeling; and design of sampling plans monitoring well networks and remediation systems. My bachelor's degree is in Geology with an environmental emphasis and my graduate degree is in Geology. My graduate work centered on determination of chemical evolution, flow directions, recharge timing and flow rates of groundwater within a western carbonate aquifer system. Between 2003 and 2008 I was employed first as a Geologist and then a Senior Geologist at the DOE Savannah River Site (SRS) in Aiken, SC. At SRS, I worked as part of a team that characterized the long term impact of the operation of multiple reactors on groundwater quality and quantity through installation, sampling and monitoring of wells as well as modeling of pumping impacts on groundwater levels, flow directions and discharge rates. Since coming to the NRC in 2008 I have provided technical oversight to impact analyses of reactor construction and operation on both ground and surface water quantity and quality for EISs at sites in the southeast and Florida.

A3(f). (LWV) The focus of my research over the past 30 years as a Research Engineer in the Hydrology Group of Pacific Northwest National Laboratory has related to the nexus of water resources and energy resources. Through the development and application of numerical models of surface water and groundwater processes, I have assessed the impacts of energy systems on water and the impact of water on energy systems. Over the years, my research has involved a broad range of topics including hydropower, thermal storage in aquifers, acid rain impacts on water quality, and climate change impacts to the water resources. Often this research has provided a characterization of hydrological alterations required by ecologists to support their assessment of ecological impacts. For the NRC, I have been involved in a variety of research and regulatory reviews, including updates to hydrology-related guidance documents.

A3(g). (RP) I have been employed as a postdoctoral research associate or a scientist in the Hydrology Group of the Pacific Northwest National Laboratory for the last 10 years. My education includes a bachelor's degree in Civil Engineering, a master's degree with focus on water resources and hydraulics, and a doctoral degree with focus on hydrologic processes and environmental engineering. My research has focused on understanding the workings of the hydrologic systems, variability of snow processes, characterization of hydrologic conditions for aquatic habitat restoration, effects of climate change, and application of hydrologic principles to further NRC Staff guidance. Starting in 2003, I worked on the first four early site permit reviews (North Anna, Clinton, Grand Gulf, and Vogtle) both on the safety as well as the environmental aspects of the review. I was the lead hydrologist for the South Texas Project combined license environmental review where I performed impact assessments related to surface water use, inter-basin water transfers, surface water quality, intake and discharge systems, cooling system, thermal plume, and climate change. On these reviews, I have closely worked with terrestrial and aquatic ecologists to provide them hydrologic characterization needs for their ecological impact assessments.

A3(h). (VRV) I have over 22 years of experience as a research engineer in the Environmental Systems Group of Pacific Northwest National Laboratory, with a focus on hydrologic and geochemical characterization, environmental monitoring, interpretation of hydrologic testing datasets, and developing/demonstrating groundwater remediation technologies. My education includes a bachelor's degree in Agricultural Engineering and a master's degree in Civil (Environmental) Engineering, with an emphasis in groundwater hydrology and numerical modeling of groundwater systems. Over the years, I have been involved in numerous remedial investigations and the development/deployment of groundwater remediation technologies at Department of Energy, Department of Defense, and Environmental Protection Agency sites located across the country. Projects specifically related to energy resources have included environmental monitoring of oil shale development, tracer methods for engineered geothermal systems, and environmental monitoring of carbon capture and sequestration in deep geologic formations. This experience has provided many direct examples of geohydrologic and geochemical heterogeneity in the subsurface, and an appreciation of the fact that these heterogeneities must be considered and accounted for when developing site conceptual models. I am also experienced in the development and interpretation of regional and local-scale groundwater flow and contaminant transport models, including both forward and inverse modeling approaches.

A3(i). (KRQ) I have been employed as a Physical Scientist (Meteorologist) at the NRC for four years in the Office of New Reactors. Before working at the NRC I was a graduate student and research assistant at the University of Alabama in Huntsville. During my time at the NRC I have been the primary meteorological technical reviewer on 6 Combined License applications and 2 Early Site Permit applications. In addition to the independent safety confirmatory review performed for each of the COL and ESP applications, I have also provided technical oversight for the meteorology and air quality review during the preparation of the related EIS sections. I have experience working with and reviewing information pertaining to regional and local climatology, onsite meteorological monitoring programs, and atmospheric dispersion estimates.

A3(j). (LKB) I have over 10 years of experience as a Meteorologist in the Atmospheric Chemistry and Meteorology Group of Pacific Northwest National Laboratory and I am an

Adjunct Professor in the Department of Atmospheric and Oceanic Sciences at the University of Wisconsin-Madison. My work at PNNL has focused on a wide range of issues related to the planetary boundary layer, which generally consists of the bottom kilometer of the atmosphere. I was part of the team that prepared the EIS for the V.C. Summer Units 2 and 3 combined licenses that were granted in 2012. My efforts related to the preparation of that EIS were focused on the meteorology and air quality sections. Other relevant projects that I have been involved in include studies of the dispersion of pollutants in urban environments, studies related to the large- and small-scale properties of low-altitude clouds, and the representation of turbulence in computer models used to simulate the weather and climate. I have served as the primary or co-primary investigator on a number of multi-agency field studies, including the Cumulus Humilis Aerosol Processing Study (CHAPS) and the ongoing Two-Column Aerosol Project (TCAP). CHAPS was a multi-aircraft field study designed to investigate interactions between clouds and particles in the atmosphere. TCAP is designed to investigate changes in the chemical and optical properties of particles downwind of North America. Prior to my employment at PNNL I attended graduate school, completing both an M.S. and Ph.D. degrees in Atmospheric Sciences, at the University of British Columbia.

**Q4. What is the purpose of this testimony?**

A4. (ALL). The purpose of this testimony is to present the NRC Staff's view with respect to Contention 4A. Because of the interrelationship among the different portions of Contention 4A, we present our testimony below in one document.

**Q5. Are you familiar with Contention 4A?**

A5. (ALL) Yes. Contention 4A, submitted in this proceeding by the Nuclear Information and Resource Service, the Ecology Party of Florida, and the Green Party of Florida (collectively, “Intervenors”[2]), as restated by the Atomic Safety and Licensing Board (“Board” )in its February 2, 2011, Memorandum and Order, alleges:

> The Draft Environmental Impact Statement (DEIS) fails to comply with 10 C.F.R. Part 51 and the National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility:
>
> A. Impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with dewatering, specifically:
>
> 1. Impacts resulting from active and passive dewatering;
> 2. Impacts resulting from the connection of the site to the underlying Floridan aquifer system;
> 3. Impacts on Outstanding Florida Waters such as the Withlacoochee and Waccasassa Rivers;
> 4. Impacts on water quality and the aquatic environment due to alterations and increases in nutrient concentrations caused by the removal of water; and
> 5. Impacts on water quality and the aquatic environment due to increased nutrients resulting from destructive wildfires resulting from dewatering.
>
> B. Impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with salt drift and salt deposition resulting from cooling towers (that use salt water) being situated in an inland, freshwater wetland area of the LNP site.
>
> C. As a result of the omissions and inadequacies described above, the Draft Environmental Impact Statement also failed to adequately identify, and inappropriately characterizes as SMALL, the proposed project’s zone of:
>
> 1. Environmental impacts,
> 2. Impact on Federally listed species,
> 3. Irreversible and irretrievable environmental impacts, and
> 4. Appropriate mitigation measures.

**Q6. Are you familiar with the supporting documentation filed by the Intervenors to support Contention 4A?**

A6. (All) Yes. We are familiar with the contention and the bases, including the associated declarations, submitted in support of the Intervenors’ Petition to Intervene and Request for Hearing by the Green Party of Florida, the Ecology Party of Florida, and Nuclear Information and Resource Service dated February 6, 2009 and in the Intervenors’ Motion for

[2] After admission of Contention 4A the Ecology Party of Florida withdrew from this proceeding. Therefore, they are not included in the term “Intervenors” as it is used throughout this testimony.”

Leave to Amend Contention 4, filed on November 11, 2010. We are also familiar with the Intervenors' declarations and bases in their Answer to Progress Energy Florida Motion to Dismiss as Moot the Aspects of Contention 4 Related to Active Dewatering During Levy County, Units 1 and 2 Nuclear Operations, and the Intervernors' Response to the Applicant's Motion for Summary Disposition of Portions of Contention 4, both dated November 15, 2010, the Intervenors' Reply to the Staff Answer to Amend Contention 4, dated December 17, 2010, and the Intervenors' Reply to PEF Answer to Amended Contention 4, dated December 17, 2010.

**Q7 Are you familiar with any other documents filed in this case?**

A7. (All) Yes. We are familiar with the Board's Orders in this case, including the Memorandum and Order (Rulings on Standing, Contention Admissibility, Motion to File New Contention, and Selection of Hearing Procedure) dated July 8, 2009, the Memorandum and Order (Admitting Contention 4A), dated February 2, 2011, the Memorandum and Order (Denying Motion to Dismiss Portions of Contention 4 as Moot), dated February 2, 2011, and the Memorandum and Order (Denying Motion for Summary Disposition of Aspects of Contention 4) dated February 2, 2011.

**Q8. Are there any other documents that you relied on to create this testimony?**

A8. (All) Yes, we relied on the following exhibits in creating this testimony. The exhibits are discussed in more depth in the testimony.

- NUREG-1941 Environmental Impact Statement for Combined Licenses (COLs) for Levy Nuclear Plant Units 1 and 2, Final Report (April, 2012) Volumes 1, 2 and 3. (NRC001).
- NUREG-1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants ("ESRP") (2000) Sections: 2.3, 2.4, 2.6, 2.7, 2.8, 3.3, 3.4, 4.2, 4.3, 5.2, 5.10, 6.3, 6.5, 10.1, and 10.2 (NRC013).
- NUREG-1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants ("ESRP") Draft Rev. 1 (2007) Sections: 4.7, 5.3, 5.11, and 9.4 (NRC014).
- NUREG-0800 Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, ("SRP") Rev. 3 (2007) Sections: 2.4.1, and 2.4.13 (NRC015).

- Application for Combined License for Levy Nuclear Plant, Units 1 and 2, Part 2, Final Safety Analysis Report, Revision 3, (2012) Section 2.5 (NRC016).

- Exhibit created by Staff showing four maps and figures of the region around the LNP site and focusing on specific features discussed in the testimony (NRC017).

- Excerpts from U.S. Geological Survey (USGS): Ground Water Atlas of the United States: Alabama, Florida, Georgia, and South Carolina HA 730-G. Ed. J.A. Miller, Reston, Virginia (1990) (NRC018).

- Excerpts from Randazzo, A.F. and D. Jones, editors: The Geology of Florida. University Press of Florida, Gainesville, Florida (1997) (NRC019).

- Excerpts from Miller, James A., Hydrogeologic Framework of the Floridan Aquifer System in Florida, and in Parts of Georgia, Alabama and South Carolina. USGS Professional Paper 1403-B, Washington, D.C. (1986) (NRC020).

- Levy Nuclear Plant Units 1 and 2 COL Application, Part 3, Environmental Report – Combined License Stage, Revision 1 (2009) Excerpts from Section 2.4 and Sections 4.1 and 5.3 (NRC021).

- Excerpts from letter from Garry Miller, Progress Energy Florida, Inc. (PEF), to NRC, dated July 29, 2009, regarding Supplement 3 to Response to Request for Additional Information Regarding the Environmental Review (NRC022).

- Letter from John Elnitsky, PEF, to NRC, dated December 14, 2009, regarding Response to Supplemental Request for Additional Information Regarding the Environmental Review (NRC023). The technical memorandum from CH2M Hill attached to this letter is exhibit PEF210.

- Southwest Florida Water Management District (SWFWMD), Environmental Resource Permitting Information Manual, Part D: Project Design Aids. West Palm Beach, Florida (1996) (NRC024).

- SWFWMD, Environmental Resource Permitting Information Manual, Part B: Basis of Review (December 29, 2011) (NRC025).

- Florida Department of Environmental Protection (FDEP), Levy Nuclear Power Plant Units 1 and 2, Progress Energy Florida, Proposed Conditions of Certification, Plant and Associated Facilities and Transmission Lines. PA08-51, Tallahassee, Florida (as amended on January 25, 2011) (PEF005).

- Florida Department of Natural Resources (FDNR), St. Martins Marsh Aquatic Preserve Management Plan. Tallahassee, Florida (1987) (NRC027).

- Estevez, E.D. and M.A. Marshall. 1993 Summary Report for: Crystal River 3 Year NPDES Monitoring Project. Mote Marine Laboratory, Sarasota, Florida (1993) (NRC028).

- Estevez, E.D. and M.A. Marshall. 1994 Summary Report for: Crystal River 3 Year

NPDES Monitoring Project. Mote Marine Laboratory, Sarasota, Florida (1994) (NRC029).

- Estevez, E.D. and M.A. Marshall. 1995 Summary Report for: Crystal River 3 Year NPDES Monitoring Project. Mote Marine Laboratory, Sarasota, Florida (1995) (NRC030).

- Letter from B.L. Mozafari, National Marine Fisheries Service to D. Young, "Crystal River Unit 3 – Section 7 Consultation under the Endangered Species Act Regarding Sea Turtles at the Crystal River Energy Complex (Sept. 19, 2002) (NRC031).

- National Marine Fisheries Sservice ("NMFS"), Sea Turtle Strandings and Salvage Network (STSSN) Reports (2009) (NRC032).

- Eaton, C., E. McMichael, B. Witherington, A. Foley, R. Hardy, and A. Meylan, In-water Sea Turtle Monitoring and Research in Florida: Review and Recommendations. National Oceanic and Atmospheric Association (NOAA) Technical Memorandum NMFS-OPR-38, Silver Spring, Maryland (2008) (NRC033).

- Fish and Wildlife Service (FWS), West Indian Manatee (*Trichechus manatus*): 5-yr review: Summary and Evaluation. Jacksonville Ecological Services Office, Boqueron, Puerto Rico (2007) (NRC034).

- Florida Fish and Wildlife Conservation Commission (FFWCC), Basic Recreational Saltwater Fishing Regulations. Tallahassee, Florida (2009). (NRC035).

- FFWCC, 2008 Annual Landings Summary: Edited Landings Data Through Batch 1015 (Closed 12/22/2008). Marine Fisheries Information System, Tallahassee, Florida (2009) (NRC036).

- Excerpts from Reisman, J., and G. Frisbie: Calculating realistic PM10 emissions from cooling towers. *Environmental Progress*, 21, (2002) (NRC037).

- Staff created exhibit showing a comparison of atmospheric conditions at Gainesville, FL and the LNP site. This graph was created by using atmospheric conditions from the National Oceanographic and Atmospheric Administration, 2008 National Climatic Data Center, Climate Data website and comparing them to data from the LNP site. (NRC038).

- Letter from J. Scarola, Progress Energy Carolinas, Inc. (PEC) to NRC, "Supplemental Meteorological Data in Support of Combined License Application for Levy Nuclear Power Plants Units 1 and 2 NRC Project Number 756." (July 28, 2008) (NRC039).

- Letter from G.D. Miller, PEC, to NRC "Supplemental Meteorological Data in Support of Combined License Application – Second Year Data." (Mar. 17, 2009) (NRC040).

- Mortellaro, S., S. Krupa, L. Fink and J. VanArman, Literature Review on the Effects of Groundwater Drawdowns on Isolated Wetlands, South Florida Water Management District, West Palm, Florida (1995) (NRC041).

- CH2M HILL, Aquatic Ecology Sampling Report Levy Nuclear Plant. 338884-TMEM-087, Revision 1, Denver, Colorado (2009) (NRC042).

- Excerpts from Stone and Webster Engineering Corporation, Crystal River 316 Studies, Final Report,Stoughton, Massachusetts (1985) (NRC043).

- Gosselink, J., Tidal Marshes: The Boundary Between Land and Ocean. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. (1980) (NRC044).

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- Mattson, R.A., T.K. Frazer, J. Hale, S. Blitch, and L. Ahijevych. “Florida Big Bend.” In Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002. L. Handley, D. Altsman, and R. DeMay, editors, Scientific Investigations Report 2006-5287 and U.S. Environmental Protection Agency 855-R-04-003, U.S. Geological Survey, Reston, Virginia (2007) (NRC046).

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**Q9. Please describe how you prepared for this testimony.**

A9. (ALL) The contention challenges the adequacy of our analysis presented in the FEIS. Our testimony therefore focuses on the Staff analysis documented in the FEIS.

**Q10. How did the NRC's definition of "construction" in 10 C.F.R. 51.45(c) affect your review?**

A10. (All) As discussed in the introduction to Chapter 4 of the FEIS, the NRC's authority related to building new nuclear units is limited to "construction activities that have a reasonable nexus to radiological health and safety and/or common defense and security" NRC001A at 4-1. The NRC has defined "construction" according to the bounds of its regulatory authority. Id. Many of the activities required to build a nuclear power plant do not fall within the NRC's regulatory authority and, therefore, are not construction as defined by the NRC. Id. Such activities are referred to as "preconstruction" activities in 10 C.F.R 51.45(c). Id. The NRC Staff evaluates the direct, indirect, and cumulative impacts of the construction activities that would be authorized with the issuance of a COL. Id. The environmental effects of preconstruction activities (e.g., clearing and grading, excavation, and erection of support buildings) are generally included as part of this FEIS in the evaluation of cumulative impacts. Id.

However, because of the collaborative effort between the NRC and the USACE in the Levy environmental review, the combined impacts of construction activities that would be authorized by the NRC with its issuance of a COL and the preconstruction activities are presented together in the FEIS in Chapter 4. When discussing activities that include both construction and preconstruction activities, the FEIS uses the term "building." For each resource area, the NRC in the FEIS also provides an impact characterization solely for construction activities that meet the NRC's definition of construction. Id. at 4-2 – 4-3. Thereafter, both the assessment of the impacts of 10 CFR 50.10(a) construction activities and the assessment of the combined impacts of construction and preconstruction are used in the description and assessment of cumulative impacts in Chapter 7. Id. at 4-2 – 4-3. For most environmental resource areas (e.g., terrestrial ecology), the impacts are not the result of either solely preconstruction or construction activities. Id. Rather, the impacts are attributable to a combination of preconstruction and construction activities. Id. Consequently, construction and preconstruction activities are described together in this testimony.

**Q11. Describe how this testimony is organized.**

A11. (ALL) This testimony is broken into 4 parts. This part, Part I, provides an introduction to each of the witnesses, provides a summary of their technical qualifications, and presents the exhibits upon which we relied to create the testimony. Part II of the testimony provides a general discussion of how we created the FEIS. Several portions of Contention 4A concern the same portion of or analysis in the FEIS. Instead of repeating this analysis for each subpart of the contention, Part II of this testimony provides relevant definitions and a fundamental explanation of the Staff's creation of the FEIS. Part III of the testimony mirrors the organization of Contention 4A and addresses in more detail how the analysis presented in Part II applies to each portion of the contention. Part IV of this testimony brings the above subparts together to present a conclusion by stating why the consequential portions of Contention 4A – Part C of the contention – are incorrect. Because of the interrelationship among the different subject matters in relation to this contention, the Staff decided to present this testimony as one whole document instead of breaking it into several pieces separated by subject matter.

# Part II - Definitions and Review Basics

(All) In Part II of this testimony, we discuss how we performed our reviews that are being challenged by Contention 4A. This explanation will then be applied to the specific aspects of the contention in Part III of the testimony. This section begins with a discussion of the hydrology analysis, including surface water and groundwater, then describes the terrestrial and aquatic ecology reviews, followed by the atmospheric review.

**Q12. What is the Staff's approach for complying with NEPA and developing the FEIS?**

A12. (MAS) The Staff followed the requirements set forth in 10 CFR Part 51 and the environmental standard review plans (ESRP) to comply with NEPA. The Staff focused on direct, indirect, and cumulative impacts to ecological resources, and acknowledges that site and offsite ecological resources will be altered. The depth of the Staff's analysis is based on the degree of likely impact to the resource area.

The hydrologists summarized their assessments in the following sections of the FEIS: Water quality is discussed in sections 2.3.3, 4.2.3, 5.2.3, and 7.2 of the FEIS. Impaired waters are discussed in Section 2.3.1.1. For both onsite and offsite areas, building and operation related water use and hydrological impacts are discussed in Sections 4.2 and 5.2, respectively. Floodplains are discussed in 4.2.1 in terms of encroachment up to the 100-year floodplain elevation above the overflow elevation, and encroachment below the overflow elevation in natural depressions including wetlands and sloughs. Floodplains were analyzed in terms of floodplain storage loss and historic basin storage.

The ecologists summarized their assessments in the following sections of the FEIS: Descriptions of resources are provided in Sections 2.4.1 and 2.4.2 of the FEIS. Building and operation effects on aquatic and terrestrial resources from dewatering and salt drift/deposition are discussed in Section 4.3 and Section 5.3 of the FEIS, respectively. Cumulative effects with incremental impacts from LNP dewatering and salt drift/deposition are described in Section 7.3 of the FEIS. The ecologists prepared biological assessments as part of NRC's responsibilities under ESA Section 7 to document potential impacts on Federally listed threatened or endangered species as a result of building and operation of the LNP site in Appendix F.

The meteorologists summarized their assessments in the following sections of the FEIS: Descriptions of climatology, air quality, and atmospheric dispersion are provided in Section 2.9 of the FEIS. Building, operation, and cumulative effects on air quality are discussed in Section 4.7, 5.7.1, 5.7.2, and 7.6 of the FEIS. Salt drift and salt deposition are discussed in Section 5.7.2 of the FEIS.

**Q13. The FEIS uses the terms SMALL, MODERATE, and LARGE; how do you define those terms?**

A13. (ALL) The terms are discussed in Chapter 1 of the FEIS and are codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. They are defined there as follows:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

# A. Hydrology Analysis

## 1. Roles and Responsibilities of Hydrologists

**Q14. Which of the sections in the FEIS related to hydrology that you were responsible for preparing are disputed in this contention?**

A14. (RP,DOB,LWV,VRV) It is the Staff's understanding that the Intervenors are disputing the impact determinations in sections 4.2.2, 4.2.3.1, 4.2.3.2, 5.2.2.1, 5.2.2.2, 5.2.3.1, 5.2.3.2, 7.2.1.1. 7.2.1.2, 7.2.2.1 and 7.2.2.2 of the FEIS.

**Q15. What Staff guidance did you refer to in making your independent assessment?**

A15. (RP,DOB,LWV,VRV) The Staff followed the ESRP (NUREG-1555). NRC013 (the 2000 version of the ESRP; NRC014 (the 2007 version of the ESRP). The Staff used the following ESRP Sections (all are version 03/2000 unless noted below):

- Sections 2.3, 2.3.1, 2.3.2, and 2.3.3: to describe the existing surface water resource at and near the LNP site that could affect the quantity and quality of water supply to the plant or be affected by building and operation of the proposed plant.
- Section 2.6: to describe the geology in the vicinity of the LNP site.
- Section 2.8: to estimate cumulative impacts of the proposed action and other past, present, and reasonably foreseeable future actions.
- Section 3.3, 3.3.1, and 3.3.2: to describe the plant water use, water consumption by the proposed units, and water treatment necessary for the plant.
- Section 3.4, 3.4.1, and 3.4.2: to describe the cooling system, its operational modes, and performance characteristics.
- Sections 4.2, 4.2.1, and 4.2.2: to describe the hydrological alterations from building the proposed plant, to estimate impacts to water resources from proposed plant use, and to estimated impacts to water quality of receiving waters.
- Section 4.7 (draft Rev 0, 07/2007): to describe and estimate cumulative impacts related to construction activities.
- Sections 5.2, 5.2.1, and 5.2.2: to describe the hydrological alterations from operations of the proposed plant, to estimate impacts to water resources from proposed plant use, and to estimated impacts to water quality of receiving waters.
- Sections 5.3, 5.3.1, and 5.3.1.1 (draft Rev 1, 07/2007): to estimate impacts from the water intake system for the proposed plant.
- Sections 5.3, 5.3.2, and 5.3.2.1: to estimate impacts from the water discharge system.
- Section 5.11 (draft Rev 0, 07/2007): to describe and estimate cumulative impacts related to operation of the LNP units.
- Section 6.3: to review hydrological monitoring.
- Section 9.4.2 (draft Rev 1, 07/2007): to review alternative circulating water systems.
- Sections 10.1 and 10.2: to describe unavoidable adverse environmental impacts and the irreversible and irretrievable commitments of resources.
- Memorandum to Brent Clayton, NRC from Jack Cushing, NRC, Providing Supplemental Staff Guidance for Cumulative Effects Analysis (April 8, 2010). This document provides supplemental guidance to the Staff on its cumulative impacts analysis associated with the proposed project when considered in the context of other past present and reasonably foreseeable future actions at the proposed site.

**Q16. What impacts determinations are associated with Hydrological Alterations (Sections 4.2.1 and 5.2.1 of the LNP FEIS)?**

A16. (RP,DOB,LWV,VRV) A hydrologic alteration is  a change in physical, topographic, or subsurface property from its existing condition because of building or operating activities; these changes may potentially affect the environment.  Examples include regrading (that would change existing surface runoff pathways), installations of intake and discharge structures (that would alter flow patterns, thermal, and salinity characteristics of waterbodies into which they are installed), placement of subsurface portions of structures (that could provide obstruction to groundwater flow patterns), and installation of production wells (that would alter groundwater flow patterns and cause drawdowns).  In accordance with Sections 4.2.1 and 5.2.1 of the ESRP, the Staff does not make impact determinations associated with hydrological alterations. NRC014 at 4.2.1-7 and 5.2.1-8 to 5.2.1-9.  The Staff makes impact determinations regarding resources.  NRC014 at 4.2.2-9 to 4.2.2-10; 4.3.1-7 to 4.3.1-9; 4.3.2-10 to 4.3.2-12; 5.2.2-9 to 5.2.2-10; 5.3.1.1-6 to 5.3.1.1-7; 5.3.1.2-8,; 5.3.3.2-5 to 5.3.2.2-7.  For instance, hydrological alterations may impact abiotic resources (e.g. water supply and water quality for potable water needs) and biotic resources (e.g. aquatic  and terrestrial biota ) and the impact determinations are made with respect to these abiotic and biotic resources.

**Q17.  How did you develop your understanding of the hydrologic environment of the proposed site?**

A17. (RP,DOB,LWV,VRV) One or more of us attended the following site visits:

1. Preapplication site visit (August 20-21, 2007) (RP)
2. Preapplication site visit (May 7-9, 2008)  (RP)
3. Environmental site audit (December 2-5, 2008)  (RP,VV)
4. Hydrology safety audit (November 3-7, 2008)  (RP,VV)
5. Supplemental site visit (April 11, 2012)  (RP,DOB).

During these tours, we observed the LNP site, the Cross Florida Barge Canal, Inglis Dam, the Old Withlacoochee River, Inglis Lock, spring discharges below the Inglis Dam and the Inglis Lock, Inglis Bypass Channel, Inglis Bypass Channel Spillway, the Lower Withlacoochee River, Lake Rousseau, Withlacoochee Bay, the Crystal River Energy Complex Intake and Discharge Canals, the Gulf of Mexico from several locations, the locations of the LNP production wells, Big and Little King Springs, the proposed location of the Tarmac King Road mine, and the Geothe National Forest. Observing these hydrologic features, discussions with the Applicant and its contractors, and our independent review of historical hydrologic data provided the basis of our understanding of the hydrologic environment.

Additionally, we reviewed the Applicant's ER and responses to 26 hydrology-related RAIs. We also reviewed publicly available historical data and studies published by Federal agencies, universities, and agencies of the State of Florida. The historical data and studies allowed us to gain an understanding of the surface water and groundwater hydrology regionally and locally around the LNP site. These data form the basis for some of the descriptions in LNP FEIS Section 2.3.

**Q18. Describe in your words what part of the hydrology analysis the contention challenges.**

A18. (RP,DOB,LWV,VRV) With respect to hydrology and water resources, the Staff understands the contention to challenge the review team's assessment that impacts to wetlands, floodplains, special aquatic sites, and other waters are SMALL from (1) dewatering associated with LNP withdrawal from the Upper Floridan aquifer and (2) salt drift and deposition from the operation of the proposed cooling system. The hydrology analysis concerning the salt drift and deposition portion of the contention is described in more detail in Part III of our testimony where we discuss Subpart B of Contention 4A.

Specifically, the dewatering-related portions of Contention 4A focus on the following portions of our analysis:

- The direct, indirect and cumulative impacts of water use during building and operation of the LNP site on the surrounding resources and connected environment;
- The magnitude of LNP groundwater withdrawal during building and operation and whether it would be large enough to result in extensive drying out of wetlands and reduction of freshwater springs which flow from the underlying Floridan aquifer system;
- Whether the impact to the Floridan aquifer would result in a reduction of the quality and quantity of water in surface water resources.
- Whether excavation, and drainage features such as wet ponds and swales will impede the natural flow of surface and groundwaters and result in "passive dewatering" of the surficial aquifers.
- The magnitude of salt deposition from salt drift generated by the proposed cooling system and the effects of this deposition on water quality.

This section of our testimony describes in detail the way we conducted our hydrology review. We also provide pertinent definitions necessary to understand our analysis regarding the hydrology-related portions of our review at issue in this case. In Part III of our testimony we apply these definitions and our review to each individual subpart of the contention.

### 2. Location and Facilities

**Q19. Where in the FEIS does the Staff describe the key features of the environment?**

A19. (ALL) FEIS Chapter 2 describes the affected environment. NRC001A at 2-1 – 2-224. FEIS Sections 2.3 and 2.4 describe the hydrological environment and the ecological environment, respectively. Id. at 2-13 – 2-41; Id. at 2-41 – 2-125.

**Q20. What are the key hydrological features that are relevant to the contention?**

A20. (RP,DOB,LWV,VRV) Both surface water and groundwater features are relevant to this contention. Large surface water bodies that are relevant to the LNP include the Gulf of Mexico, the Cross Florida Barge Canal (CFBC), the Old Withlacoochee River, the lower Withlacoochee River, the Withlacoochee River above Lake Rousseau , the Waccasassa River, and Lake Rousseau. Id. at 2-13 -- 2-16. A figure showing the location of these water-bodies is included as an exhibit. NRC017 at 1–2. The contention is focused on wetlands, floodplains, special aquatic sites, and other waters. We interpret the term “other waters” in the contention to include freshwater springs, and other waterbodies not afforded specific State or Federal protections or classifications. Even if these water bodies had not been covered in the ‘other water’ category, they are still considered in the hydrology review because of their role in controlling the hydrological response to alterations in the hydrosphere. There are also a number of smaller perennial and ephemeral streams on the site and in the vicinity of the site, such as Spring Run. NRC001A at 2-15, Figure 2-6 and NRC017 at 2. Two springs, the Little King and the Big King, located approximately 3 mi northwest of excavations for the LNP facilities are also considered in our review. NRC017 at 2.

**Q21. Where in the FEIS does the Staff describe activities needed to build the LNP?**

A21. (RP,DOB,LWV,VRV) FEIS Section 3.3 describes the activities that would be involved in building the proposed plant. NRC001A at 3-17 – 3-24.

**Q22. What are the building activities that are related to the contention?**

A22. (RP,DOB,LWV,VRV) Any activities with a nexus to declines in the offsite groundwater elevation or changes in the temporal and spatial pattern of overland flow, that reasonably could affect wetlands, floodplains, special aquatic sites, or other waters. Pumping water from the production wells to provide water for construction needs will lead to a decline in the water table. In FEIS Section 3.3.1.7, the estimated average and the maximum groundwater use during building activities is listed as 275,000 gpd and 550,000 gallons per day (gpd), respectively. Id. at 3-21. In addition, water will be extracted to allow excavations for building the LNP facilities. Water that has seeped into the excavated pits for the nuclear islands will also be pumped out. These and other activities are listed in FEIS Table 3-1. Id. at 3-18 – 3-19. Changes in land cover and site grading during construction has an indirect relationship on groundwater elevation through a change in recharge rates. These activities are listed in FEIS Table 3-1 as clearing, grubbing, grading, paving, shallow excavation, and vegetation management. Id. The disturbed footprint of the plant will be 777 acres (ac). Id at 3-24,Table 3-2.

**Q23. Where in the FEIS does the Staff describe the plant structures that are related to the contention?**

A23. (RP,DOB,LWV,VRV) FEIS Section 3.2 describes the structures associated with building and operating the plant. Id. at 3-2 – 3-17.

**Q24. Which of the structures in Section 3.2 are related to the contention?**

A24. (RP,DOB,LWV,VRV) The structures that have the potential to alter the offsite patterns of groundwater flow or surface water flow that could reasonably affect wetlands, floodplains, special aquatic sites, or other waters. The Staff acknowledges that the surface of the site will be profoundly altered. The structures that might alter offsite flow patterns are the diaphragm wall and subsurface grouting to assist excavation dewatering, the production wells, the cooling water intake structure, the barge-unloading facility, the portion of the blowdown discharge pipeline that would cross the CFBC, and the stormwater drainage system. The diaphragm wall and grout injection are described in FEIS Section 3.2.2.3. Id. at 3-13. The diaphragm walls would be installed below land surface surrounding the area to be excavated to minimize the lateral flow of groundwater into the excavation and the grout would be injected into the carbonate rock below the planned excavation depth of 100 feet (ft) below current grade to minimize upward groundwater flow into the excavation. Id. Production wells that would be installed to supply water during building and operations of the plant are described in FEIS Section 3.2.2.3. Id. Four 16-in.-diameter production wells installed in an Applicant-owned area to the south of the site to a depth of 500 ft with at least 150 ft of casing would supply water during building and operation of the plant. Id. at 3-21. Each well would have a capacity of 1000 gallons per minute (gpm). Id.; NRC017 at 2–3. The cooling water intake structure is described in FEIS Section 3.2.2.2. NRC001A at 3-7. The intake structure, located approximately 0.5 mi west of Inglis Lock, would be approximately 111 ft long (along the water-facing side) and 86 ft in width (extending shoreward). Id.; NRC017 at 3. The barge-unloading facility is described in FEIS Section 3.2.2.3, and itwould be located west of the intake structure on the northern bank of the CFBC. NRC001A at 3-13; NRC017 at 3. The blowdown discharge pipeline is described in FEIS Section 3.2.3.2. NRC001A at 3-16. The approximately 13-mi long blowdown discharge pipeline would consist of two 54 in.-diameter pipes that would cross over the Inglis Lock Bypass Channel and under the CFBC near Highway 19. Id.; NRC017 at 2–3.

(RP,DOB,LWV,VRV) The stormwater drainage system, consisting of site grading, drainage ditches, swales, and retention and filtration ponds is described in FEIS Section 3.2.2.1. NRC001A at 3-7. Drainage ditches would be used to collect surface runoff from the built-up areas of the LNP site and direct the runoff away from plant facilities and towards the stormwater ponds. Swales are engineered depressions, usually grass-lined, that run along roads, collect stormwater runoff from the roads, and allow detention and infiltration of the runoff. Retention and filtration ponds collect stormwater runoff, allow filtration of sediment and other contaminants that may be present in runoff, and allow collected water to infiltrate into the soil. The three stormwater ponds proposed on the LNP site are retention and filtration ponds. The three stormwater ponds are shown in FEIS Figure 3-4 (Pond A, Pond B, and Ponds C1 and C2). Id. at 3-8. The LNP site will be graded during building of the plant facilities to drain surface runoff away from the facilities and into a series of drainage ditches. The drainage ditches would collect surface runoff (stormwater) and convey it away from the plant area towards the three stormwater ponds.

(RP,DOB,LWV,VRV) The placement of the diaphragm wall and injection of the grout has the potential to alter existing groundwater flow around the excavations within which the LNP facilities would be built. The extraction of groundwater via the production wells would result in a drawdown which may affect offsite areas, including wetlands. The installations of the cooling water intake structure, the barge-unloading facility, and the portion of the blowdown discharge pipeline that would cross the CFBC would require temporary dewatering. The stormwater drainage system has the potential to alter offsite surface water flow and recharge characteristics.

**Q25. Where in the FEIS does the Staff describe the operating activities that are related to the contention?**

A25. (RP,DOB,LWV,VRV) FEIS Section 3.4 describes the activities associated with operating the plant. Id. at 3-25.

**Q26. What are the operating activities that are relevant to the contention?**

A26. (RP,DOB,LWV,VRV) The LNP operation activities that are relevant to the contention are those that have the potential to alter the offsite patterns of groundwater flow or surface water flow. These activities consist of groundwater extraction via production wells to support LNP operations and the functioning of the site drainage and stormwater management system. The effects of groundwater extraction for LNP operations are described in FEIS Section 5.2.2.2. Id. at 5-7 – 5-8. The effects of the functioning of site drainage and stormwater management systems are described in FEIS Section 5.2.3.1. Id. at 5-15 – 5-16.

**Q27. What are the structures with environmental interfaces that are relevant to the contention?**

A27. (RP,DOB,LWV,VRV) The production wells, the site drainage, and stormwater management systems are relevant to the contention. The production wells are described in FEIS Section 3.4.2.5. Id. at 3-30. Plant operations would require an annual average total withdrawal of 1.58 million gallons per day (Mgd) and a potential maximum daily withdrawal of 5.8 Mgd. Id. Four 16-in.-diameter production wells installed to a depth of 500 ft with at least 150 ft of casing would be installed. Each well would have a capacity of 1000 gpm. Id. at 3-21. The site drainage and stormwater management systems are described in FEIS Section 3.4.2.4. Id. at 3-30. The three stormwater ponds are shown in FEIS Figure 3-4 (Pond A, Pond B, and Ponds C1 and C2). Id. at 3-8. The LNP site would be graded during building of the plant facilities to drain surface runoff away from the facilities and into a series of drainage ditches. The drainage ditches would collect surface runoff (stormwater) and convey them away from the plant area towards the three stormwater ponds.

### 3. Scope of Hydrological Review

**Q28. What is the spatial extent of the region considered in the hydrological review?**

A28. (RP,DOB,LWV,VRV) The spatial extent of the region considered in the hydrological review was determined using guidance from Section 5.11 of the ESRP, which encourages use of natural boundaries of the resource(s) being evaluated (i.e. the drainage basin for surface water resources). For its determination of surface water impacts, the Staff reviewed the location of surface water bodies in relation to the LNP site to determine the spatial extent of the region that could potentially be affected by building and operating the proposed reactors. NRC013 at 4.2.1-3. The impacts of building the proposed LNP facilities on surface water resources are discussed in FEIS Sections 4.2.2 (water use) and 4.2.3.1 (water quality). To estimate impacts from building, the Staff considered both onsite and offsite areas. The onsite areas considered included the whole LNP site because of potential alterations to wetlands, floodplains, and the existing grade. The offsite areas we considered included areas immediately downstream of the LNP site, the CFBC, the Lower Withlacoochee River, and the Gulf of Mexico. The impact of building the proposed LNP facilities on groundwater resources are discussed in FEIS Sections 4.2.2 (water use) and 4.2.3.2 (water quality). Id. at 4-25; 4-27. The Staff considered the aquifers underlying the LNP site and the aquifers' regional extent inasmuch as they are related to regional groundwater flow and usage. The aquifers the Staff considered included the surficial, the Upper Floridan, and the Lower Floridan.

The impacts of plant operation on surface water are discussed in FEIS Sections 5.2.2.1 (water use) and 5.2.3.1 (water quality). Id. at 5-7 to 5-8; 5-10 to 5-16. According to guidance in ESRP Section 5.2.1, the Staff also considered onsite and offsite areas to estimate the impacts from operations; onsite areas included the whole LNP site because of alterations to surface grading, infiltration pattern, runoff pathways, and effects from stormwater detention ponds; and offsite areas included areas immediately downstream of the LNP site, the CFBC and the Old Withlacoochee River, the lower Withlacoochee River, and the Gulf of Mexico. NRC013 at 5.2.1-2 to 5.2.1-4; 5.2.1-7 to 5.2.1-8. The impacts of plant operation on groundwater are discussed in FEIS Section 5.2.2.2 (water use) and 5.2.3.2 (water quality). NRC001A at 5-7 to 5-8; 5-16. The Staff considered the aquifers underlying the LNP site and the aquifers' regional extent inasmuch as they are related to regional groundwater flow and usage. The aquifers the Staff considered included the surficial, the Upper Floridan, and the Lower Floridan.

To estimate cumulative impacts, the Staff hydrologists considered areas within a 20-mile radius around the LNP site. The Staff used a 20-mile radius because it includes water users and watersheds (such as the lower watersheds of the Withlocoochee and Waccasassa River basins) that would be expected to be affected by building and operating the LNP in this region of the

Florida Gulf Coast. Id. at 7-10. As a result, the cumulative impacts analysis includes those surface waters and past, present and reasonably foreseeable future actions/projects that contribute to cumulative impacts on the surface water resources affected by LNP building and operations.

**Q29. How did you establish the key hydrological alterations that would occur as a result of the proposed action?**

A29. (RP,DOB,LWV,VRV) According to guidance in ESRP Sections 4.2.1 and 5.2.1, the Staff reviewed the Applicant's ER to develop an understanding of the proposed alterations to the land surface and locations of plant facilities. The Staff also reviewed publicly-available hydrological data and used the knowledge obtained on site tours to determine where the alterations would occur. The Staff described these alterations in Sections 4.2.1 and 5.2.1 of the FEIS. NRC013 at 4.2.1-1; 4.2.1-3 to 4.2.1-7; 4.2.2-1; 4.2.2-3; 4.2.2-6 to 4.2.2-8; 5.2.1-1; 5.2.1-3 to 5.2.1-8.

### 4. Role of Modeling

**Q30. What NRC Staff guidance discusses the use of groundwater models?**

A30. (VRV,DOB,LWV,RP) Several ESRP sections provide guidance to the Staff regarding conceptual groundwater models:

- ESRP Section 2.3.1 states that "[a] detailed and thorough description of the hydrologic environment is essential for the evaluation of potential impacts to the environment that may result from plant construction or operation." NRC013 at 2.3.1-6.
- ESRP Section 2.3.1 directs the (hydrology) reviewer to ensure that "data are sufficient to provide quantitative information on the hydrological resources potentially affecting or affected by plant construction and operation." Id. at 2.3.1-7.

- ESRP Section 2.3.2 states that following information should be included in the EIS: "a summary of present and known future groundwater withdrawals on the site and for distances great enough to cover potentially affected groundwater aquifers." Id. at 2.3.2-7.
- ESRP 4.2.1 directs the reviewer to obtain information for "identification and location of groundwater … users and areas that could be affected by project related hydrologic alterations." Id. at 4.2.1-3.
- ESRP Section 5.2.2 states that the reviewer should "[e]nsure that the water users and water-use areas potentially impacted by alterations in water quantity and availability as a result of plant operation have been identified and that any impacts of reduced water quantity and availability have been identified and assessed." Id. at 5.2.2-7.

This information identified in the ESRP is used by the Staff to conceptualize the groundwater hydrology inasmuch as it is relevant for assessment of impacts to the environment from building and operating a nuclear power plant.

Additionally, for the Staff's safety review, NUREG-0800, the "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP) Sections 2.4.1 and 2.4.13 states that applicants should present plausible alternative conceptual models of the groundwater environment with and without the proposed plant. NRC015 at 2.4.1 to 2, 2.4.1-5; 2.4.1-8; 2.4.13-2; 2.4.13-4; 2.4.13-5. A conceptual model is a description of the groundwater system. Because hydrogeologic data typically contain a fair amount of uncertainty, our knowledge of the behavior of the groundwater system is also uncertain. Therefore, several alternative conceptual models are needed to adequately describe a range of plausible groundwater system behavior. The discussion of alternative conceptual models in the SRP is relevant to the analysis of impacts in the FEIS because the same groundwater system is being evaluated in both (safety and environmental perspectives, respectively) cases.

**Q31. What is the difference between a conceptual model and a numerical model?**

A31. (VRV,DOB,LWV,RP) A conceptual model is a description of the groundwater system. It generally includes narrative text and may include figures and schematics. It defines the relevant geometry including the lithology and important subsurface features and properties. A conceptual model is a prerequisite to any numerical model. A numerical model is a mathematical translation of the conceptual model using the governing equations of groundwater mechanics to produce an analytical tool. This tool is generally a computer code. Site-specific data provide the properties, geometry, initial conditions, and boundary conditions for the numerical model simulation. Often, the analytical tool and the site-specific data together are referred to as “the model.”

**Q32. Is there only one plausible conceptual model?**

A32. (VRV,DOB,LWV,RP) No. Without perfect and complete information all conceptual models include some uncertainty. Generally, the Staff’s review considers many plausible conceptual models that can describe the behavior of the groundwater system with similar accuracy. One of the goals of the Staff’s review is to determine if the conceptual model presented by the applicant is sufficiently conservative for the specific impact assessment and belongs in the suite of plausible conceptual models.

**Q33. Could you have separate conceptual models used for different assessments on the same project?**

A33. (VRV,DOB,LWV,RP) Yes. A conceptual model that would conservatively estimate the maximum groundwater drawdown may not be considered conservative in estimating the minimum travel time of a radionuclide. For example, preferential pathways 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 since 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 groundwater pumpage in formations containing preferential pathways could 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.

**Q34. Does the Staff utilize the most conservative plausible conceptual model in making its impact determination?**

A34. (VRV,DOB,LWV,RP) The most conservative plausible criteria would be appropriate in a safety assessment. However, in the environmental review, the Staff attempts to discuss the impacts that are reasonably foreseeable over the duration of the license.

**Q35. How does the Staff determine which of these plausible conceptual models is the correct one?**

A35. (VRV,DOB,LWV,RP) There is no one ”correct” conceptual model. Models by their nature are imperfect representations of the actual system. In other words, all conceptual models contain some uncertainty with respect to the “correct” behavior of the groundwater system.

**Q36. When would the Staff utilize a numerical model, and can the Staff make an impact determination without a numerical model?**

A36. (VRV,DOB,LWV,RP) Whenever such an analysis is needed to make an impact determination. It is not always necessary for the Staff to use a numerical model to make impact determinations.

**Q37. Why did the Staff not request the groundwater model input files for the LNP environmental review?**

A37. (VRV,DOB,LWV,RP) Because the Staff determined that for the assessment needs related to groundwater, additional model runs would not alter the impact determinations. The Applicant's modeling effort was performed in accordance with a state-sanctioned process in coordination with SWFWMD Staff and SWFWMD approval was required prior to issuing the State of Florida's site certification and the accompanying conditions of certification for groundwater usage. Given the model development pedigree and the fact that graphical model inputs and outputs provided by the Applicant under oath and affirmation were sufficient to meet our assessment needs, the Staff considered the general modeling approach and model implementation to be technically sound and determined that rerunning the Applicant's model was not warranted. In addition, the Staff recognizes the inherent uncertainties in model predictions, and thus, the model was not used as the sole basis for our assessment. If the model had been used as the sole basis of the assessment, independent verification of model runs by the Staff would have been warranted.

**Q38. Why did Staff request development of an alternate, recalibrated model in addition to the original model PEF constructed as a requirement of its Florida Site Certification Application?**

A38. (VRV,DOB,LWV,RP) The state of Florida, as part of the site certification application process, requires that applicants use a SWFWMD developed groundwater model called the District Wide Regulation Model (DWRM2) to assess potential impacts from proposed groundwater usage. This model incorporates geohydrologic characterization data and interpretations collected over the years by the USGS and other state and federal agencies. The Applicant's modeling effort was performed in accordance with this state-sanctioned process in coordination with SWFWMD staff and SWFMD approval was required prior to issuing the conditions of certification for groundwater usage. Staff identified a discrepancy between this model's simulated potentiometric surface (i.e., the shape of the head contours describing groundwater flow direction) in the vicinity of the LNP site and water-level observations in site monitoring wells. The model recalibration was requested to provide Staff with some indication as to the sensitivity of the model 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. Because the resulting model better matched site specific conditions and was the more conservative of the two models, the Staff used the recalibrated model in those areas where model results were utilized in the Staff's assessment.

The reasons for the Staff's request are discussed in further detail below in A45.

### 5. Hydrology-Related Definitions

**Q39. How do you understand the terms "active dewatering" and "passive dewatering" as they are used in contention 4A?**

A39. (RP,DOB,LWV,VRV) The Staff does not use the terms 'active dewatering' and 'passive dewatering' in the manner being used by the Intervenors in the contention because these terms have a more limited definition in the Staff's safety review. In Section 2.4.12 of both the Applicant's Final Safety Analysis Report (FSAR) and the Staff's Safety Evaluation Report (SER), dewatering is considered an action performed with the purpose of ensuring the water table elevation does not exceed a level safe for the particular reactor design. In this safety context dewatering is a deliberate action to protect the plants from excessive hydrostatic loads, buoyancy issues, and water penetration into safety structures. For safety purposes, 'active dewatering' is the operation of pumping wells around the structures to ensure that the water table does not rise too high and 'passive dewatering' would involve installation of features such as subsurface tile drains to maintain the water table at a safe level. Therefore, in the FEIS, the Staff only refers to dewatering in the limited context of building activities, such as temporary dewatering offsite of portions of the CFBC for intake and pumphouse installation.

Based on the definitions above there are neither active nor passive dewatering systems proposed for the LNP site. Therefore, the terms “active dewatering” and “passive dewatering” were not used in the FEIS. For instance, the safety analysis did not rely on the operation of the proposed pumping well to maintain safe water table elevations. However, for this testimony, the Staff will adopt the use of the meaning of the terms “active dewatering” and “passive dewatering” based on our understating of the Intervenors’ usage.

We understand that the Intervenors use the term “active dewatering” to refer to activities resulting in lower water table elevations. Activities that result in active dewatering are the operation of the four production wells, dewatering of the excavations where LNP facilities would be built, dewatering in the CFBC associated with installation of the intake structure, barge unloading facility, and laying of the portion of blowdown discharge pipeline where it crosses the CFBC. The Staff understand that the Intervenors use “passive dewatering” to refer to the changes in surface water and shallow groundwater from changes in land cover, site drainage design, and changes in subsurface flow properties in the excavated zone. Additionally, in its cumulative impacts review, the Staff considers impacts of offsite mines to involve passive dewatering because the mines could induce seepage of surrounding groundwater into open pits and its subsequent evaporation.

**Q40. What is the Staff’s interpretation of the term “floodplain” used by the Intervenors?**

A40. (RP,DOB,LWV,VRV) The Staff interprets the term “floodplains,” in contention 4A to mean the term floodplain as defined by Executive Order 11988 (42 Fed. Reg. 26,951) and the areas delineated as “floodplains” by the Federal Emergency Management Agency (FEMA) on and near the LNP site. Executive Order 11988, Floodplain Management, dated May 24, 1977, states:

> The term "floodplain" shall mean the lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year.

42 Fed. Reg. 26,951. The floodplain, as defined above, is also called the 100-year floodplain. The LNP site is located within the 100-year floodplain. NRC001A at 2-22. FEMA, under the National Flood Insurance Program, delineates areas that will be inundated by the 100-year flood or equivalent. 44 C.F.R. § 59.1, et. seq.

### 6. Groundwater Hydrology Assessment in the FEIS

**Q41. How did the review of characterization and monitoring data formulate your conceptual understanding of the groundwater system at the LNP site?**

A41. (VRV,DOB,LWV,RP) Site specific characterization and monitoring data collected during the LNP field investigation were integral to formulating a conceptual model of the groundwater system beneath the LNP site. These data were used in conjunction with regional information available from the SWFWMD and USGS to 1) verify whether site specific information was consistent with the geohydrologic conceptual model for the region, 2) reconcile inconsistencies between the two measurement scales and develop a cohesive site specific conceptual model, 3) constrain local-scale parameter estimates (e.g., hydraulic properties, water table elevation), 4), assess, to the extent possible, the spatial and temporal variability present within the groundwater system, and 5) identify sources of increased uncertainty in the geohydrologic conceptual model. A detailed discussion of groundwater hydrology, including the collection and interpretation of site specific information, is included in Section 2.3 of the FEIS.

Site specific characterization data collected at the LNP site were generally consistent with regional descriptions. A surficial aquifer system is present throughout the entire study area, ranging in thickness from 10 to 200 ft, with an average thickness of approximately 50 ft. NRC001A at 2-25. The surficial aquifer, which is composed primarily of unconsolidated sands and directly overlies the Upper Floridan Aquifer, provides substantial recharge to the Floridan aquifer system. Id. at 2-22. No confining unit exists between the surficial and Upper Floridan aquifer systems in this area and, thus, the two aquifers are hydraulically connected. Id. The Upper Floridan aquifer is a highly productive groundwater system and is the main source of potable water (both private and municipal) and spring flow in west-central Florida. Id. This bedrock aquifer is estimated to be approximately 520 ft thick beneath the LNP site, with the most productive intervals thought to be at depths from 100 to 300 ft below ground surface. Id. at 2-25.

With respect to hydraulic property estimates, PEF conducted hydraulic tests in site monitoring wells and analyzed the test results to provide site specific hydraulic property estimates for both the surficial and Upper Floridan aquifers, which improved the conceptual understanding of the site and helped to constrain the property values used in the model. The resulting horizontal hydraulic conductivity values for the Upper Floridan aquifer ranged from 120 to 130 ft/d and transmissivity values ranged from 62,000 to 69,000 square foot per day ($ft^2/d$). Id. at 2-26. Hydraulic conductivity and transmissivity are hydraulic properties that describe the ease with which groundwater can move through an aquifer system; transmissivity is the product of hydraulic conductivity times the aquifer thickness. In the surficial aquifer, the estimated conductivity value was approximately an order of magnitude lower, at 13 ft/d. Id.

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, the threshold for which is placed in the 250,000 to 1,000,000 $ft^2/d$ range. NRC018 at 14. The LNP site does not reside within a region of well-developed karst topography (NRC019 at 85; NRC020 at B49, B76), although some of the wetlands onsite may be associated with karst development. NRC001A at. 2-25. The chapter cited in Randazzo and Jones 1997 (NRC019) and the USGS Professional Paper of Miller 1986 (NRC020), both of which are authored by James A. Miller, a retired hydrogeologist for the USGS, were a commonly referenced text for the Staff's review that provided a general description of the hydrogeology of Florida. The hydrogeologic description includes an interpretation of transmissivity distributions and major spring locations in the vicinity of the LNP site. Where present, karst features in the dolomitized Avon Park Formation limestones, which represents the uppermost bedrock formation present beneath the LNP site and is overlain by 10's of feet of surficial sediments, would be expected to develop at a much slower rate than where pure calcium carbonate limestone zones outcrop. Hydrogeologic and geophysical characterization of the LNP site found no indications of well developed karst (e.g., sinkholes) within the study area. NRC016 at 2.5-97.

With respect to site-specific water-level data, one year of continuous water-level monitoring data were collected by PEF from March 2007 through March 2008. Evaluation of these data along with longer-term water-level data from two nearby USGS monitoring wells 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. Water-level measurements collected at the site were inconsistent with regional descriptions provided by the USGS. Id. at 2-26 and 2-27. Measurements at the site resulted in head values approximately 10 ft higher than indicated by the USGS potentiometric surface. Id. at 2-27. This magnitude of difference is not unexpected given the regional scale of the USGS contour map and the fact that LNP site-specific data were not available for inclusion in the USGS interpretation. Id. Although incorporation of site-specific water-level data did not significantly affect interpreted groundwater flow directions, the hydraulic gradient across the

LNP site decreased by approximately 25 percent relative to the original USGS interpretation. Id. A potentiometric high exists to the east of the site, with the direction of groundwater flow in the vicinity of the LNP site being generally west-southwest at an approximate gradient of 0.0009 (~5 ft/mi). Id. The hydraulic gradient investigation also included nested monitoring well pairs that measured vertical gradients and determined connectivity between the surficial and bedrock aquifers. These measurements indicated that heads in the surficial aquifer were always slightly higher than heads in the Upper Floridan Aquifer (ranging spatially from 0.03 to 0.57 ft), indicating that in the vicinity of the LNP site vertical flow directions are downward and the Upper Floridan Aquifer is being recharged by the surficial aquifer. Id. at 2-28. Vertical gradients measured between the surficial and bedrock aquifers remained relatively constant throughout the monitoring period. Downgradient of the LNP site, this vertical flow relationship reverses and the Upper Floridan Aquifer discharges to the surficial aquifer. Id. at 2-27. Discharge areas for the Upper Floridan aquifer include areas where groundwater moves upward into the surficial aquifer, discharges to local springs, and discharges to offshore springs in the Gulf of Mexico. Id.

The Staff also analyzed monitoring data related to water quality. Groundwater samples were collected from four wells during quarterly monitoring in 2007 for water-quality determinations. NRC001A at 2-41. Monitoring results indicate groundwater near the LNP site is a calcium bicarbonate type water that is typical of this part of Florida. Id. at 2-38. Total dissolved solids are within regulatory limits for potable groundwater and analytes such as nitrate that may indicate contamination are generally low. Id. For all analytical parameters that have primary drinking water standards in the State of Florida, none exceeded the maximum permissible contaminant level. Id.

One of the largest sources of uncertainty with respect to estimating groundwater usage impacts is hydraulic properties in the vicinity of the proposed wellfield. No characterization wells have been drilled in this area and thus hydraulic property estimates are based on regional interpretations. This uncertainty will be greatly reduced once the planned wellfield hydraulic characterization activities have been conducted. As part of the FDEP Conditions of Certification (Section B.A.4, Special Conditions, Aquifer Testing and Groundwater Impact Analysis), aquifer testing must occur on the planned production wells 5 years prior to initial use of 100,000 gpd (annual average) or more. PEF005 at Section B.A.4.

**Q42. How did input from other agencies help formulate your conceptual understanding of the groundwater system at the LNP site?**

A42. (VRV,DOB,LWV,RP) The Staff evaluated regional-scale information compiled and documented by the USGS and SWFWMD (e.g., potentiometric surfaces, hydraulic property distributions, surface recharge distributions, hydrogeologic and stratigraphic descriptions, distribution of well developed karst) to check for consistency and provide a context for local-scale characterization and monitoring data generated by PEF. The review team also included personnel from the local field office of the USACE who provided their input throughout the review process. In addition to reviewing published documentation, Staff participated in a September 2009 conference call with SWFWMD to discuss recalibration of the local-scale model and SWFMD's conditions of certification, which are included in the FDEP COCs, regarding any explicit limits on impacts to adjacent permitted users and surface waterbodies.

**Q43. How did the site visit help formulate your conceptual understanding of the groundwater system at the LNP site?**

A43. (VRV,DOB,LWV,RP) During the site visit, the Staff was given a tour of the LNP site and surrounding environment. During this site tour, Staff developed an appreciation for the shallow water table condition at the site, the distribution and quality of existing wetlands, and the proximity of the site to nearby surface water features (e.g., Big and Little King Springs, the

Withlacoochee River, Cross Florida Barge Canal, and Lake Rousseau). The Staff were also able to visit the characterization and monitoring well locations and inspect rock core samples collected from the Upper Floridan Aquifer. Observed rock core characteristics were consistent with PEF's reported core interpretation and geophysical testing activities, which did not indicate the presence of major solution features beneath the site. NRC016 at 2.5-10.

**Q44. What was the role of the groundwater model in the Staff's impact determination?**

A44. (VRV,DOB,LWV,RP) The Staff used results from the recalibrated groundwater model in its assessment of groundwater-use impacts at the LNP site. However, the model results were not the sole basis of the Staff's assessment. Given the complex site hydrologic conditions, including natural annual variability in 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. NRC001A at 2-29. 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. Id. The Staff did use results from the groundwater models 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. The recalibrated model was used in the assessment because it represents the most conservative (i.e., largest water usage impacts) of the two plausible conceptual models evaluated. Results from the recalibrated model indicate that average LNP operational usage (1.58 Mgd) represents only a small percentage (0.8 percent) of the total water flux (208 Mgd) through the model domain. Id. at 5-8. For comparison, the original (i.e., pre-calibration effort) model predicted a total water flux of ~ 450 Mgd, or a PEF usage of ~ 0.4 percent of the total. NRC022 at 14. Although the Staff used simulation results from the recalibrated model as the basis for its assessment, and thus they are the only simulation results presented in the FEIS, results from both the original model constructed as a requirement of its Florida Site Certification Application and the recalibrated model were considered (i.e., comparison of results from the two models provided some indication of the sensitivity of the model to changes in transmissivity distribution).

The Staff also 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 ~ 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.

**Q45. Why did you require the Applicant to do another groundwater model run?**

A45. (VRV,DOB,LWV,RP) As discussed briefly above in the answer to question A38, PEF used a local-scale steady-state groundwater model, constructed as a requirement of its Florida Site Certification Application, to simulate predevelopment, current, and future potentiometric surfaces for the LNP site and vicinity. NRC001A at 2-29. The local-scale model was a submodel of the SWFWMD's DWRM2 regional groundwater flow model. Because this DWRM2 model was calibrated to the USGS regional interpretation of the Upper Floridan aquifer potentiometric surface, which incorporated only limited information in the vicinity of the LNP site, a poor fit between simulated and observed water-levels in the vicinity of the LNP site was obtained. Measured water-level values in the vicinity of the LNP site were approximately 10 ft higher than indicated by the USGS potentiometric surface. To improve the goodness of fit over this portion of the model domain, which encompasses the proposed LNP wellfield and thus is important to the assessment of groundwater-use impacts, the model was recalibrated by PEF using both site-specific and regional water table elevation data. Id. PEF provided a detailed description of this model and the recalibration process. Id.

Staff participated in a September 2009 conference call with SWFWMD to discuss recalibration of the local-scale model and FDEP's conditions of certification, which include SWFWMD's conditions of issuance for water use permits, regarding any explicit limits on impacts to adjacent permitted users and surface waterbodies. Significant outcomes from this conference call included 1) SWFWMD staff indicated that they do not provide explicit limits on usage impacts, but instead rely on the monitoring program required by the conditions of certification to account for uncertainty in model parameters and implementation, 2) SWFMD staff indicated there would be no conflict with PEF recalibrating a local-scale model for use in the FEIS, and 3) SWFWMD staff indicated that they had revisited the model submitted by PEF and identified some problems with boundary condition implementation and made technical recommendations related to modification of the transmissivity distribution and surface recharge that would act to improve model fit.

**Q46. Was the Applicant's model flawed and is the revised model correct?**

A46. (VRV,DOB,LWV,RP) Staff made no assessment as to the relative merit of these two models; rather, comparison of their results provided some indication as to the sensitivity of the model to transmissivity value changes sufficient to better match observed water-levels in the vicinity of the LNP site. The model recalibration effort, which was performed by PEF in consultation with SWFWMD, resulted in improved model fit to local LNP water-level data. The Applicant reported on the results of the calibration process in a December 2009 Technical Memorandum. NRC023. PEF concluded that "the revised TMR model more closely simulates the USGS published potentiometric surface map of the UFA. The simulated drawdown impacts are greater than those from the DWRM2 TMR model. The differences are a result of the revised aquifer parameter values distribution. Actual field conditions will be confirmed by the environmental monitoring and testing discussed below." Id. at 4. Head residuals following the calibration process ranged from -3.25 to +3.87 ft across the model domain and -0.56 to +2.35 ft within the boundary of the LNP site. PEF210 at 7 of Attachment 5.2.2-4A (CH2M Hill Tech Memo). This result was an improvement over the observed pre-calibration head residuals of approximately 10 ft near the LNP site.

The Staff recognizes that other model fit and/or implementation validity metrics may have been adversely impacted by the calibration process. However, there was no mention of any model validity or mass balance concerns in the model calibration technical memorandum. As such, Staff considered results provided under oath an affirmation for both the original and recalibrated models to be technically sound. Based on this assumption and the fact that the model was not used as the sole basis of the assessment, the Staff did not perform a rigorous evaluation of the relative contributions of various components of the water balance calculation or confirm that all model implementation assumptions were valid. The recalibrated model was selected for use in Staff's groundwater usage impacts assessment because it best approximated site specific conditions and provided a more conservative estimate of groundwater usage impacts. Both models are subject to uncertainty, including the relatively large uncertainty associated with transmissivity estimates in the vicinity of the proposed wellfield, and, thus, neither groundwater model alone would be sufficient for supporting a definitive assessment of wetlands impacts.

**Q47. Why did you not independently run the Applicant's model?**

A47. (VRV,DOB,LWV,RP) The state of Florida, as part of the site certification application process, requires that applicants use the SWFWMD-developed DWRM2 model to assess potential impacts from proposed groundwater usage. This model incorporates geohydrologic characterization data and interpretations collected over the years by the USGS and other state and federal agencies. The Applicant's modeling effort was performed in accordance with this state-sanctioned process in coordination with SWFWMD staff, and SWFMD approval was required prior to issuing the conditions of certification for groundwater usage. Given the model development pedigree and the fact that graphical model inputs and outputs provided by the Applicant under oath and affirmation were sufficient to meet our assessment needs, the Staff considered the general modeling approach and model implementation to be technically sound and determined that rerunning the applicant's model was not warranted. Although the Staff did not rerun the models, it did evaluate PEF's modeling approach, review all reported model inputs for consistency with the site conceptual model, and verify that all reported model outputs were plausible.

The Staff recognizes the inherent uncertainties in model predictions, and thus, the model was not used as the sole basis for our assessment. If the model had been used as the sole basis of the assessment, independent verification of model runs by Staff would have been warranted. Monitoring requirements in the state's water use permitting process imply acknowledgment of the inherent uncertainties in model predictions. Groundwater usage requirements included as special conditions of FDEP's conditions of certification include 1) reporting and data submittal (Section B.A.1, PEF005 at 41), 2) environmental impacts, monitoring and mitigation (Section B.A.2, Id. at 42), 3) alternative water supply implementation (Section B.A.3, Id. at 43), 4) aquifer testing and groundwater impact analysis (Section B.A.4, Id. at 45), 5) compliance reporting (Section B.A.5, Id. at 46), 6) pumpage reporting (Section B.A.6 Id. at 47), 7) distribution flexibility (Section B.A.7, Id. at 48), 8) water quality sampling (Section B.A.8, Id. at 49), and 9) well construction, operations, and testing. (Section B.A.4, Id. at 52).

**Q48. Under what conditions would you have done an independent model run?**

A48. (VRV,DOB,LWV,RP) If the model had been used as the sole basis of the assessment, had not been vetted by the state of Florida, or produced results that were questionable, independent verification of model runs by Staff would have been warranted.

**Q49. Why did the terrestrial ecologist rely on the revised model?**

A49. (VRV,DOB,LWV,RP, JPD,) The recalibrated model was selected for use in Staff's terrestrial ecology assessment because it best approximated site specific conditions and provided a more conservative estimate of groundwater usage impacts. Both the original model constructed by PEF as a requirement of its Florida Site Certification Application and the recalibrated model are subjected to uncertainty, including the relatively large uncertainty associated with transmissivity estimates in the vicinity of the proposed wellfield, and thus neither groundwater model alone would be sufficient for supporting a definitive assessment of wetlands impacts. Therefore, the terrestrial ecologists used results from the most conservative model, and considered the state's conditions of certification, when determining impacts.

**Q50. Was either model used to evaluate the effects of dewatering during building activities?**

A50. (VRV,DOB,LWV,RP) Neither model was used to assess the impacts of dewatering during building activities. Anticipated hydrologic alterations during building include temporary changes in the groundwater levels associated with dewatering of excavations for the proposed structures. The current conceptual foundation design calls for excavation of each nuclear island area (containing the containment vessel, shield building, and auxiliary building) to depths of approximately 75 ft and substantial dewatering to depths of approximately 100 ft below the existing grade. NRC001A at 4-21. Under this design, subsurface grouting and diaphragm walls would be used to isolate the excavation and minimize the impacts of dewatering on surrounding groundwater levels. Grouted diaphragm walls would be installed to minimize lateral groundwater inflow, and grout would be injected into the carbonate rock below the planned excavation depth to minimize upward groundwater flow into the excavation. Id. at 4-21 to 4-22. These two engineered barriers would allow the excavation to be dewatered and minimize the amount of drawdown that occurs outside the grouted excavation. Id. at 4-22. In addition, localized, short-term, building-related dewatering of the surficial aquifer outside the nuclear island excavation (e.g., dewatering of shallow trenches for pipelines and other utilities) would occur over a relatively small portion of the LNP site, primarily within the footprint of the LNP site boundaries and along the makeup-water and blowdown pipeline corridor. Id. Because these groundwater withdrawals will be relatively small and of short duration, and because their impact will be bounded by operational impacts, a separate model effort to evaluate these impacts was not needed.

**Q51. Compare how you used the model for general water use questions and wetlands impact assessments.**

A51. (VRV,DOB,LWV,RP, JPD) Given the complex site hydrologic conditions, including natural annual variability in 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. Id. at 2-29. 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. Id. The Staff did use results from the recalibrated model 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.

An example of the relative sensitivity of the groundwater usage related water table drawdown predictions and hydrologic water balance calculations is provided by a direct comparison of simulation results from the original and recalibrated models. Drawdown predictions based on the original model showed the 0.5 ft drawdown contour associated with LNP groundwater usage extending approximately 0.1 miles from the supply wells and affecting only a very small portion of any areas delineated as wetlands. NRC022 at Attachment 5.2.2-3Q, Exhibit 14. Conversely, the recalibrated model predicted that the 0.5 ft drawdown contour associated with LNP groundwater usage would extend approximately 3 miles from the supply wells, encompassing a relatively large area that does include wetlands. NRC001A at 5-5. In this case, results from the original model lead to a very different wetlands impact assessment than is provided by results from the recalibrated model.

This is not the case for the hydrologic water balance calculation. Results from the recalibrated model indicate that average LNP operational usage (1.58 Mgd) represents only a small percentage (0.8 percent) of the total water flux (208 Mgd) through the model domain. Id. at 5-8. For comparison, the original model predicted a total water flux of ~ 450 Mgd, or a PEF usage of ~ 0.4 percent of the total. NRC022 at 14. Although the flux calculations for the two models differ by a factor of 2, this difference would not change the Staffs' assessment of impacts to other groundwater users (i.e., both are relatively small numbers). This comparison demonstrates 1) the relative sensitivity of these two model outputs to changes in the transmissivity field and 2) the reason Staff are comfortable using the recalibrated model as a means of performing a local-scale hydrologic water balance calculation and not as a tool for providing a definitive assessment of wetlands impacts.

### 7. Stormwater Systems

**Q52. What stormwater systems are employed on the LNP site?**

A52. (RP,DOB,LWV,VRV) A stormwater management system may include site grading, drainage ditches, swales, and retention and filtration ponds. NRC001A at 3-7. At the LNP site, the Applicant has proposed using these elements to provide both a safety function (to keep local intense precipitation away from safety-related structures) and an environmental function (to manage site runoff to minimize erosion and effects on nearby water resources). At the LNP site, three stormwater ponds, which are retention and infiltration ponds, will be created. Id. Drainage ditches and pipes would route surface water to the three ponds. Id. at 3-19. Stormwater runoff from roadways would be managed using a series of roadside swales. Id. at 5-26. The three stormwater ponds are shown in FEIS Figure 3-4 (Pond A, Pond B, and Ponds C1 and C2). Id. at 3-8. The LNP site would be graded during building of the plant facilities to drain surface runoff away from the facilities and into a series of drainage ditches. The drainage ditches would collect surface runoff (stormwater) and convey it away from the plant area towards the three stormwater ponds.

**Q53. What type of stormwater ponds will be installed at the LNP site?**

A53. (RP,DOB,LWV,VRV) The three stormwater ponds at the LNP site are retention/infiltration ponds. Id. at 3-30. The ponds are designed with a minimum freeboard of 2 ft above the spillway elevation to retain a 25-year, 24-hour rainfall event. The "25-year, 24-hour rainfall event" refers to a 24-hour rain storm that, over a long period of time (much longer than 25 years), occurs on an average once every 25 years. Runoff from larger rainfall events may exceed the capacity of the ponds. The excess runoff would flow out of the ponds through broad-crested weir emergency spillways and small-diameter pipes and spread to the surrounding wetland as sheet flow to prevent erosion. Id. The ponds are designed to drain within 5 days. Id. The LNP COLA ER Section 4.1.1.1.2.1 states that the bottom of these ponds would be at the same elevation as the seasonal high groundwater level. NRC021 at 4-6. During periods when infiltration and drainage from the stormwater ponds are inadequate to dispose of the collected stormwater, some stormwater from the ponds may be pumped to cooling tower basins and eventually discharged with blowdown. NRC001A at 3-25.

**Q54. How would the stormwater ponds affect surface water runoff at the LNP site?**

A54. (RP,DOB,LWV) After development of the LNP site, paved and impervious areas would generate more surface runoff and less recharge or infiltration compared to pre-development land cover conditions. The stormwater ponds serve two purposes—they hold the increased and more rapid runoff from the paved and impervious areas and provide opportunity for reinfiltration to compensate for reduction in recharge from paved and impervious areas. As discussed above in A53, the stormwater ponds are designed to retain a 25-year, 24-hour rainfall event. Id. at 3-30. The 25-year, 24-hour rainfall depth near the LNP site is between 8 and 9 in. NRC024 at D-9. Rainfall events larger than the 25-year, 24-hour event that exceed the capacity of the ponds would overflow the ponds through broad-crested weir emergency spillways and small-diameter pipes and spread to the surrounding areas as sheet flow. NRC001A at 3-30.

**Q55. How would the stormwater ponds affect the groundwater at the LNP site?**

A55. (RP,DOB,LWV) After development of the LNP site, the stormwater ponds would retain runoff from rainfall events as large as a 25-year, 24-hour event and this runoff would subsequently infiltrate into the soil within 5 days. Id. The bottom of these ponds would be at the same elevation as the seasonal high groundwater level. NRC021 at 4-6. The seasonal high groundwater table elevation is defined by the State of Florida as the highest level of the saturated zone in the soil in a year with normal rainfall. Fla. Admin. Code r. 40C-42.021(23). 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 concludes 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.

**Q56. How would the stormwater ponds result in dewatering at the LNP site?**

A56. (RP,DOB,LWV) As explained above in response to A55, during a normal year, the stormwater ponds would recharge the surficial aquifer during most of the year and would experience little groundwater seepage during the wettest season. Therefore the stormwater ponds would not result in dewatering at the LNP site.

### 8. Floodplains Analysis

**Q57. How would the building of LNP structures and facilities affect the 100-year floodplain?**

A57. (RP,DOB,LWV) The 100-year floodplain is defined above in A40. Building LNP Units 1 and 2 and their ancillary facilities would occur within the 100-year floodplain. NRC001A at 4-

18. As stated by SWFMWD in its Basis of Review document for Environmental Resource Permits, "under Part IV of Chapter 373, Florida Statutes (F.S.) and Chapters 40D-4, 40, and 400, Florida Administrative Code (F.A.C.), the District is responsible for permitting construction and operation of surface water management systems within its jurisdictional boundaries." NRC025 at B1-1. SWFWMD requires that any encroachment on the 100-year floodplain that may result in loss of flood storage be compensated such that no net encroachment occurs. NRC025 at B4-2—B4-3. Building in floodplains may result in two effects: (1) encroachment up to the 100-year floodplain elevation above the overflow elevation and (2) encroachment below the overflow elevation in natural depressions including wetlands and sloughs. NRC001A at 4-19. Topographic depressions, depending on their capacities (or volumes), would fill up during a large rainfall event as water collects in them and eventually overflow as water inflow into them exceeds their capacity. The water level at which a depression overflows is called the overflow elevation. The 100-year floodplain elevation could be above the overflow elevation of a depression. The volume of water stored between the overflow elevation and the 100-year floodplain elevation is the subject of effect (1) above. As rainfall stops and flooding recedes, the water level would fall below the 100-year floodplain elevation and release the "detained" storage between the 100-year floodplain elevation and the overflow elevation. As the flood continues to recede, the water level in the depression would fall below the overflow elevation at which time the remaining water in the depression would be "retained" because the depression would cease to overflow and would not contribute to downstream discharge. This retained storage of water below the overflow elevation is the subject of effect (2) above. Therefore, the effects from building in floodplains results in loss of detention and retention storage capacities of the floodplain. The retention storage below the overflow elevation of natural depressions is also called historic basin storage (HBS). The SWFWMD Environmental Resource Permit Sections 4.4 and 4.7 require compensation for floodplain storage loss and replacement or mitigation of the loss of HBS, respectively. NRC025 at B4-2 and B4-3.

**Q58. What analysis did you perform to determine the effects of building the LNP structures and facilities on the 100-year floodplain?**

A58. (RP,DOB,LWV) To develop the FEIS, the Staff reviewed two analyses by the Applicant to determine if compensation of floodplain storage loss and HBS would be needed. In the first analysis, PEF performed a bounding analysis to conservatively estimate the loss of floodplain storage because of building and fill needed for the LNP facilities. NRC001A at 4-19. This analysis used high-resolution digital elevation data and FEMA Flood Insurance Rate Maps along with the map of LNP facilities to estimate areas where floodplain loss would occur. Id. The analysis estimated the overflow elevation of natural depressions using wetland, soil, and hydrologic information. Id. The estimated floodplain fill volume was 252.4 ac-ft and the HBS loss was 73.9 ac-ft. Id. This estimate of floodplain storage loss is the bounding estimate or bounding floodplain loss. By evenly distributing the lost volume on the remaining floodplain area within the LNP site boundary downstream of the facilities, the estimated rise in flood elevation is 0.22 ft. Id. at 4-20.

**Q59. How was it determined that the bounding floodplain loss could be compensated?**

A59. (RP,DOB,LWV) We reviewed the Applicant's use of habitat data, land used and cover classifications, natural areas inventory, and other resources to identify upland areas that may be available for compensating for floodplain storage and HBS losses. This review resulted in an estimate that on a 322-ac area on the LNP site, 320.9 ac-ft of compensating volume above the seasonal high groundwater elevation could be provided. Id. As described in A57, SWFWMD requires compensation for floodplain storage loss and replacement or mitigation of HBS loss. Because the bounding floodplain storage loss was estimated to be 252.4 ac-ft, and an estimated 320.9 ac-ft of potential compensating volume is available, there is sufficient onsite capacity available for floodplain storage loss compensation. Id.

The HBS loss is essentially loss of pre-development retention storage. Replacement or compensation of HBS loss could be provided by excavating deeper on the same area where floodplain storage loss compensation is provided. To replace the estimated 73.9 ac-ft of HBS loss, an additional 0.5 ft excavation on 148 of the available 322 ac would be needed. Id. If the whole 322 ac area were to be used for replacement of HBS loss, the additional necessary excavation would be approximately 0.23 ft or 2.75 in. Therefore the Staff concluded that floodplain storage loss and HBS loss can be addressed onsite within the SWFWMD requirements.

**Q60. How was the second floodplain storage loss analysis made?**

A60. (RP,DOB,LWV) We also reviewed the Applicant's second analysis where it performed a more detailed hydrologic and hydraulic modeling of the LNP site as required by the FDEP Conditions of Certification for the LNP Units 1 and 2. Id. The FDEP required the Applicant to perform a floodplain analysis in Condition XXVII.H. NRC064 at 26. In this analysis, the Applicant used the EPA Storm Water Management Model (SWMM). The Applicant used a 100-year, 24-hour rainfall event over the drainage area to estimate flooding, which provides the total amount of rainfall to estimate the extent of the floodplain. NRC001A at 4-20. The "100-year, 24-hour rainfall event" refers to a 24-hour rain storm that, over a long period of time (much longer than 100 years), occurs on an average once every 100 years. The SWFWMD has adopted 24-hour design rainfall events of various durations for evaluation of surface water and stormwater management systems. NRC024 at D-4. Because there would be variation of rainfall intensity during the 24-hour design event, the total rainfall depths and time variation for the design event are recommended by SWFWMD. Id. at D-12. PEF estimated the runoff from the rainfall event using a composite curve number approach that allows for the effect of rainfall losses depending on soil type. The estimated runoff was input into the SWMM model for estimating flood elevations. In the SWMM model, no infiltration or evaporation occurred during the event, which maximizes runoff volume. NRC001A at 4-20. The landscape near the LNP site was represented by a network of storage units, channels, and culverts to approximate the surface water hydrology and hydraulics. Two simulations were performed—one for existing or without LNP site development conditions and the other for proposed or with LNP site development conditions. The simulated peak floodwater elevations in each of the model storage units for the proposed and existing conditions were compared. Based on this comparison, PEF determined that because of installation of LNP facilities, all upgradient increases in flood levels would remain on the LNP site and some down-gradient areas would experience slight increase or slight decrease in flood elevation. The estimated maximum increase in flood elevation down-gradient of the LNP site would be less than 0.08 ft or approximately 1 in. Id. The Staff reviewed this calculation and agreed with it because the SWFWMD-recommended design rainfall was used, runoff from the rainfall event was estimated using a method common in practice (curve number approach), infiltration and evaporation losses were ignored in SWMM, and conservative surface roughness coefficients were used in the hydraulic analysis in SWMM—these factors maximize flood runoff volume and flood water surface elevation. Id. Therefore, the Staff concluded that this analysis is conservative and results in only a minor increase of downstream flood elevation. Id. at 4-21.

**Q61. What compensation for floodplain storage loss is proposed based on the second analysis?**

A61. (RP,DOB,LWV) Based on the second, detailed floodplain analysis, where the maximum increase in flood elevation down-gradient of the LNP site is less than 0.08 ft or approximately 1 in.; the Applicant has proposed that no compensation should be required. The Staff's review of the second analysis that estimated the effects of floodplain storage loss and HBS loss using detailed hydrologic and hydraulic method, concluded that the impact on the floodplain storage and flood elevation downstream of the LNP facilities because of their (the facilities') placement would be minor. NRC001A at 4-21.

## B. Terrestrial Ecology Background and Definitions

### 1. Background

**Q62. Which sections in the FEIS related to terrestrial ecology and wetlands that you were responsible for preparing are disputed in this contention?**

A62. (JPD, LMA) Sections that I prepared that are disputed in the contention are Sections 2.4.1, 4.3.1, 5.3.1, and 7.3.1.

**Q63. How did you develop your understanding of the terrestrial ecology of the proposed site?**

A63. (JPD) I read the Applicant's ER and participated in the development of a terrestrial ecology information needs table requesting from the Applicant additional technical information needed to complete an effective review of terrestrial ecology issues. I attended the NRC site audit at the Applicant's office facilities in Crystal River, Florida from December 2 to 5, 2008. During the site audit, I participated in three tours conducted by the Applicant: a general site tour; a driving tour to the proposed barge slip site and to representative points on the proposed routes for the transmission lines and pipelines; and a boat tour on the Cross Florida Barge Canal following a portion of the proposed route for a blowdown pipeline. I also worked with the Applicant's contractors to identify and visit representative wetland and upland areas on the LNP site and other property owned by the Applicant to the south that would be traversed by a proposed "common corridor" containing the heavy haul road, pipelines, and transmission lines and where the proposed water production wells would be built.

I attended the NEPA scoping meeting on December 4, 2008 and reviewed responses to 14 terrestrial ecology-related RAIs as well as additional responses to RAIs developed by USACE. After publication of the draft EIS, I participated in a public comment meeting in Crystal River on September 23, 2010. To support terrestrial elements of the consultation I performed under Section 7 of the Endangered Species Act, I attended coordination meetings with the U.S. Fish and Wildlife Service at their Jacksonville, Florida field office on January 4 and March 14, 2011.

I reviewed all material prepared by NRC contractors for inclusion in the terrestrial ecology sections of the FEIS and the Biological Assessment. I ensured that the subject sections were technically accurate and complete. I scrutinized relevant materials submitted by the Applicant on the proposed LNP design and kept current with new information sources pertinent to the assessment of possible impacts from the project on terrestrial environmental resources. I revised the subject sections of the FEIS as necessary to reflect the new information sources.

**Q64. Describe in your words what you interpret Contention 4A to challenge regarding terrestrial ecology in the FEIS.**

A64. (JPD, LMA) It is my understanding that Contention 4A alleges that the FEIS inadequately assessed the direct, indirect, and cumulative impacts to terrestrial ecological resources from PEF's planned dewatering activities while building and operating the proposed LNP facilities, salt drift from operation of the proposed LNP cooling towers, and deposition of the salt from the drift on wetlands and other terrestrial habitats. It is my understanding that Contention 4A alleges that the terrestrial ecology impact analyses reported in the FEIS are too focused on localized effects and do not adequately consider possible onsite and offsite effects distant from where the proposed LNP facilities would be built and operated. Contention 4A also alleges that the cumulative effects of the LNP project, the proposed Tarmac King Road Mine, and other urbanization in the region could ultimately result in drier wetlands with reduced area and impaired function, reduced flow to springs and other surface water features, increased nutrient loading in wetlands and surface waters, and increased regional wild fire potential caused by regional drying trends.

Below I describe the terrestrial ecology-related definitions that are relevant to contention 4A and provide detail on how I performed my review. In Part III of my testimony below, I apply these definitions and my review to the specific allegations in contention 4A.

**Q65. Are any of the impact determinations that you made part of the subject of this proceeding?**

A65. (JPD, LMA) Yes. The contention disputes the impact determinations presented in Sections 4.3.1, 5.3.1, and 7.3.1 of the EIS. In Section 4.3.1.8 of the FEIS, the NRC Staff states:

> Based on the review team's independent evaluation of the LNP project, including the ER, the SCA [applicant's Site Certification Application], FDEP [Florida Department of Environmental Protection] Conditions of Certification, PEF's responses to NRC's and USACE's [U.S. Army Corps of Engineers] Requests for Additional Information, the identified mitigation measures and BMPs [best management practices], and consultation with other Federal and State regulatory agencies, the review team concludes that the impacts of construction and preconstruction activities to terrestrial ecological resources (including wetlands and threatened and endangered species) would be MODERATE. This moderate conclusion reflects the impacts on wetlands, wildlife, and Federally and State-listed species at the LNP site and the associated offsite facilities. Even with implementation of BMPs, the proposed wetland mitigation plan, and other mitigation outlined in the FDEP Conditions of Certification, the review team believes that the impacts to wetland and upland terrestrial habitats and their associated wildlife would still be noticeable in the surrounding landscape, especially in the short term. However, the review team also believes that the proposed mitigation measures, especially those in the wetland mitigation plan, would substantially offset the adverse losses to upland as well as wetland habitats in the long term. The review team therefore concludes that the terrestrial impacts resulting from the Levy project would not destabilize the continued existence of any wetland or upland habitats and associated wildlife in the surrounding landscape. . . . NRC-authorized construction activities are not expected to increase floral or faunal mortality rates enough to destabilize affected populations, and detectable changes in abundance would not be expected Construction Impacts at the Proposed Site at a regional population level. In addition, impacts to wetlands and important terrestrial species during NRC-authorized construction activities are expected to be minor. Temporary water

> table fluctuations caused by dewatering the power block excavations during construction are not expected to affect wetland hydrology outside of the known range of natural periodic water table fluctuations. Based on these analyses, the NRC staff concludes that impacts to terrestrial ecological resources from NRC-authorized construction activities would be SMALL, and no mitigation beyond the actions stated in Section 4.3.1.7 would be warranted.

NRC001A at 4-71 to 4-72. In Section 5.3.1.6 of the FEIS, the NRC Staff states:

> Based on the review team's independent evaluation of the LNP project, including the ER, the Site Certification Application, PEF's responses to the review team's RAIs, interactions with State and Federal agencies, the public scoping process, and the identified mitigation measures and BMPs, the review team concludes that operational impacts on terrestrial ecological resources (including wetlands and listed species) would be SMALL to MODERATE. A range is provided to account for the uncertainty that exists regarding the potential effects of groundwater withdrawal on wetlands and associated biota. The review team believes that any possible effects of groundwater withdrawals on wetlands would be temporary and localized as long as the FDEP and USACE conditions are met. Additional mitigation beyond that proposed by PEF is not warranted; however, as stated in the State of Florida Conditions of Certification (FDEP 2011a), PEF must monitor groundwater and, if substantial operational hydrological effects on wetlands are discovered, PEF must either mitigate or utilize an alternative water source.

Id. at 5-47. In Section 7.3.1.3 of the FEIS, the NRC Staff states:

> The review team therefore concludes that the cumulative impacts to terrestrial resources from past, present, and reasonably foreseeable future actions in the geographic area of interest would be MODERATE. This determination is based primarily upon the extent of expected wetland loss and fragmentation of wetland and upland forest habitats resulting from the LNP project and other activities in the geographical area of interest, as well as from continued widespread manipulation of habitats for commercial forest management. The incremental impacts from NRC-authorized construction and operation activities would be SMALL to MODERATE, primarily due to the possible effects of groundwater withdrawal on nearby wetlands and associated biota. Although incremental impacts on terrestrial resources could be noticeable near the LNP project, these impacts would not be expected to broadly destabilize the overall ecology of the regional landscape.

NRC001B at 7-29. In their Motion for Leave to Amend Contention 4, dated November 15, 2010, the Intervenors state that "reliance by NRC Staff and now PEF, upon 'conditions' placed on the State of Florida Certificate of Compliance water 'permit' do not satisfy or validate the assertion that building and operating two AP1000 reactors in Levy County would result in

SMALL hydro ecological impacts; in our view, and that of our expert, Dr. Sydney Bacchus this is an incorrect finding; the impacts are under estimated and would be LARGE." Ecology Party of Florida, Green Party of Florida, Nuclear Information and Resource Service Motion for Leave to Amend Contention 4 at 3 (Nov. 15, 2010). The "hydro ecological" impacts referred to above encompass impacts to wetlands and surrounding terrestrial habitats. Contention C-4A, as admitted by the ASLB, claims that impacts to wetlands, floodplains, special aquatic sites, and other waters resulting from groundwater dewatering and salt drift are inappropriately characterized in the draft EIS. Ecological impacts to wetlands and other terrestrial habitats are addressed in the FEIS in the terrestrial ecology sections noted in the response to Q1.

**Q66. Describe your understanding of the terrestrial ecology setting for the LNP Project.**

A66. (JPD, LMA) The terrestrial ecology reviewers present their characterization of the LNP site, proposed rights-of-way for offsite LNP facilities, and the surrounding landscape in Section 2.4.1 of the FEIS. The LNP site and surrounding landscape have been substantially modified by past land use practices, especially forestry. Section 2.4.1.1 of the FEIS states that "[p]rior to being acquired by PEF, the [LNP] site was in active forest management and leased for hunting and target practice. Vegetation, soils, and localized drainage patterns had been extensively altered through forest plantation activities including clearing, logging, road development, ditching, grading, bedding, and replanting." NRC001A at 2-42. Regarding the proposed offsite facility corridors, which cross the landscape south of the LNP site, Section 2.4.1.2 states "The vegetation cover types within corridors up to the first substation reflect the past level of human-induced change that has occurred across the landscape. Much of the historical vegetation on and around the corridors has been cleared or altered for land uses such as agriculture, residential development, forest management, utilities, and for roads and highways." Id. at 2-56. The landscape south of the LNP site has also been substantially altered by construction of the Cross Florida Barge Canal and Inglis Lock.

## 2. Terrestrial Ecology Definitions of Terms Used in Contention 4A

**Q67. What is the Staff's interpretation of the term "wetlands"?**

A67. (JPD, LMA) The Staff interprets the Intervenors' usage of the term "wetlands" to be the same as the Staff's usage of that term in the FEIS. In the FEIS, the Staff broadly interpreted the term "wetlands" to include all areas meeting either the Federal or State of Florida regulatory definitions for wetlands. The definitions are similar but not identical. The U.S. Army Corps of Engineers defines wetlands for purposes of Section 404 of the Clean Water Act as:those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

33 CFR 328.3b. The definition established by the State of Florida for purposes of wetland delineation for state-level regulatory purposes encompasses:

> those areas that are inundated or saturated by surface water or ground water at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above. These species, due to morphological, physiological, or reproductive adaptations, have the ability to grow, reproduce or persist in aquatic environments or anaerobic soil conditions. Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas. Florida wetlands generally do not include longleaf or slash pine flatwoods with an understory dominated by saw palmetto.

Fla. Admin. Code Ann. r. 62-340.200 (2011).

The Staff's analysis of wetlands impacts in the FEIS extends to all wetlands meeting either the Federal or Florida definitions, regardless of whether the USACE determines the wetlands to be “adjacent” or “isolated” for purposes of Clean Water Act jurisdiction. The USACE is authorized under Section 404 of the Clean Water Act to regulate wetlands that are “adjacent” to other waters of the United States but lacks the authority to regulate wetlands that are not adjacent to other waters of the United States, i.e. that are “isolated.” The USACE defines “adjacent” wetlands in 33 CFR 328.3(8)(c) as those that are “bordering, contiguous, or neighboring,” including “wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like.”

### 3. Terrestrial Ecology Review Topics

**Q68. What Staff guidance did you use in making your independent assessment?**

A68. (JPD, LMA) The Staff used the following guidance in evaluating potential terrestrial ecology impacts when preparing the FEIS:

- The Staff used ESRP 2.4.1 with respect to characterizing the terrestrial and wetland habitats potentially affected by the proposed LNP project. The Staff also used ESRP 2.4.1 with respect to identifying and describing important species potentially affected by the proposed LNP project, including but not limited to Federal and state endangered, threatened, and special status species; Federally-designated critical habitats; and sanctuaries, preserves, refuges, and other terrestrial habitats identified by State or Federal agencies as unique, rare, or of priority for protection.
- The Staff used ESRP 4.3.1 with respect to assessing potential impacts to terrestrial habitats on and off of the LNP site from building and construction of the LNP project.
- The Staff used ESRP 5.3.3.2 with respect to assessing potential impacts to terrestrial habitats on and off of the LNP site from the operation of heat dissipation systems, especially cooling towers.

- The Staff used ESRP 4.7 and ESRP 5.11 with respect to identifying past, present, and future Federal, non-Federal, and private actions that could have cumulative impacts with the proposed action on terrestrial ecology.

**Q69. What methodologies did you use in making your assessment?**

A69. (JPD, LMA) Following the ESRPs noted in A68, the terrestrial ecology reviewers examined each revision of the Applicant's ER, dated July 28, 2008 (Rev. 0), October 2, 2009 (Rev. 1), and October 4, 2010 (Rev. 2). The reviewers issued multiple RAIs requesting additional technical data about the LNP project needed to complete an adequate evaluation of possible impacts to terrestrial resources. The terrestrial ecology reviewers conferred frequently with reviewers for other technical fields potentially capable of affecting terrestrial ecological resources, such as hydrology, meteorology, land use, and aquatic ecology. Of particular importance were the groundwater modeling data generated by the hydrology reviewers and the cooling tower drift modeling data generated by the meteorology reviewers. The terrestrial ecology reviewers evaluated how the results of the modeling and impact analyses reported by these other specialists could affect wetlands and other terrestrial habitats.

For preparing the Biological Assessment and performing the consultation activities required under Section 7 of the Endangered Species Act, the terrestrial ecology reviewers followed the Endangered Species Consultation Handbook published by the U.S. Fish and Wildlife Service and National Marine Fisheries Service. NRC066. The terrestrial ecology reviewers conferred frequently with the U.S. Fish and Wildlife Service, initially via an informal information request letter dated November 5, 2008 and by subsequent in-person meetings on January 4 and March 14, 2011.

**Q70. What is the spatial extent of the region considered in the terrestrial ecology review?**

A70. (JPD, LMA) The terrestrial ecology review considered any areas of terrestrial habitat, including wetlands, potentially affected by building or operating the proposed onsite or offsite LNP facilities. The review of potential direct and indirect impacts was not confined to the LNP site boundaries, boundaries of proposed rights-of-way for offsite facilities, or property owned by the Applicant. Instead, the geographic extent of the review was dictated by the potential spatial effects of each possible category of terrestrial ecology impacts, not by an arbitrarily defined geographic radius or other predetermined study area. The review thereby retained the flexibility to adjust the geographic area considered in the evaluation in response to new data generated for the FEIS, especially hydrological and meteorological modeling results.

The review of potential cumulative impacts from building and operating the proposed LNP facilities in Section 7.3.1 of the FEIS encompassed a "geographic area of interest" including the LNP site, areas with a 20-mile radius of the LNP site, as well as any additional areas included in the linear corridors certified by the FDEP for the transmission lines and other offsite linear facilities that are part of the proposed LNP project. NRC001B at 7-21. Although the spatial bounds of the cumulative impacts evaluation were defined in part by a geographic radius, the Staff independently tailored that radius to the specific needs of the LNP project and setting.

**Q71. How did you establish which terrestrial ecology impacts needed to be evaluated as a result of the proposed action?**

A71. (JPD, LMA) The terrestrial ecology reviewers used direction contained in ESRPs 4.3.1 and 5.3.3.2, as well as information in comments received during the NEPA scoping process and in the petition to intervene, to identify possible terrestrial ecology impacts to address in the EIS.

Section 4.3.1 of the FEIS focuses primarily, but not exclusively, on the following categories of terrestrial ecology impacts:

- losses of, and changes to, terrestrial habitats, including wetlands, and terrestrial wildlife caused by developing facilities on the LNP site;
- effects on terrestrial habitats, especially wetlands, caused by active and passive groundwater dewatering caused by proposed excavation to build the nuclear island;
- losses of, and changes to, terrestrial habitats, including wetlands, and terrestrial wildlife caused by developing the offsite facilities, including the heavy haul road, barge dock, intake and discharge pipelines; and
- effects on important species and habitats, as defined in ESRP 2.4.1, including but not limited to Federally- and state-listed endangered, threatened, and other special status species; wildlife sanctuaries, refuges, or preserves; Federally-designated critical habitats; wetlands and floodplains; commercially or recreationally valuable species; species that are essential to the maintenance and survival of special status species; species critical to the structure and function of the local terrestrial ecosystem; and species that may serve as biological indicators to monitor effects on the terrestrial environment. NRC013 at 2.1.4-7.

Section 5.3.1 of the FEIS focuses primarily, but not exclusively, on the following categories of terrestrial ecology impacts:

- effects on terrestrial habitats, especially wetlands, caused by active groundwater dewatering caused by operation of the four proposed water production wells;
- effects on terrestrial habitats, especially wetlands, caused by passive groundwater dewatering caused by stormwater management facilities;

- effects on terrestrial habitats caused by salt drift from operation of the proposed cooling towers;
- effects on terrestrial wildlife caused by noise, light, and other physical disturbances coincident to operation of the LNP facilities; and
- effects on terrestrial habitats and wildlife caused by operation and maintenance of the proposed new transmission lines.

Specific areas for evaluation of possible terrestrial ecology impacts were identified based on the projected spatial extent of possible direct, indirect, or cumulative effects from building and operating the proposed LNP facilities. For example, the evaluation of possible effects from active or passive dewatering while building or operating the proposed LNP facilities extended to any terrestrial habitats occurring within the area of potential effects indicated by the DWRM2 hydrological modeling or the “recalibrated” hydrological modeling used by hydrology experts on the Staff to prepare Sections 4.2 and 5.2 of the FEIS. Groundwater models that were used to support the Staff’s assessment, including a local-scale model constructed by PEF as a requirement of its Florida Site Certification Application and a recalibrated model requested by the Staff, are discussed in more detail in the responses to Q30 through Q38. The evaluation of possible effects on terrestrial ecological resources from salt drift extended to any terrestrial habitats occurring within the area of potential effects predicted by the AERMOD drift modeling used by meteorology experts on the Staff to prepare Section 5.7 of the FEIS. The AERMOD drift modeling is discussed in more detail in the response in the response to Q86.

**Q72. What sources of terrestrial and wetland mapping data did you use for your analyses?**

A72. (JPD, LMA) For the LNP site, the Applicant’s property to the south, and the surrounding landscape, the terrestrial ecology reviewers relied on habitat maps and descriptions in Section 2.4.1.1 of the Applicant's ER. NRC021 at Figure 2.4-6; 2-355 to 2-359. For rights-of-way proposed for development of transmission lines, pipelines, and other linear facilities extending off of the Applicant's property, the terrestrial ecology reviewers relied on habitat maps and descriptions in Section 2.4.1.2 of the Applicant's ER. NRC021 at Figure 2.4-8; 2-368 to 2-369. The Applicant initially developed these maps and descriptions using Florida Land Use, Cover, and Forms (FLUCFCS) land use/land cover mapping shape files published by the Southwest Florida Water Management District (SWFWMD). NRC069. FLUCFCS is a system for mapping the land areas of Florida using uniform definitions based on land use and land cover properties tailored to Florida. The SWFWMD, which encompasses the LNP site and surrounding landscape, has developed land use/land cover mapping using FLUCFCS definitions for nearly all land areas under its jurisdiction. The Applicant adjusted the SWFWMD mapping data using field observations collected during ecological surveys of the LNP site and the Applicant's property to the south performed between September 2006 and January 2008. NRC021 at 2-355; 2-368.

Wetlands are depicted in Figure 2.4-6 of the ER using FLUCFCS land use/land cover codes in the 6000 series (i.e., beginning with "6"). Wetlands are defined for purposes of FLUCFCS as "those areas where the water table is at, near or above the land surface for a significant portion of most years. The hydrologic regime is such that aquatic or hydrophytic vegetation usually is established, although alluvial and tidal flats may be non-vegetated. NRC068 at 40. This definition is "tailored to the limitations imposed upon image analysis which must classify wetlands according to evidence recorded by remotely sensed images. Id. The Applicant adjusted the SWFWMD mapping data to accurately reflect onsite wetland delineations conducted using wetland delineation guidance approved by USACE and FDEP. These delineations followed procedures in the Corps of Engineers Wetlands Delineation Manual (NRC069) and Fla. Admin. Code Ann. r. 62-340 (2011). Once issued in 2011, the Staff also examined jurisdictional determinations from USACE and FDEP.  Because of the close scrutiny of the Applicant's wetland delineations by the USACE and FDEP, and the need for USACE and FDEP to approve the wetland delineations prior to issuing permits required to build the proposed LNP facilities, the Staff considered the wetland delineation data provided by the Applicant to be reliable as a basis for wetland impact analysis in the FEIS.

For assessing potential impacts to wetlands on the LNP site and proposed rights-of-way for offsite facilities in the FEIS, the Staff relied on data provided in the ER for FLUCFCS cover types in the 6000 series (Level I), which are classified as wetlands.  For the LNP site and rights-of-way for proposed offsite facilities, the Applicant had adjusted mapping data from FLUCFCS and other published sources to reflect onsite wetland delineation field work conducted by the Applicant's contractors following procedures in the Corps of Engineers Wetlands Delineation Manual (NRC069) and Fla. Admin. Code Ann. r. 62-340 (2011).  NRC021 at 2-366 to 2-367.

## C. Aquatic Ecology Background and Definitions

### 1. Background

**Q73. How did you develop your understanding of the aquatic ecology of the proposed site?**

A73. (ALM) I attended the following site visits: pre-application site visits on August 20-21, 2007, January 6-8, 2008, May 7-9, 2008, environmental readiness assessment on December 2-5, 2008, and public meetings on December 4, 2008, and September 23, 2010.  Additionally, I reviewed the Applicant's ER and responses to six aquatic ecology-related RAIs.  Informal consultation with Florida Fish and Wildlife Conservation Commission (FFWCC), US Fish and Wildlife Service (FWS), and National Marine Fisheries Service (NMFS) occurred during the Levy environmental site audit on December 2-5, 2008

(MTM) I developed my understanding of the aquatic ecology of the proposed site and the surrounding geographic area of interest through several site visits in which I toured the site and surrounding waterbodies, reviewed the applicant's ER, reviewed PEF responses to RAIs, and other relevant documents supplied by PEF.

Once the July 2008 COLA was submitted to the NRC I reviewed the PEF ER, supporting documentation, the State of Florida Conditions of Certification and other scientific information pertinent to the review. I re-familiarized myself with Reg Guide 4.2 and NUREG-1555 ESRP Sections 2.4.2, 4.3.2, 5.3.1.2, 4.7 and 5.11. I held discussions with NRC Staff and PNNL team members to ensure that appropriate impacts were considered and assessments initiated. I attended both the site audit and the audit of alternative sites. I attended the public scoping meeting and factored in the concerns expressed by the public at the meeting into the review. I spoke and/or corresponded with members of the USGS, FWS, NMFS and the State of Florida as part of my review. I reviewed and commented on the preparation of RAIs. I required close coordination between the hydrology and aquatic ecology reviews because of the significant interdependence between the two disciplines. As PNNL's assessment of impact to the aquatic environment progressed I provided oversight, guidance, and advice on technical issues. I participated in numerous interactions with the USACE on a variety of subjects directly related to impacts to aquatic resources related to building and operation of LNP. I reviewed the scoping summary report and a draft version of the DEIS providing comments and suggested changes to both the hydrology and aquatic ecology sections. I reviewed and commented on the Biological Assessments as part of the Section 7 Consultation under the Endangered Species Act (ESA). I also provided oversight in the preparation of an assessment of essential fish habitat and subsequent interactions with the NMFS. I attended and listened to public comments on the DEIS at the September 2010 public meeting. I provided oversight in the revisions to the DEIS as a result of comments received on the DEIS. I assisted in drafting responses to comments, which appear in Appendix E in the FEIS. As a lead technical reviewer for assessing impacts to the aquatic environment I have provided oversight for the entire review period.

**Q74. Describe your interpretation of contention 4A regarding aquatic ecology impacts in the FEIS.**

A74. (ALM, MTM) It is our understanding that contention 4A alleges that the review team inadequately assessed the direct, indirect, and cumulative impacts to the environment from PEF's planned dewatering at the site, salt drift from the cooling towers, and deposition of the salt from the drift on wetlands, special aquatic sites, and other waters, both surface and groundwater. Contention 4A asserts that the planned dewatering, both surface water alteration on site and the planned withdrawal of groundwater, could affect Outstanding Florida Waters, damage the underlying Florida Aquifer, adversely affect Federal threatened and endangered species, and detrimentally affect water quality. Contention 4A also asserts that the review team greatly underestimated the effect of plant construction and operation on wetlands. The intervenors further claim that the above listed impacts are irreversible and irretrievable.

In this section of our testimony, we provide the important definitions necessary to understand our aquatic ecology review in the FEIS as it relates to Contention 4A. We also discuss in detail the review that we performed to create the FEIS. In Part III of our testimony, we apply these definitions and our review to the specific subparts of Contention 4A.

### 2. Definitions Related to Aquatic Ecology

**Q75. What is the Staff interpretation of the term 'Special aquatic sites' used in Contention 4A?**

A75. (ALM, MTM) Special aquatic sites are defined by the Environmental Protection Agency (EPA) in 40 C.F.R. § 230.3(q-1) as "either large or small areas possessing special ecological characteristics of productivity, habitat, wildlife protection or other important and easily disrupted ecological values." Special aquatic sites include fish and wildlife sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffles and pool complexes. The Staff did not use the term, "special aquatic sites" in the FEIS, preferring to use the individual descriptor associated with the resource in question (i.e. wetlands, refuges, etc). No wildlife sanctuaries or refuges are within the site boundaries, or close enough to be directly or indirectly affected by building and operation of the LNP. For purposes of discussion of aquatic ecology impacts, special aquatic sites relevant to aquatic ecology in this testimony are mud flats and vegetated shallows. Wetlands are covered under terrestrial ecology.

**Q76. What is the Staff's understanding of 'Other waters' as used in Contention 4A?**

A76. (ALM, MTM) We are unaware of any formal definition of "other waters" that would be applicable to this region and the review of this application The Staff interprets "other waters", as used in Contention 4A, to mean freshwater springs, and other waterbodies not afforded specific State or Federal protections or classifications. There are two named freshwater springs nearby the LNP site; Big King Spring and Little King Spring.

There are a number of unnamed and uncharacterized freshwater springs and seeps that were visible during several trips to the site. These were primarily noted in the CFBC, which is an additional "other" water not identified as an Outstanding Florida Water or special aquatic site.

### 3. Aquatic Ecology Review Topics

**Q77.What Staff guidance did you refer to in making your independent assessment (ALM, MTM)?**

A77. (ALM,MTM) The Staff used the following guidance:

- The Staff used NUREG-1555, ESRP 2.4.2 with respect to describing the affected environment such that the aquatic ecological systems and biota are described in sufficient detail to assess proposed construction, building, and operation.
- The Staff used NUREG-1555, ESRP 2.4.2 with respect to describing species protected by the ESA, and critical habitats for ESA species, sanctuaries, preserves, refuges, and habitats identified by State or Federal agencies as unique, rare, or of priority for protection.
- The Staff used NUREG-1555, ESRP 4.3.2 with respect to assessment of onsite and offsite construction and building activities to include transmission line corridors.
- The Staff used NUREG-1555, ESRP 5.3.1.2 with respect to assessment of entrapment, impingement, entrainment, altered circulation patterns, and water quality to predict potential effects on aquatic biota and their habitats, to include ESA species.
- The Staff used NUREG-1555, ESRP 4.7 with respect to assessment of cumulative impacts related to building and operation activities on aquatic ecology.
- The Staff used NUREG-1555, ESRP 5.11 with respect to identifying past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have cumulative impacts with the proposed action on aquatic ecology.

**Q78. What is the spatial extent of the region considered in the aquatic ecology review?**

A78. (ALM, MTM) The geographical region considered for the aquatic ecology review for direct, indirect, and cumulative impacts included onsite permanent and seasonal shallow ponds and offsite waterbodies that would or could be affected by offsite facilities. Offsite waterbodies include, but are not limited to, the CFBC, Lake Rousseau, the Inglis lock and by-pass channel, the Old Withlacoochee River (OWR), the lower Withlacoochee River (LWR), the Crystal River Energy Complex (CREC) intake and discharge areas, Crystal Bay and the Gulf of Mexico offshore of Levy and Citrus Counties, and streams and other waterbodies in or contiguous to the transmission corridors. We considered named and unnamed freshwater springs that reasonably could be potentially affected by the building and operation of LNP.

**Q79. How did you establish the key aquatic ecology impacts that needed to be evaluated as a result of the proposed action?**

A79. (ALM, MTM) After familiarizing ourselves with the site and the geographic area of interest, relevant plant parameters, and consistent with ESRP Section 2.4.2, we began to formulate the review team's description of the aquatic environment. We examined all aquatic habitats that were onsite, near proposed offsite facilities, and associated with transmission line corridors. Hydrological connection of these surface waters with other water sources was also considered in terms of habitat contribution and water quality. Section 2.4.2 of the ESRP includes a discussion of these aquatic habitats, their attributes, and assemblages of species, including Federally listed species. NRC013 at 2.4.2-2, 2.4.2-3. Several refuges and marine preserves are located within the geographic region, but were described in the FEIS as outside the affected area of the proposed building and operation of LNP primarily based on geographic distance. NRC001A at 2-91. Big Bend Seagrasses Aquatic Preserve is located 5 nautical miles to the north of the CFBC, St. Martins Marsh Aquatic Preserve is located approximately 6 nautical miles to the south of the CFBC (NRC027 at 1-3), and Crystal River National Wildlife Refuge is located at Kings Bay which is 10 miles inland from the mouth of Crystal River which empties to the Gulf of Mexico just north of the St. Martins Marsh Aquatic Preserve. It is highly unlikely that there exists a causal link between the activities at the LNP site and these preserves and refuges over the distances identified. Building and operation of the LNP will have no detectable impact on the distribution and abundance of aquatic biota inhabiting these preserves or refuges. Other waters such as documented first magnitude freshwater springs (discharge >

100 cubic feet per second (cfs)) with special ecological significance were also excluded based on geographical distance and hydrological considerations.

Aquatic resources included for analyses were considered due to potential for direct, indirect, or cumulative impacts from building activities and operation of cooling water intake and discharge, and transmission corridor maintenance effects. Aquatic resources potentially affected by building activities included onsite aquatic habitats the CFBC for placement of discharge pipeline, installation of cooling water intakes and pumphouse, and barge slip, and barge traffic during transportation of LNP site construction materials. Building best management practices (BMPs), special permitting requirements, and impact minimization practices were assessed in relation to aquatic resources located in the CFBC for their potential to minimize adverse impacts. The results of that assessment are presented in Sections 4.3.2, 5.3.2, and 7.3.2 of the FEIS.

Aquatic resources potentially affected by operation activities included the CFBC for cooling water intake operation and barge traffic, OWR for cooling water intake operation, and the nearshore Crystal Bay environment for effluent discharge. Intake operations such as approach velocities, through-screen velocities, impingement and entrainment were assessed under the various tidal conditions that would result from intake operations. This included assessment of habitat alteration and potential for increase in salinity further upstream in the barge canal and mouth of the OWR as well as the potential for aquatic species, including Federally listed species, to become impinged or entrained.

Therefore, consistent with NUREG-1555, ESRP 2.4.2, the description in FEIS Section 2.4.2 included the spatial and temporal distribution, abundance of biotic assemblages found onsite as well as on or near LNP facilities not on the LNP site including transmission lines.

**Q80. How did you make your assessment?**

A80 (ALM) I reviewed the Applicant's environmental report and field surveys to assess the water quality, biotic integrity, and species assemblages in the CFBC, OWR, and nearshore Crystal Bay marine habitat near the CREC discharge. In addition, I reviewed the extensive seagrass surveys done since the early 1990s, and historic and current records of sea turtle and manatee population surveys and fishery statistics in order to assess aquatic resources in the area over the past 20 years. I reviewed three studies by Estevez and Marshall from 1993 (NRC028), 1994 (NRC029) and 1995 (NRC030), where they analyzed the impacts from CREC discharge on seagrass beds in Crystal Bay. I reviewed ESA consultation for operation impacts of CREC on sea turtles (NRC031), numbers of sea turtle strandings in the region (NRC032), and an overview of sea turtle population health and trends for Florida (NRC033). I reviewed information available on manatee populations and management in Florida waters (NRC034) and general fisheries information and limits for the region to assess relative productivity (NRC035, NRC036). The Staff used this information to describe the aquatic resources in the area that could potentially be affected by the proposed action.

I reviewed the Applicant's environmental report, responses to RAIs, FDEP Conditions of Certification, BMPs from the Applicant, consultation letters from FWS and NMFS, and in-water work requirements from FDEP in order to assess building and operation impacts on aquatic resources. Life history attributes of aquatic species and habitat stability were assessed for disruption and sustainability of aquatic resources with the proposed action. Comparisons of recreational and commercial harvest statistics for the past 10 years were used to determine population stability in the nearshore Crystal Bay marine habitat. Species assemblages in various portions of the water bodies assessed were reviewed for appropriate habitat utilization and abundances under temporal conditions.

I consulted with the surface water and groundwater hydrologists that prepared the FEIS to determine impacts to surface waters, groundwater, and overall impacts to water volumes and water quality.

I reviewed past, present, and reasonably foreseeable future Federal, non-Federal, and private actions within the region that may affect the aquatic resources previously described.

**Q81. Are any of the impact determinations that you made part of the subject of this proceeding?**

A81. (ALM, MTM) Yes. The contention disputes the Staff impact determinations made in Sections 4.3.2, 5.3.2, and 7.3.2 of the FEIS. In Section 4.3.2.6 of the FEIS we state "Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that the impacts of construction and preconstruction activities on the freshwater, estuarine, and marine aquatic biota and habitats, including impacts on aquatic threatened and endangered species and other important species onsite, offsite, and within the transmission-line corridors would be SMALL, and no additional mitigation measures are proposed at this time." NRC001A at 4-79.

In Section 5.3.2.5 of the FEIS we state "[t]he staff has reviewed the proposed operational activities for proposed LNP Units 1 and 2 and the potential impacts on aquatic biota in the CFBC, OWR, Gulf of Mexico, and rivers and perennial/seasonal streams crossed by transmission-line corridors. Based on this review, the Staff has determined that the impacts resulting from the proposed operational activities would be SMALL, and any mitigation beyond what is already described above would not be warranted." Id. at 5-61.

In Section 7.3.2 of the FEIS we state "Cumulative impacts on aquatic ecology resources are estimated based on the information provided by PEF and the review team's independent review.

The review team concludes that the cumulative impacts of past, present, and reasonably foreseeable future activities on the aquatic resources of Crystal Bay would be SMALL to MODERATE, primarily due to the continued operation of CREC. However, the review team concludes that the incremental contribution to this assessment of impact from the NRC-authorized activities related to construction and operation of LNP 1 and 2 would be SMALL." NRC001 at 7-34.

## D. Atmospheric Review Background and Definitions

**Q82.** Which of the sections in the FEIS related to meteorology that you were responsible for preparing are disputed in this contention?

A82. (LKB) I understand that the Intervenors are challenging the description of the meteorological and air quality impacts of construction and operation of the LNP, including the Staff's performance of the confirmatory review of the salt deposition analysis provided by the Applicant (which is presented in section 5.7.2 of the EIS).

(KRQ) I was the lead technical reviewer for the LNP safety review. As such, I was not directly involved in writing the LNP FEIS sections. I did review each of the FEIS sections as they were developed and completed and I provided any comments, suggestions, or revisions that I considered to be necessary. I worked to ensure that the FEIS sections were consistent with the findings in the Safety Evaluation Report sections being developed as part of the safety review.

**Q83. Are any of the impacts determinations that you made part of the subject of this proceeding?**

A83. (LKB, KRQ) No, we did not make any impact determinations in regards to the salt deposition or any other aspect that are the subject of the contested proceeding.

**Q84. How did you develop your understanding of the atmospheric conditions used in your deposition analysis for the proposed site?**

A84. (LKB) I attended the environmental site audit (December 2-5, 2008) and examined the meteorological tower that was located on the LNP site. We also reviewed the two-years of onsite meteorological data as well as climatological data from Gainesville and Tampa, FL. Temperature data from the tower was used to document the climatology of the site (Section 2.9.1 of the FEIS), as well as the atmospheric stability. The atmospheric stability is used to quantify the amount of mixing that occurs due to atmospheric turbulence. When the atmosphere is stable there is little turbulence and hence little mixing of pollutants. When the atmosphere is unstable there are large amounts of turbulence and much mixing. Wind data collected from the tower was analyzed to determine the prevailing wind direction and speed, as well as distribution of wind speed and wind direction that could have impacts on the dispersion patterns around the site. For example, at the LNP site winds are commonly from the east-northeast or west. NRC001A at 2-181. This flow pattern is indicative of a sea-breeze circulation that it is very common at the LNP. Id. The wind speed and wind direction from Gainesville was used in some initial calculations of the salt deposition.

**Q85. What Staff guidance did you refer to in making your independent assessment?**

A85. (LKB, KRQ) We used NUREG-1555 Section 2.7, with respect to the documentation of air quality and meteorology for the site, and we used NUREG-1555 Section 5.3.3.1, with respect to the cooling tower drift associated with the operation of the cooling towers. NRC013.

**Q86. What methodologies did you use in your analysis?**

A86 (LKB) I reviewed the Applicant's environmental report in regards to air-quality and meteorological impacts associated with the construction and operation of the LNP, including salt drift and deposition associated with the operation of the cooling systems. We also reviewed the Applicant's RAI responses pertaining to salt drift and deposition at the LNP site.

Salt drift is defined to be the salt-containing water drops that escape from the mechanical draft cooling towers that will be employed at the LNP. Salt deposition is defined to be the salt that is deposited on the surface as a result of the salt drift. Salt drift is not unique to the LNP site and is associated with the operation of cooling towers.

The estimation of the salt drift and deposition can be broken into two parts: the computation of the amount of salt drift emanating from the cooling towers (also called the source term) and the subsequent calculation of the dispersion through the atmosphere and subsequent deposition. The source term is directly related to the amount of water that flows through the cooling system and the concentration of salt in the cooling water. As described on page 5-4 of the FEIS, makeup water for the cooling system will be supplied from the Gulf of Mexico via the Cross Florida Barge Canal (CFBC). NRC001A at 5-4. The salt concentration of water in the CFBC is expected to be 25,000 ppm. Id. at 5-86. Cooling water is typically cycled through the cooling system more than once, leading to an additional concentration of salt. PEF plans to operate the cooling system of the LNP at 1.5 to 2.0 cycles of concentration. Id. at 3-26. In general, periods with 2.0 cycles of concentration will be of limited duration. NRC021 at 5-37. In these calculations, we assumed that the cooling system is run at 1.5 cycles of concentration during normal plant operations. Drift eliminators will be employed at the LNP cooling towers that limit the salt drift to be 0.0005% of the total flow through the system. NRC001A at 5-86. The dispersion of the cooling tower drift is also influenced by the size of the salt particles that escape from the cooling tower. As part of our analysis of the source term, we applied size distributions of the salt particles, based on cooling tower measurements that have appeared in the literature. NRC037 at 127-129. An additional input into the calculation is the circulating water flow rate. The designed flow rate through the system is 531,100 gpm, but the maximum possible flow rate of the system is 600,000 gpm. NRC001A at 3-28. As a conservative assumption, the salt deposition results were scaled up to account for a flow rate of 600,000 gpm. With these assumptions, the total dissolved solids escaping from the cooling towers is estimated to be 115.7 lb/hr during normal operation and 154.26 lb/hr during short-duration excursions. Id. at 5-86.

Once we computed the source term that represents the drops that escape from the cooling towers, we modeled the salt dispersion and deposition using the US EPA preferred/recommended AERMOD modeling system. The development of AERMOD was a joint effort of the American Meteorological Society and the EPA, and can be used in a range of regulatory processes, including: State Implementation Plan revisions for existing sources, New Source Review, and Prevention of Significant Deterioration programs. AERMOD is a plume modeling system that utilizes wind and mixing depth data to predict the dispersion and deposition. The analysis reported in the ER and the FEIS made use of off-site surface meteorological data collected in Gainesville, Florida. NRC021 at 5-40; NRC001A at 5-86.

**Q87. What additional analysis did you complete?**

A87. (LKB) The atmospheric conditions at Gainesville, FLand the LNP site, while similar, are not identical. NRC038 at 1-2. The Staff conducted a comparison of wind speed and wind direction between the onsite observations at the LNP site (NRC038 at 1 -2 ) and the National Weather Service observation station at Gainesville, FL Regional Airport (GNV). GNV does not record wind speeds less than 1.5 meters per second (m/s). The onsite meteorological observation tower at the LNP site begins recording data at 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 are predictably higher 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.

Therefore, as part of my confirmatory analysis of the Applicant's salt deposition calculations, I ran AERMOD using one-year of meteorological data that was collected by the instruments on the meteorological tower at the LNP site during 2008. The results from these simulations were not substantially different from the AERMOD simulations completed by the Applicant and presented in the ER, which used surface wind data from Gainesville. NRC021 at 5-40. For example, the highest onsite deposition rate based on calculations made using the LNP meteorological data was 9.95 kilograms per hectare per month (kg/ha/mo), compared to 10.75 kg/ha/mo (which occurred using data from 2005) that was reported in the EIS. NRC001A at 5-86. The largest onsite deposition rates in a given year (computed using data from Gainesville, FL) ranged from a value of 8.21 kg/ha/mo using data from 2001 to 10.76 kg/ha/mo using data from 2005. In addition the patterns of the dispersion were very similar between the two sets of simulations.

**Q88. How can this occur when the winds are different between the two locations?**

A88. (LKB) A number of factors contribute to the dispersion in the atmosphere, including the wind speed, wind direction, and atmospheric stability. While the distribution of wind directions from Gainesville and LNP are not identical, both locations frequently have east-northeasterly wind, and as shown by our analysis, similar dispersion characteristics.

# Part III Analysis of Specific Portions of Contention 4A

(All) In this portion of the testimony we apply the definitions and reviews described in Part II of our testimony to each of the subparts of the contention. This section is organized based on the wording of contention 4A

## A. Contention Subpart A1

**Q89. What is Subpart A1 of this contention?**

A89. (ALL) In Contention 4A and specifically Subpart A1 the Intervenors state the "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. A. Impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with dewatering, specifically: 1. Impacts resulting from active and passive dewatering;"

**Q90. What is the Staff's understanding of this subpart of the contention?**

A90. (ALL) This portion of Contention 4A challenges the analysis in the FEIS related to the potential impact to wetlands resulting from building and operating the LNP units. The Staff's description of the groundwater model and its subsequent use in the Staff's assessment is described in A30-A38 and A41-A51 of this testimony.

Contention 4A also alleges that the Staff's assessment that impacts to water use and water quality within wetlands, floodplains, special aquatic sites, and other waters because of construction and operation of the LNP units would be SMALL. For this subpart of the contention, the Intervenors' disagreements with the impact assessments in the FEIS are limited to active and passive dewatering. For active dewatering, Contention 4A appears to include a challenge to the impacts associated with dewatering activities in the CFBC associated with in-water work for the barge facility, intake and pumphouse, and blowdown pipeline installation. For passive dewatering, this portion of Contention 4A alleges that passive dewatering could alter groundwater and surface water flow that would affect surface water habitats in special aquatic sites and other waters. The Staff's understanding of the term dewatering, as used by the Intervenors, including active and passive dewatering, is described in A39 of this testimony.

### 1. Hydrologic Assessments Review Related to Subpart A1 of Contention 4A

**Q91. What hydrologic evaluations support the Staff's assessment of impacts to wetlands?**

A91. (VRV,DOB,LWV,RP) The Staff's hydrologic assessment to support determination of impacts to wetlands is described in Part II of this testimony. This hydrologic assessment included characterization of the depth, extent and hydrologic parameters of the aquifers at and around the site. As part of this evaluation, the Staff evaluated field data from the site characterization activities as well as local and regional studies to evaluate the potential for the occurrence of preferential flowpaths between aquifers and wetlands created by fractures and karst dissolution beneath the site. This data was used to create conceptual models of the groundwater system and the interaction of the groundwater system and the environment, including wetlands. These were reviewed by the Staff and are described in Part II, A31—A35. Staff also reviewed numerical models, which were created to support impact determinations.

This is described in Part II, A36 -- A38. For this portion of the contention, the Staff's definition of dewatering in Part II, A39 is particularly relevant.

**Q92. What is the Staff's interpretation of the term "wetlands" as used by the Intervenors?**

A92. (JPD) As stated in A67, the Staff broadly interprets the term "wetlands" to include all areas meeting either the Federal definition of wetlands established by the USACE in 33 CFR 328.3 or the definition of wetlands by the State of Florida in Fla. Stat § 373.019 (25) (2011). The Staff's analysis of wetlands impacts in the EIS extends to all wetlands meeting either the Federal or Florida definitions, regardless of whether the USACE determines the wetlands to be "adjacent" or "isolated" for purposes of Clean Water Act jurisdiction.

### 2. Impacts to Wetlands from Active and Passive Dewatering

**Q93. Where in the FEIS did the Staff consider impacts to wetlands from active and passive dewatering?**

A93. (JPD) Possible effects on wetlands and other terrestrial ecosystems from active and passive dewatering during building and development of the LNP are addressed in Section 4.3.1.1. NRC001A at 4-31 to 4-35. Possible effects on wetlands and other terrestrial ecosystems from active and passive dewatering during LNP operations are addressed in Section 5.3.1.1. Id. at 5-26 to 5-31. Dewatering impacts on wetlands are also considered in the evaluation of cumulative impacts on terrestrial ecological resources in Section 7.3.1. Id. at 7-20 to 7-29.

**Q94. What guidance did the Staff follow to assess possible effects of active and passive dewatering on wetlands?**

A94. (JPD) The Staff followed ESRP 4.3.1 for assessing potential impacts on wetlands and other terrestrial habitats from building the proposed LNP facilities. There is no ESRP specifically addressing the analysis of operational impacts on wetlands and other terrestrial habitats, but terrestrial ecologists with the Staff drew upon analyses by Staff hydrologists that followed ESRPs 4.2.1, 4.2.2, 5.2.1, and 5.2.2 for evaluating the potential hydrological effects from operation of the facilities. To supplement the ESRPs, the Staff developed analytical methodologies individually tailored to the unique hydrogeological and ecological setting of the LNP. These methodologies are described where appropriate in the responses to the succeeding questions, below.

**i. Active Dewatering – Building and Development of the LNP**

**Q95. How did the Staff analyze potential wetland impacts caused by active dewatering necessary to build the proposed LNP facilities?**

A95. (JPD) To prepare Section 4.3.1 of the FEIS in a manner achieving the objectives of ESRP 4.3.1, the Staff independently reviewed the Applicant's evaluation titled "Effects of Temporary Dewatering on Wetlands for the Construction of the Levy Nuclear Plant Levy County, Florida." PEF014. This document evaluated the possible effects on wetlands caused by 1) active dewatering of excavations needed to excavate for and build the power blocks for the two reactors and 2) active dewatering of temporary trenches needed to build buried makeup water intake and blowdown water discharge pipelines. The Staff also reviewed the Conditions of Certification issued to the Applicant by the State of Florida. PEF005.

**Q96. What did the Staff conclude regarding potential wetland impacts caused by active dewatering necessary to excavate for and build the proposed LNP power blocks?**

A96. (JPD) The Staff expects that the effects on wetlands caused by active dewatering of the two large excavations needed to build the proposed LNP power blocks (including the nuclear islands) would be temporary and localized. NRC001A at 4-32 to 4-35. The Staff reviewed the Applicant's proposed plans for subsurface grouting and installation of diaphragm walls around the proposed excavations to minimize entry by groundwater and concluded that the effects on the surrounding groundwater system would be minor, with only "localized, short-term" effects. Id. at 4-22. The Staff further notes that the Applicant would pump water that does accumulate in the excavations to an unlined infiltration basin, thereby allowing gradual recharge of the underlying aquifer in a natural manner. Id. at 4-34. The Staff 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.

**Q97. Did you analyze impacts to wetlands from active dewatering necessary to build any other LNP facilities?**

A97. (JPD) For the same reasons stated for the power block excavations in the response to the previous question, the Staff expects that the hydrological effects on wetlands from temporary active dewatering of shallower excavations needed to build other LNP buildings would be temporary, limited, and localized. Regarding dewatering of trenches to install buried pipelines, the Staff notes that the Applicant proposes to perform the dewatering in segments, each of short duration, and to direct the pumped water into unlined infiltration trenches allowing it to gradually recharge the underlying aquifer in a natural manner. Id. The Staff concludes "Because of the short duration of dewatering, the shallow depth of the excavations, and the groundwater recharge achieved through groundwater mounding, no long-term impacts on wetlands, including wetland functions, are expected from pipeline installation." Id.

**Q98. Did the Staff take into consideration the influence of natural seasonal and episodic variation in groundwater levels affecting wetlands on and in the vicinity of the LNP site?**

A98. (JPD, LMA, VRV) Yes, the Staff's conclusions reflect the expected magnitude and duration of dewatering the power block excavation in light of natural seasonal and annual variability in groundwater levels in the landscape. PEF's conceptual foundation design calls for substantial dewatering to depths of approximately 100 ft below the existing grade. Id. at 4-21. Under this design, subsurface grouting and diaphragm walls would be used to isolate the excavation and minimize the impacts of dewatering on surrounding groundwater levels. The Staff reviewed groundwater monitoring conducted by the Applicant that showed groundwater levels on the LNP site fluctuating by as much as 5 ft over the course of 1 year (March 2007 to March 2008), as well as long-term data provided from nearby wells suggesting seasonal groundwater fluctuations of as much as 7 to 8 feet. Id. at 4-34. The Staff considered the possible temporary groundwater drawdown resulting from the power block excavations to be "within the range of variability to which these wetlands systems have adapted." Id. The Staff expects that the temporarily depressed groundwater levels resulting during the 2-4 years of LNP development would be within the range of groundwater fluctuations to which the affected wetlands have already adapted. The composition of vegetation in the affected wetlands and the functional properties of the wetlands are therefore not expected to be permanently altered, or otherwise destabilized.

**Q99. How did the Conditions of Certification imposed on the Applicant by the State of Florida factor into the Staff's analysis?**

A99. (JPD, LMA) The Staff's conclusions in the FEIS regarding dewatering impacts on wetlands during excavation of the powerblocks do not rely exclusively on the Staff's review of PEF's information on the proposed excavations. They also rely on the State of Florida requiring the Applicant to prepare a construction dewatering plan for approval by FDEP and SWFWMD prior to initiating excavations. NRC001A at 4-34. The FDEP Conditions of Certification that are necessary for SWFWMD permitting require that the construction dewatering plan include "the details of the dewatering system, discharge quantities and location, a monitoring plan, and other details as appropriate to demonstrate that the dewatering plans meet the [District's] Conditions of Issuance as included in 40D-2.301 and comply with all applicable Environmental Resource Permit construction dewatering requirements." PEF005 at 53. The FDEP Conditions of Certification necessary for SWFWMD permitting also state that if unacceptable adverse impacts to wetlands and other surface waters occur, the SWFWMD will require PEF to curtail or abate the impacts, unless the impacts can be mitigated. PEF005 at 53.

**ii. Active Dewatering – Operation of the LNP**

**Q100. How did the Staff analyze potential wetland impacts caused by active dewatering during operation of the proposed LNP facilities?**

A100. (JPD, LMA) The Staff found that active dewatering potentially affecting wetlands during LNP operations would be limited to operation of the four water production wells proposed for installation on the Applicant's property south of the LNP site. The Staff performed a quantitative analysis of possible wetland impacts from operating the wells. The analysis consisted of overlaying groundwater drawdown contours estimated for operation of the four production wells over a 60-year lifespan using predictive simulations (Figure 5-1 in NRC001A) over wetland mapping data for the LNP site and surrounding landscape (Figure 2-15 in NRC001A). NRC001A at 5-6; 2-43. The Staff identified all wetlands overlying areas where the predicted simulation of groundwater drawdown equaled or exceeded 0.5 feet. The analysis identifying the extent of adverse wetland impacts assumes that groundwater drawdowns exceeding 0.5 foot could adversely affect overlying wetlands, while projected drawdowns less than 0.5 foot would not adversely affect overlying wetlands. Id. at 5-27. The basis for this assumption is explained in the response to the next question.

In addition to the quantitative analysis of projected wetland impacts resulting from modeled drawdown levels, the Staff reviewed the requirements for monitoring and mitigation of groundwater impacts established by the Florida DEP in their Conditions of Certification for the LNP. PEF005.

**Q101. What was the basis for the Staff using 0.5 feet as a threshold for possible adverse wetland effects in their quantitative analysis?**

A101. (JPD, LMA) The 0.5-foot drawdown threshold was based on a literature review of water table drawdown effects on wetlands produced by the Southwest Florida Water Management District (SWFWMD). NRC041. The authors of the literature review describe the study as “a compilation of readily available information on the cause and effect relationship between TDFM [timing, duration, frequency, and magnitude] of groundwater drawdowns and ecological impacts on isolated wetlands.” Id. at 3. Approximately 20 of the 24 articles and reports discovered by the authors to report adverse effects on wetlands caused by man-made groundwater drawdown were based on observations in Florida. Id. at 4. The authors conclude:

> Although none of the studies provided sufficient data to quantify a relationship between the TDFM [timing, duration, frequency, and magnitude] of groundwater withdrawals beneath isolated wetlands and observable adverse effects on wetlands ecology, at least six of the studies 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.

**Q102. How did the Staff establish wetland boundaries for purpose of their quantitative analysis of potential impacts on wetlands caused by operation of the production wells?**

A102. (JPD, LMA) The Staff used Florida Land Use, Cover, and Forms Classification System (FLUCFCS) mapping data available from SWFWMD. FLUCFCS data provides a uniform data source using consistent definitions for the entire region potentially affected by the LNP project. FLUCFCS map units beginning with the number “6” are wetlands. FLUCFCS maps are produced using aerial photointerpretation using 1:24,000 or closer color infrared aerial photographs confirmed by representative ground truthing. Ground truthing consists of on-the-ground observations to confirm aerial photointerpretation. FLUCFCS provides a generally consistent approach to wetland mapping tailored to State of Florida with further regional adjustments. Figure 2-15 in the FEIS depicts the FLUCFCS mapping of the LNP and surrounding landscape. NRC001A at 2-43. Areas mapped using FLUCFCS wetlands categories appear in black on this figure.

**Q103. How did the Staff estimate water table drawdown for purposes of their quantitative analysis of potential drawdown impacts on wetlands?**

A103. (JPD, LMA) The Staff’s quantitative analysis for possible active dewatering impacts on wetlands relied on the groundwater modeling described in Section 5.2.2 of the EIS. Id. at 5-7 to 5-8. The analysis considered the modeling results from a local-scale model developed by the Applicant as part of the site certification application process and a recalibrated model requested by Staff hydrology experts. Because the recalibrated modeling indicated a greater potential for possible wetland impacts, the Staff’s analysis of dewatering effects on wetlands presented in Section 5.3.1.1 of the EIS relies primarily on the recalibrated modeling. Id. at 5-26 to 5-31. The Staff further discusses reliance on the Applicant's groundwater modeling above in A30 -- A38.

**Q104. What were the results of the Staff's quantitative analysis of the possible effects on wetlands from operation of the LNP water production wells?**

A104. (JPD, LMA) Based on results from the recalibrated model, 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. The results are depicted graphically in Figure 5-5 of the FEIS and numerically in Table 5-2 of the FEIS. Id. at 5-28 and 5-29, respectively. Figure 5-5 in the FEIS indicates that modeled drawdowns of greater than 0.5 feet would not affect wetlands more than 1 mile from the 3,105-acre LNP site or the property owned by the Applicant south of the site. Id. at 5-28. Modeled drawdowns of over 1.0 foot would be almost completely confined to the Applicant's property south of the LNP site, and modeled drawdowns of over 1.5 feet would be completely confined to the Applicant's property south of the LNP site. The greatest modeled drawdowns (exceeding 2.0 feet) would be limited to areas in the immediate proximity (less than 500 feet) of the production well locations. Table 5-2 of the FEIS indicates that only about 563 acres of wetlands would be affected by modeled drawdowns exceeding 1.0 foot, and that only about 190 acres of wetlands would be affected by modeled drawdowns exceeding 1.5 feet. Id. at 5-29. Wetlands affected by the greatest modeled drawdowns (exceeding 2.0 feet) would be limited to approximately 35 acres. Id.

**Q105. What elements of the Conditions of Certification did the Staff consider important in its evaluation of potential wetland impacts from active dewatering during operation of the proposed LNP wells?**

A105. (JPD, LMA) Specifically relevant to the Staff's review were Chapter II (Southwest Florida Water Management District), Part A (Special Conditions), Subpart 2 (Environmental Impacts, Monitoring, and Mitigation) and Subpart 3 (Alternative Water Supply Implementation). PEF005 at 42 to 43 and 43 to 46, respectively. The former section calls for the Applicant to submit Annual Environmental Monitoring Reports that must "assess relationships between water level fluctuations, well pumpage, atmospheric conditions, and drainage factors related to the environmental condition of the wetlands and surface waters in the vicinity of the [LNP]." PEF005 at 43. The latter requires the Applicant to investigate possible development of alternative water sources to use in case monitoring reveals possible adverse groundwater impacts from operation of the proposed production wells.

**Q106. What did the Staff conclude regarding the potential effects of active dewatering on wetlands?**

A106. (JPD, LMA) The Staff concludes in Section 5.3.1.1 of the FEIS that operation of the four production wells over a postulated 60-year operational life of the LNP reactors "could affect the hydrological and hence ecological properties of wetlands within a localized area." NRC001A at 5-30. The FEIS states "The review team believes that any possible effects of groundwater withdrawals on wetlands would be temporary and localized as long as the FDEP and USACE conditions are met." Id. at 5-47. The determination that the wetland impacts would be "localized" is based on the data presented in Figure 5-5 and Table 5-2 of the FEIS, which show that projected wetland impacts would not extend more than about 3 miles from the production well locations. Id. at 5-28 and 5-29, respectively. In addition to their interpretation of the groundwater modeling results, the Staff's conclusions also rely on Conditions of Certification issued by State of Florida requiring the Applicant to monitor groundwater levels during the initial years of operation and to switch to alternative water sources if "wellfield aquifer performance testing, revised groundwater modeling or environmental monitoring of wetlands either detects or predicts adverse wetland impacts." Id. at 5-46.

The Staff concludes that the potential overall impacts on terrestrial ecological resources, including wetlands, from operation of the LNP would be SMALL to MODERATE. Id. at 5-47. The "to MODERATE" reflects the Staff's acknowledgement of uncertainty in the ability of the Applicant's proposed monitoring efforts to detect or predict adverse wetland impacts in time to switch to an alternate water source before noticeable effects ensue. Id. However, because the Conditions of Certification call for corrective action as soon as adverse wetland impacts are noticed, the Staff did not find that a LARGE conclusion is warranted.

**Q107. How far from the proposed well locations did the Staff extend its analysis of possible wetland impacts caused by well operations?**

A107. (JPD, LMA) The analysis was not limited to the LNP site or other property owned by the Applicant. 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. All wetlands overlying areas where the hydrological modeling showed possible groundwater drawdown were considered in the analysis.

**iii. Passive Dewatering – Building and Operation of LNP**

**Q108. How did the Staff evaluate possible passive dewatering impacts on wetlands?**

A108. (JPD, LMA) The Staff's evaluation of possible effects on wetlands caused by passive dewatering focused on stormwater flow changes caused by the LNP project. The Staff reviewed the Applicant's proposed stormwater management plan and proposed best management practices for controlling runoff and sedimentation over the life the project. NRC001A at 4-26 and 5-15 to 5-16. The Applicant stated that after site grading, it would build a series of stormwater drainage ditches to direct runoff to three stormwater ponds. NRC021 at 5-15. The ponds would be retention/infiltration ponds designed to retain a 25-year, 24-hour rainfall event and to drain within 5 days. NRC021 at 5-16. A 25-year, 24-hour rainfall event is the maximum 24-hour precipitation event with a probable recurrence interval of once in 25 years. Rainfall exceeding the capacity of the stormwater ponds would be pumped to the cooling tower blowdown basin and discharged with blowdown to the Gulf of Mexico or released through emergency spillways to spreader swales that would in turn release the runoff as sheet flow to adjoining natural wetlands. NRC021 at 5-16.

**Q109. What did the Staff conclude regarding possible effects of passive dewatering on wetlands?**

A109. (JPD, LMA) The Staff concludes in the FEIS that wetlands remaining in undeveloped areas would not be affected by stormwater runoff from impervious surfaces on the LNP site. NRC001A at 5-26. The Staff expects that the unlined stormwater management facilities proposed by the Applicant would direct storm flows to adjoining wetlands and other naturally vegetated areas in a manner mimicking natural surface flow and groundwater recharge patterns. Stormwater runoff captured by three stormwater ponds would leach into the surficial aquifer in a natural manner with little potential for causing surface erosion or substantially altering the hydroperiod of connected wetlands. The roadside ditches built to receive runoff from LNP roadways would similarly release flow as seepage to the surficial aquifer or as sheetflow to adjoining wetlands at dispersed locations. The ditches would likewise have little potential to cause surface erosion or substantially alter the hydroperiod of affected wetlands. The emergency measures proposed by the Applicant would be too infrequent to substantially alter adjoining wetlands or other natural areas.

### iv. Cumulative Impacts to Wetlands from Active and Passive Dewatering

**Q110. How did the Staff characterize cumulative impacts to wetlands from active and passive dewatering?**

A110. (JPD, LMA) The assessment of cumulative impacts to terrestrial ecological resources, including wetlands, is presented in Section 7.3 of the FEIS. The assessment considers possible effects from the LNP project combined with other past, present, or reasonably foreseeable future impacts from the other activities listed in Table 7-1 of the FEIS. NRC001B at 7-3. Included in the activities considered is the proposed Tarmac King Road limestone mine. The FEIS states that "Based on this analysis, the review team concludes that cumulative impacts from construction, preconstruction, and operations of the proposed LNP units and from other past, present, and reasonably foreseeable future actions on wildlife, important species and their habitats would noticeably alter, but not likely destabilize, terrestrial ecological resources in the surrounding landscape." Id. at 7-28 to 7-29. The FEIS acknowledges the ongoing loss and fragmentation of natural habitats in the region and concludes that overall potential cumulative impacts on terrestrial ecological resources would be MODERATE. Id. at 7-29. It concludes however that the incremental effects from the LNP project would be SMALL to MODERATE, primarily due to the potential for operation of the proposed water production well during LNP operations to cause possible groundwater drawdown in nearby wetlands before corrective action required by the Conditions of Certification can be implemented (see A106). Id. The Applicant would be required by the State of Florida to monitor groundwater levels during the initial years of LNP operations and to switch water sources or mitigate if the monitoring indicates a potential for drawdown capable of adversely affecting wetlands. NRC001A at 5-30 to 5-31. The monitoring would detect overall drawdown near the wells but would not be capable of distinguishing drawdown caused by the wells from drawdown caused by other nearby activities. As indicated in A105 above, the Applicant would be required to terminate well operations or mitigate for drawdown effects if the monitoring indicates a potential for net drawdown impacts from the totality of actions affecting water table depths in areas subject to potential effects from the production wells.

### 3. Impacts to floodplains from active and passive dewatering.

**Q111. Where in the FEIS did the Staff consider impacts to floodplains?**

A111. (RP,DOB,LWV,VRV) The Staff's assessment of the effects of building activities on floodplains is described in FEIS Sections 4.2.1 and 4.2.3. NRC001A at 4-18 to 4-21. The Staff's assessment of the cumulative impacts to water quality, including the effects of building within the floodplain described in FEIS Section 7.2.2 considered the incremental contribution of the LNP project in addition to impacts from other past, present and reasonably foreseeable future actions. NRC001B at 7-16 to 7-17.

**Q112. What guidance did the Staff use in its impacts assessment to floodplains?**

A112. (RP,DOB,LWV,VRV) The Staff followed guidance in ESRP Sections 2.3.1, 2.3.2, and 2.3.3 to describe the existing surface water resource and water quality (NRC013 at 2.3.1-2, 2.3.1-3, 2.3.1-5, 2.3.1-6, 2.3.2-4, 2.3.3-3), ESRP Sections 3.3 and 3.3.1 to describe LNP plant water use (Id. at 3.3.1-2), ESRP Section 3.4 and 3.4.1 to describe the LNP cooling system (Id. at 3.4-2, 3.4.1-2 – 3.4.1-4), ESRP Sections 4.2.1, and 4.2.2 to estimate impacts on water use and quality from hydrological alterations and building activities (Id. at 4.2.1-2, 4.2.1-3 – 4.2.1-6, 4.2.2-2, 4.2.2-4, 4.2.2-6, 4.2.2-8 – 4.2.2-9), ESRP Section 4.7 to estimate cumulative impacts from building activities (NRC014 at 4.7-2 – 4.7-3), ESRP Sections 5.2, 5.2.1, and 5.2.2 to estimate impacts on water use and quality from hydrological alterations and plant operations (NRC013 at 5.2.1-2 – 5.2.1-4, 5.2.1-7 – 5.2.1-8), and ESRP Section 5.11 to estimate cumulative impacts from plant operations (NRC014 at 5.11-2 – 5.11-3).

**Q113. How would the floodplain be affected by operation-related active dewatering?**

A113. (RP,DOB,LWV,VRV) Active dewatering during operation of the LNP facilities will result from LNP groundwater withdrawal. During operations, LNP will withdraw an annual average of 1.58 Mgd using its production wells. NRC001A at 3-30. As described in Part II, A40 of the Staff's testimony, the 100-year floodplain extends to surface areas that have a 1 percent chance of inundation by floods in any given year. As the Staff interprets the contention, Subpart A1 implies that the active and passive dewatering related to the building and operation of the LNP plant would cause a lowering of the groundwater levels in the aquifers at the LNP site. The Staff also interprets Subpart A1 of this contention to imply that lowering of the groundwater level would increase the potential for recharge during rainfall events and thus could reduce the magnitude of runoff leading to a reduction in the area of the floodplain. As noted in Part II, A44 of the Staff's testimony, the annual average recharge at the LNP site is between 4 and 9 in./yr. This annual recharge is equivalent to a daily average recharge rate between 0.011 and 0.025 in./day. As also noted in Part II, A60, the 100-year, 24-hour rainfall amount was used for the detailed floodplain analysis. The 100-year, 24-hour rainfall amount near the LNP site is between 11 and 12 in. NRC024 at D-11. Therefore, the daily average recharge is between 0.1 and 0.22 percent (0.011 in./day divided by 12 in. and 0.025 in./day divided by 11 in. both expressed as percentages, respectively) of the 100-year, 24-hour rainfall amount. Because the average recharge is a small fraction of the rainfall amount, a large majority of the rainfall, between 99.8 to 99.9 percent, would run off during the 100-year, 24-hour rainfall event.

As stated in Part II, A44 of the Staff's testimony, the annual average recharge at the LNP site is between 0.9 and 2.0 Mgd over the LNP site area of 3,105 acres. To completely replace the LNP groundwater withdrawal of 1.58 Mgd, a total annual average recharge of 2.48 to 3.58 Mgd would be needed, which is equivalent to 0.029 to 0.042 in./day. Using the existing maximum annual average recharge of 0.025 in./day, the total recharge to replace the LNP groundwater withdrawal would then range from 0.054 (0.029 + 0.025) to 0.067 (0.042 + 0.025) in./day.  To provide a recharge of 0.054 to 0.067 in./day, the infiltration losses during a 100-year, 24-hour rainfall event would range from 0.49 to 0.61 percent (for 11 in. of rainfall amount) or 0.45 to 0.56 percent (for 12 in. of rainfall amount).  The maximum recharge, 0.61 percent, accounting for the LNP withdrawal, is still a small fraction of the 100-year, 24-hour rainfall and would still result in 99.4 percent of the rainfall being converted to runoff.  Because the reduction in runoff is minor (99.4 percent vs. 99.8 or 99.9 percent), the Staff concludes that the active dewatering associated with the LNP production wells' withdrawal would not affect the floodplain area.

**Q114.  How would the floodplain be affected by building activity-related active dewatering?**

A114. (RP,DOB,LWV,VRV)  As stated above in Part II, A39, active dewatering during building of the LNP facilities would occur due to groundwater withdrawals from the four production wells, dewatering of the excavations where LNP facilities would be built, dewatering in the CFBC associated with installation of the intake structure, barge unloading facility, and laying of the portion of blowdown discharge pipeline where it crosses the CFBC.  During building, the projected average estimated maximum groundwater usage is 275,000 gpd and the projected total maximum usage is 550,000 gpd, which would be supplied from the four production wells.  These uses are both significantly smaller than the LNP operational annual average groundwater use of 1.58 Mgd used in A113 above.  The Staff determined that the floodplain would not be affected by active dewatering with an LNP operational annual average groundwater use of 1.58 Mgd.  Because the groundwater use during building would be smaller than that during operations, the Staff concludes that active dewatering because of groundwater withdrawal during building would also not affect the floodplain.

(RP,DOB,LWV,VRV) Rainfall collected in the excavation pits for the LNP facilities will be pumped out (active dewatering). The area of the excavation pit for the LNP facilities is approximately 6 ac. NRC017 at 4. The drainage area of Direct Runoff to Gulf subbasin upstream of the LNP site that would contribute to flooding is over 2,000 ac. Id. at 2. Therefore, 0.3 percent (6 ac of 2,000 ac expressed as percent) of the rainfall over the contributing area during the rainfall event will collect in the excavation pits and would not contribute to the flood discharge downstream of the LNP site. Because the rainfall loss to the excavation pits is a small fraction of the rainfall, which would also occur during large rainfall events, including those that inundate the 100-year floodplain near the LNP site, the 100-year floodplain will not be noticeably affected. Therefore, the floodplain would not be affected by active dewatering from the excavation pits.

(RP,DOB,LWV,VRV) As stated above in Part II, A39, active dewatering during building of the LNP facilities will occur during installation of intake structure in the CFBC, building of the barge unloading facility adjacent to the CFBC, and laying of the portion of blowdown discharge pipeline where it crosses the CFBC. NRC017 at 2–3. The active dewatering related to these activities would occur temporarily during the building period. These three areas, where dewatering for building activities would occur, are all within or immediately adjacent to the CFBC. The CFBC is directly connected to the Gulf of Mexico and therefore its water surface elevation reflects that of the Gulf. The surficial aquifer adjacent to the CFBC discharges groundwater into the CFBC. NRC001A at 2-27. Because of dewatering during building activities in these three areas, the standing water in the CFBC adjacent to its northern berm will be removed. This water removal may result in some additional groundwater flow into the three areas. The surficial aquifer is in contact with the CFBC northern berm all along the CFBC's approximately 7 mi length. Along the northern berm of the CFBC, the intake structure will be approximately 111 ft in width. Id. at 3-7. Along the northern berm of the CFBC, the barge facility will be approximately 400 ft in width and the blowdown discharge pipeline corridor, as it crosses the CFBC will be approximately 140 ft in width. NRC017 at 2. The temporary cofferdam for building the intake structure will be approximately twice as wide as the width of the intake structure. NRC001A at 3-20. Assuming that the cofferdams for the other two areas would be similar to that for the intake structure, the width of the CFBC berm that will be affected by dewatering would be approximately 1,302 ft (111 ft x 2 plus 400 ft x 2 plus 140 ft x 2). This total width of the affected CFBC berm is approximately 3.5 percent of the total length of the berm. Because this is a small fraction and the dewatering would only be temporary, the additional groundwater flow into the CFBC from the adjacent surficial aquifer will result in a minor and unnoticeable effect on the aquifer; consequently, floodplains will not be noticeably affected.

**Q115. How would the floodplain be affected by operation-related passive dewatering?**

A115. (RP,DOB,LWV,VRV) As stated above in Part II, A39, the Staff understands that the Intervenors use the term passive dewatering to refer to the changes in surface water and shallow groundwater from changes in land cover, site drainage design, and changes in subsurface flow properties in the excavated zone. During operation of the LNP units, passive dewatering resulting from land cover changes and stormwater drainage could affect the floodplain. Land cover changes at the LNP site would increase the paved and impervious areas. Runoff would increase and recharge would be reduced by the paved and impervious areas. Reduced recharge could lead to lower groundwater levels. A stormwater management system for the LNP site may include site grading, drainage ditches, swales, and retention and filtration ponds. NRC001A at 3-7. The LNP site would be graded during building of the plant facilities to drain surface runoff away from the facilities and into a series of drainage ditches. The drainage ditches would collect surface runoff (stormwater) and convey them away from the plant area towards the three retention and infiltration ponds. Id. As discussed in Part II, A53 of the Staff's testimony, the stormwater ponds are designed to retain a 25-year, 24-hour rainfall event. Id. at 3-30. The 25-year, 24-hour rainfall depth near the LNP site is between 8 and 9 in. NRC024 at D-9. As noted in Part II, A44 of the Staff's testimony, the annual average recharge at the LNP site is between 4 and 9 in./yr. This annual recharge is equivalent to a daily average recharge rate between 0.011 and 0.025 in./day. From paved and impervious areas, runoff would be increased by the same amount that would have recharged the aquifer, a daily average rate between 0.011 and 0.025 in./day. The stormwater ponds have sufficient capacity to retain the increased runoff from the paved and impervious areas, which will subsequently recharge the aquifer over five days. Therefore, passive dewatering due to changes in land cover and drainage design at the LNP site will not result in noticeable aquifer dewatering; consequently, the effect on the floodplain will also not be noticeable.

(RP,DOB,LWV,VRV) After the LNP facilities are built and during plant operations, they will present obstructions to the regional groundwater flow within the excavated zone. The area of the excavation pit for the LNP facilities is approximately 6 ac. NRC017 at 4. The existing groundwater would flow around these subsurface structures and resume its original flow pattern some distance downgradient of the LNP site. Although the changes in subsurface flow properties during LNP operations compared to existing conditions would be different on the LNP site, particularly near the LNP facilities, the effects on the regional groundwater flow properties would not be noticeable because the excavated area is (and thus the obstructions are) small compared to the portion of the aquifer upgradient of the LNP site. Therefore, the changes in subsurface flow properties in the excavated zone would not noticeably change regional groundwater flow in the aquifer; consequently, the recharge to the aquifer would not change noticeably and, therefore, the effects on floodplains will be unnoticeable.

**Q116. How would the floodplain be affected by building-activity related passive dewatering?**

A116. (RP,DOB,LWV,VRV) The Staff considered passive dewatering during building activities to occur from reduction in recharge from paved and impervious areas. Runoff from these areas would be collected in the three stormwater ponds where it would infiltrate into the soil. NRC001A at 3-7 to 3-8, 3-19, 3-30. The increased runoff from these areas would reinfiltrate nearby (via the stormwater ponds). This situation is similar to that described above in A115 that described the effect on floodplains from operation-related activities. Therefore, building-activity related passive dewatering would not result in noticeable changes to the floodplain.

**Q117. Did the Staff consider potential ecological impacts from active and passive dewatering on the natural plant communities typically occurring in floodplains?**

A117. (JPD, LMA) The LNP site and adjoining properties, including the Applicant's property to the south where the production wells would be sited, lack stream valleys containing distinct floodplain vegetation. The FEIS characterizes the LNP site as "relatively level with very little variation in surface topography, no rivers, no streams, and no other major drainage features." NRC001A at 2-5. The same is true for adjoining properties. As is evident from Figure 2-15 of the FEIS (Id. at 2-43), vegetation cover in that part of the LNP site and adjoining properties within the 100-year floodplain of the Withlacoochee River follows the same general pattern as that within the non-floodplain portions of the landscape: level areas dominated by slash pine (*Pinus elliottii*) and other yellow pines punctuated by frequent shallow depressions dominated by pond cypress (*Taxodium ascendens*) and other wetland hardwoods. Id. at 2-42 to 2-48. Floodplains in such a landscape are purely hydrological, and not ecological, features, and are distinguished from other parts of the landscape on the basis of infrequent flood occurrence only.

They do not constitute a separate ecological feature warranting a separate analysis.  The consideration of potential impacts on upland and wetland habitats in Sections 4.3.1 and 5.3.1 of the FEIS therefore constitutes an integrated analysis of potential impacts to terrestrial habitats both inside and outside of the 100-year floodplain.

### 4. Impacts to special aquatic sites from active and passive dewatering.

**Q118.  What are special aquatic sites and are they afforded any special protection or consideration?**

A118. (ALM, MTM) As defined previously, special aquatic sites include wetlands, fish and wildlife sanctuaries and refuges, mud flats, vegetated shallows, coral reefs, and riffles and pool complexes.  Special aquatic sites are defined by the EPA in 40 C.F.R. § 404(b)(1)(q-1) as geographic areas that have special characteristics such as ecological value related to productivity, habitat, or wildlife protection. These sites are recognized as having significant value and contribution to the ecosystem health of a region. The Staff did not use the term, "special aquatic sites" in the FEIS, preferring to use the individual descriptive term associated with the resource in question (i.e. wetlands, refuges, etc).

**Q119.  What hydrologic characterization supports the Staff's assessment of impacts to special aquatic sites and other waters?**

A119. (RP,DOB,LWV,VRV)  The Staff's hydrologic assessment to support determination of impacts to special aquatic sites and other waters is described in A16 of this testimony.  Site specific characterization and monitoring data collected during the LNP field investigation were integral to formulating a conceptual model of the groundwater system beneath the LNP site. These data were used in conjunction with regional information available from the SWFWMD and USGS to support the Staff's assessment.

**Q120. Are there any aquatic sanctuaries or refuges in the aquatic ecology geographic area of interest that could have observable direct, indirect or cumulative impacts on the resource, habitat or feature?**

A120. (ALM, MTM) No aquatic sanctuaries, refuges, or coral reefs occur close enough to the LNP site to potentially be directly or indirectly influenced by LNP activities. Big Bend Seagrasses Aquatic Preserve covers over 945,000 acres of saltmarsh, estuarine and marine habitat that extends 150 miles along the northeast coast of Florida from Waccasassa Bay northwest to Apalachee Bay. The southern tip of the Big Bend Seagrasses Aquatic Preserve is located approximately 10 mi offshore and to the west and north of the LNP site and about 5 nautical miles to the north of the CFBC. NRC001A at 2-91; NRC017.

St. Martins Marsh Aquatic Preserve is located approximately 11 miles southwest of the LNP site and 6 nautical miles to the south of the CFBC. The Crystal River National Wildlife Refuge is located at Kings Bay which is approximately 12 miles due south of the LNP site and 10 miles inland from the mouth of Crystal River which empties to the Gulf of Mexico just north of the St. Martins Marsh Aquatic Preserve. NRC001A at 2-91. The Staff does not expect direct, indirect or cumulative impacts to these resources from building and operation of LNP because of the distance from the site and the SMALL impacts predicted to onsite aquatic resources.

**Q121. Are there any coral reefs in the aquatic ecology geographic area of interest?**

A121. (ALM, MTM) No coral reef habitats occur within the aquatic ecology geographic area of interest. The nearest shallow water coral reef habitat to the LNP site occurs to the south in the waters associated with the Florida Keys, over 250 miles from the LNP site. Therefore, the Staff does not expect any direct, indirect or cumulative impacts to coral reefs from building and operation of LNP.

**Q122. Are there any riffle and pool complexes in the aquatic ecology geographic area of interest?**

A122. (ALM, MTM) As defined in 40 C.F.R. § 230.45 “Steep gradient sections of streams are sometimes characterized by riffle and pool complexes. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. Pools are characterized by a slower stream velocity, a steaming flow, a smooth surface, and a finer substrate”. Riffle and pool complexes do not occur within the aquatic ecology geographic area of interest and are not present in any of the nearby flowing waters such as the Old or Lower Withlacoochee River or the tidal CFBC.

**Q123. Are there any mud flats in the aquatic ecology geographic area of interest?**

A123. (ALM, MTM) Mud flats are where sedimentation occurs over broad, flat areas along coastal rivers and coastal lands and may extend inland to the extent of the tidal influence (40 CFR Part 230). Coastal mud flats fluctuate between being exposed at low tides and covered by water at high tides just at or near the surface of the substrate. Mud flats have ecological significance as areas where wave energy is dissipated and serve as a barrier to erosion of saltmarshes and coastal lands. Mud flats occur at the mouth of the CFBC and all along the coastal lands of the Gulf of Mexico and along the banks of the tidal portions of the lower Withlacoochee River. Therefore, mudflats occur within the aquatic ecology geographic area of interest. The potential for LNP affecting nearby mudflats is discussed in questions A126 through A129 and A131 below.

**Q124. Are there any vegetated shallows in the aquatic ecology geographic area of interest?**

A124. (ALM, MTM) Vegetated shallows are regions of aquatic vegetation in marine, estuarine, or freshwater habitats that are permanently inundated. These regions are often defined by the vegetation type such as "seagrass beds", and can also be referred to as submerged aquatic vegetation (SAV). SAV are important areas of ecosystem productivity and provide habitat, protection, and food for many aquatic species. SAV occur where sunlight can penetrate through the surface of the water, which allows photosynthesis to occur and adds dissolved oxygen to the water as a by-product. SAV occurs in the nearshore marine waters near the mouth of the CFBC, Withlacoochee Bay and Crystal Bay as seagrass beds. Therefore, vegetated shallows, or SAV, occur within the aquatic ecology geographic area of interest. The potential for LNP affecting nearby SAVs is discussed in questions A126 through A130 below.

**Q125. What guidance did you rely on to assess the impact of dewatering associated with LNP on the biota of nearby special aquatic sites?**

A125. (ALM, MTM) We used NUREG-1555, ESRP 2.4.2 (NRC013) with respect to the affected environment such that the aquatic ecological systems and biota are described in sufficient detail to assess proposed construction, building, and operation.

We used NUREG-1555, ESRP 4.3.2 (NRC013) with respect to assessment of onsite and offsite construction and building activities to include transmission line corridors.

We used NUREG-1555, ESRP 5.11 (NRC 013) with respect to identifying past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have cumulative impacts with the proposed action on aquatic ecology.

**Q126. Where in the FEIS did you consider direct impacts from LNP dewatering to the biota of SAV and mud flats?**

A126. (ALM, MTM) Building and operation effects from active dewatering are discussed in Sections 4.3.2 and 5.3.2 of the FEIS. In-water construction activities that require dewatering are planned for the CFBC for the installation of a barge facility, intake and pumphouse installation, and placement of the blowdown pipeline. NRC001A at 4-72. There is no SAV within the CFBC based on sampling and characterization studies performed in 2007 and 2008. NRC042 at 17-18. In addition, there are no mud flat habitats in the locations where the barge facility, intake and pumphouse installation, and placement of the blowdown pipeline dewatering for construction will occur. Therefore, there are no direct effects to SAV or mud flats from active dewatering from building activities. Operation activities will have no direct impacts from active dewatering because the wellfield is not located near or in any nearby SAV or mud flat habitats.

**Q127. Where in the FEIS did you consider indirect impacts from LNP dewatering to the biota of SAV and mud flats?**

A127. (MTM, ALM) Building and operation effects from dewatering are discussed in Sections 4.2.2 and 5.2.2 of the FEIS. Dewatering activities that will occur on site were assessed for indirect effects on SAV in Crystal Bay and mud flats along coastal areas by determining impacts of building and operation to groundwater. Building-related dewatering is expected to be temporary and occur over a small portion of the LNP site and along the blowdown pipeline corridors NRC001A at 4-22; 4-23 (Figure 4-1). Therefore, building-related activities are not expected to indirectly affect SAV in Crystal Bay or mud flats along coastal areas. Groundwater pumping activities for service water during LNP operation are predicted to have a highly localized area of influence within LNP site boundaries and will not be detectable in the estuarine or marine habitats with SAV or the coastal mud flats that occur at the mouth of the CFBC or nearshore Crystal Bay. Id. at 5-7 to 5-8, 5-6 (Figure 5-1).

**Q128. Where in the FEIS did you consider cumulative impacts from LNP dewatering to the biota of SAV and mud flats?**

A128. (ALM, MTM) Cumulative effects from dewatering are discussed in Section 7.3.2. of the FEIS Past, present, and reasonably foreseeable future dewatering activities are described in Section 7.2.1.2 and provide the basis for assessing SAV and mud flats impacts in addition to impacts from other activities and natural phenomena. NRC001 at 7-13 to 7-15. Cumulative actions in the geographic area of interest include refurbishment, modification, and continued operation of the existing Crystal River Energy Complex (CREC), the proposed power uprate of CREC Unit 3, current operation of the Inglis Quarry, widening of the US-19 bridge across the CFBC, a proposed hydropower project on the Inglis Lock bypass channel spillway, the proposed Tarmac King Road Limestone Mine, decommissioning of CREC Units 1 and 2, development of a Port District along the CFBC, and natural environmental stressors such as weather and climate flux. Id. at 7-29, 7-30.

(ALM, MTM) Section 7.2.1.2 discusses the past, present and reasonably foreseeable future usage of groundwater resources as managed by SWFWMD and concludes that the past, present, and projected usage is relatively minor when compared to local-scale groundwater flow model domain. Id. at 7-14. Dewatering through active and passive means at the LNP site is limited, and is not likely to detectably affect the distribution and abundance of aquatic biota in offsite waterbodies or other aquatic habitats. Additionally dewatering activities associated with LNP are unlikely to affect future planning for the region. Id. Past and present activities such as the operation of Crystal River Energy Complex caused a noticeable reduction in SAV in Crystal Bay due to increased thermal discharge, and noticeable impingement and entrainment mortality from intake operations. Therefore, cumulative impacts to the biota of SAV and mud flats are noticeable due to these past activities that are currently mitigated through the use of additional cooling towers and mariculture supplementation. Id. at 7-34. However, the incremental impact to SAV and biota inhabiting mud flats attributable to LNP dewatering activities, are expected to be inconsequential.

**Q129. Which aquatic biota could potentially be affected in nearby SAV and mud flats as a result of LNP active dewatering?**

A129. (ALM, MTM) SAV habitats in the nearshore Crystal Bay and nearshore coastal waters at the mouth of the CFBC are dominated by *Halodule wrightii* (shoal grass), *Syringodium filiforme* (manatee grass), and *Thalassia testudinum* (turtle grass). NRC043 at 6-43 to 6-51; NRC028, NRC029, NRC030. As previously stated, onsite active dewatering will not affect SAV as no active dewatering activities will occur in these areas. Mud flat habitats along the coastal shorelines on Crystal Bay and the CFBC are tidally influenced and are not expected to be affected by LNP active dewatering activities, as these habitats do not occur in areas where active dewatering will take place. NRC001A at 4-22; 4-23 (Figure 4-1).

**Q130. What would be the impact to the distribution and abundance of aquatic biota in SAV habitats because of LNP passive dewatering?**

A130. (ALM, MTM) Passive dewatering from changes in onsite surface runoff patterns is not expected to significantly reduce freshwater contributions in the CFBC as described in A115 and therefore would not noticeably affect salinity levels. The LNP site is located almost 8 miles west of the Gulf of Mexico where the SAV are found. Shifts in salinity of nearshore estuarine and marine waters occur due to tidal and seasonal influences under natural conditions. SAV that occur in the tidal zone are adapted for fluctuations in salinity. NRC044 at 4-5. Salinity levels at the mouth of the CFBC average 17.83 practical salinity scale (pss) at the surface and 25.91 pss at 4 m. NRC001A at 2-93. Shoal grasses tolerate a wide range of salinities ranging between 3.5-44 psu and are fast-growing, early colonizers of shallow marine habitats as shown in a FWS report by Zieman and Zieman which presents the ecology of seagrasses in west coastal Florida waters. NRC045 at 20. Turtle grasses prefer a narrower range of salinities between 24 and 35 psu and tend to grow optimally at depths greater than 3 ft (Id.), which are less affected by estuarine and tidal fluctuations. Manatee grasses grow optimally at salinities around 25 psu, preferring a moderate salinity range. NRC047 at 20. A 2006 report by USGS describes the seagrass distribution in the region as patchy with variable fluctuations between 1984 and 1992. NRC046 at 177-178. Therefore, minor fluctuations in salinity due to reduction of freshwater influence from runoff and stormwater management would not negatively affect SAV.

**Q131. What would be the impact to the distribution and abundance of aquatic biota in mud flats habitats because of LNP passive dewatering?**

A131. (ALM, MTM) Passive dewatering from changes in onsite surface runoff patterns is not expected to significantly reduce freshwater contributions in the CFBC as described in A115, and therefore would not noticeably affect water quality for mud flat habitats. No significant reduction in runoff of stormwater discharge is expected as described in A115, and therefore would not noticeably affect water quality for mud flat habitats. The LNP site is located almost 8 miles west of the Gulf of Mexico where the mudflats are found. The rich nutrients that collect in tidal mud flats stimulate the development of aquatic and estuarine vegetation that provide protection and habitat to aquatic and terrestrial biota. Benthic invertebrates (an animal without a backbone, such as a clam, that lives on or in the sea bed) reside in mud flat habitats and provide a food source for crustaceans, fish, sharks, rays, and birds. Mud flats occur in tidal zones and provide habitat for aquatic species that are adapted for fluctuations induced by tidal energies and water chemistry. NRC046 at 5. Therefore, minor fluctuations in salinity and water quality due to reduction of freshwater influence from runoff and stormwater management would not negatively affect mud flat habitats.

**Q132. What was your conclusion concerning the direct, indirect and cumulative impacts to the biota of special aquatic sites?**

A132. (ALM, MTM) In 4.3.2.6 of the EIS we state "[b]ased on the information provided by PEF and the review team's independent evaluation, the review team concludes that the impacts of construction and preconstruction activities on the freshwater, estuarine, and marine aquatic biota and habitats, including impacts on aquatic threatened and endangered species and other important species onsite, offsite, and within the transmission-line corridors would be SMALL, and no additional mitigation measures are proposed at this time." NRC001A at 4-79. Contention 4A alleges that the Staff's impact determination of SMALL was inappropriate. Impacts to aquatic biota in nearby surface waterbodies due to active and passive dewatering during the building of LNP would be undetectable and not destabilizing and therefore would not be categorized as MODERATE or LARGE. Therefore, the Staff finds that its categorization of SMALL for its significance level appropriate.

In 5.3.2.5 of the EIS we state "[t]he Staff has reviewed the proposed operational activities for proposed LNP Units 1 and 2 and the potential impacts on aquatic biota in the CFBC, OWR, Gulf of Mexico, and rivers and perennial/seasonal streams crossed by transmission-line corridors. Based on this review, the Staff has determined that the impacts resulting from the proposed operational activities would be SMALL, and any mitigation beyond what is already described above would not be warranted." Id. at 5-61. Contention 4A alleges that the Staff's impact determination of SMALL was inappropriate. Impacts to aquatic biota in nearby surface waterbodies due to active and passive dewatering during the operation of LNP would be undetectable and not destabilizing and therefore would not be categorized as MODERATE or LARGE. Therefore, the Staff finds that its categorization of SMALL for its significance level appropriate.

In 7.3.2 of the EIS we state "Cumulative impacts on aquatic ecology resources are estimated based on the information provided by PEF and the review team's independent review. The review team concludes that the cumulative impacts of past, present, and reasonable foreseeable future activities on the aquatic resources of Crystal Bay would be SMALL to MODERATE, primarily due to the past and continued operation of CREC. However, the review team concludes that the incremental contribution to this assessment of impact from the NRC-authorized activities related to construction and operation of LNP 1 and 2 would be SMALL." NRC001B at 7-34.

### 5. Impacts to "other waters" from active and passive dewatering

**Q133. What other waters did you consider in the hydrology-related analysis?**

A133. (RP,DOB,LWV,VRV) As stated above in Part II, A76, the review team assumed that the Intervenors meant the term "other waters" to include freshwater springs, and other waterbodies not afforded specific State or Federal protections or classifications. The review team considered the following unnamed freshwater springs as "other waters": (1) spring below the Inglis Dam that discharges freshwater to the Old Withlacoochee River (NRC001A at 5-5), (2) spring in the CFBC below the Inglis Lock that discharges freshwater to the canal (Id.), (3) spring flow in west-central Florida (Id. at 2-22), and (4) offshore springs in the Gulf of Mexico (Id. at 2-27). The review team also considered the Little King and Big King springs, which are located approximately 2 mi northwest of the LNP site. Id. at 2-32 (Figure 2-12).

**Q134. How did you determine the hydrologic impacts to other waters from active and passive dewatering?**

A134. (RP,DOB,LWV,VRV) During active dewatering associated with the LNP operational groundwater usage, groundwater discharges to the two largest springs in the vicinity of the proposed LNP site, Big King and Little King Springs, were predicted by the recalibrated model to decrease by approximately 0.05 Mgd (35 gpm) or about 1 percent of their total simulated flux. Id. at 5-8. As discussed in previous testimony (Part II, A44), both modeling results and simplified volumetric calculations show that proposed LNP groundwater usage represents a relatively small usage from a local-scale water balance perspective. Based on these water balance considerations and the fact that model-predicted reduction in these springs' flow is a small fraction of their discharge, the Staff determined that the impact of active dewatering from LNP operations on Little and Big King Springs would be insignificant. Discharges of springs located below the Inglis Dam and Inglis Lock will not be significantly affected by the active dewatering because Lake Rousseau is the source of these spring discharges (via groundwater upwelling). Lake Rousseau receives mean annual discharges of 627 Mgd (970 cfs) from the Withlacoochee River (Id. at 2-19) and 440 Mgd (681 cfs) from the Rainbow River (NRC063). The combined mean annual discharge into the lake, 1067 Mgd, is nearly three orders of magnitude greater than the LNP groundwater withdrawal during operation. Therefore, the Staff concluded that Lake Rousseau and the springs located below Inglis Dam and Inglis Lock would not be noticeably affected by the LNP groundwater withdrawal during operation. Because the groundwater withdrawal during building is smaller than that during operation, the Staff concluded that Lake Rousseau and the springs located below Inglis Dam and Inglis Lock would not be noticeably affected by the LNP groundwater withdrawal during building.

(RP,DOB,LWV,VRV) As stated above in Part III, A115 and A116, the Staff considered the effects of passive dewatering during operations and building of the LNP, respectively. The Staff considers passive dewatering to be the changes in surface water and shallow groundwater from changes in land cover, site drainage design, and changes in subsurface flow properties in the excavated zone. During operations of the LNP, because of increase in paved and impervious areas, runoff from the LNP site would increase and the recharge would reduce. The increased runoff would be retained in the three stormwater ponds where it will infiltrate during the next five days. Because this subsequent recharge will happen on the LNP site, land cover and the site drainage system will not result in noticeable passive dewatering of the aquifer. Additionally, during operations of the LNP, because of the presence of the subsurface portion of structures within the aquifer, the regional groundwater flow would be obstructed. The area of LNP excavations is approximately 6 ac. The existing groundwater flow would bend around these obstructions and resume its original pattern some distance downgradient of the LNP site. The Staff concludes that although the changes in subsurface flow properties would be different than existing on the LNP site, particularly close to the LNP facilities, the effects on the regional flow pattern would be unnoticeable because of the small area of obstruction compared to the extent of the upgradient aquifer. Therefore, other waters mentioned above would not be noticeably affected because they are located far from the LNP site in relation to the local extent of the effects of changes in land cover, site drainage design, and subsurface flow properties in the excavated zone.

**Q135. What others waters in the aquatic ecology geographic area of interest might be affected by LNP dewatering to an extent that the distribution and abundance of biota inhabiting those waters may be detectably altered?**

A135. (ALM, MTM) Other waters that occur in the aquatic ecology geographic area of interest include named and unnamed freshwater springs. Aquatic biota sampling information is available to assess abundances of species within the CFBC, where several unnamed freshwater springs occur, to assess potential for impacts related to dewatering. A detailed description of aquatic communities within the CFBC appears below. Two named springs, Little King Spring, and Big King Spring, are geographically separate from the onsite and offsite building and operation activities for the LNP and were not assessed for aquatic biota. However, as discussed in A134, the potential for a very minor reduction of flow to these springs from dewatering is unlikely to affect any aquatic biota present in the freshwater springs that discharge into the CFBC, Little King Spring, and Big King Spring as the reductions would be insignificant, especially to euryhaline organisms (organisms able to tolerate a wide range of salinities).

**Q136. What guidance did you rely on to assess the impact of dewatering associated with LNP on the biota of nearby waters?**

A136. (ALM, MTM) We used NUREG-1555, ESRP 2.4.2 with respect to the affected environment such that the aquatic ecological systems and biota are described in sufficient detail to assess proposed construction, building, and operation.

We used NUREG-1555, ESRP 4.3.2 with respect to assessment of onsite and offsite construction and building activities to include transmission line corridors.

We used NUREG-1555, ESRP 5.11 with respect to identifying past, present, and future Federal, non-Federal, and private actions that could have cumulative impacts with the proposed action on aquatic ecology.

**Q137. Where in the FEIS did you consider direct impacts from LNP dewatering to the biota of the CFBC and freshwater springs?**

A137. (ALM, MTM) Building and operation effects from dewatering are discussed in Sections 4.3.2 and 5.3.2 of the EIS. In-water construction activities that require dewatering are planned for the CFBC for the installation of a barge facility, intake and pumphouse , and placement of the blowdown pipeline. Sampling and characterization of aquatic biota in the CFBC was performed in 2007 and 2008 and is described in Section 2.4.2 of the EIS. NRC001A at 2-94 to 2-101. CFBC salinities range from an average of 5.75 practical salinity scale (pss) units at the surface to 16.87 pss at a depth of 4 m near the Inglis Lock, and average 17.83 pss at the surface and 25.91 pss at 4 m just outside the mouth of the CFBC in the Gulf of Mexico. NRC001A at 2-93; NRC042. Overall, the results of fish, plankton, and macroinvertebrate (larger animals without a backbone easily seen by the naked eye) sampling in the CFBC indicate a biologically diverse and dynamic aquatic community at the mouth of the CFBC and just inside the mouth of the CFBC. NRC001A at 2-96 to 2-100; NRC042. At the furthest up-canal location near the Inglis Lock, a less diverse community exists and is made up of a few species of sediment-dwelling invertebrates and small assemblages of pelagic or open-water inhabiting species that use the fresher water habitat on a seasonal basis. NRC001A at 2-101. Installation activities requiring dewatering in the CFBC would result in displacement or mortality of benthic invertebrates. Steel sheet piling, cofferdams, and turbidity barriers would be installed to minimize effects of the temporary dewatering necessary for these installation activities. Id. at 4-73. However, sampling in these areas indicate limited numbers and low biodiversity of benthic organisms. Id. at 2-101. Fish and motile invertebrates will likely avoid areas of installation activities in the CFBC, which will be temporary. As required by FDEP and Florida Fish and Wildlife Conservation Commission (FFWCC), a biologist would be present to visually monitor for threatened and endangered species that may appear in the CFBC during installation activities. Id. at 4-79. Sea turtles and manatees might approach these areas, and their presence near the installation and dewatered areas during activity may require a temporary halt of work until the animals move out of the area. Id. Operation activities will not directly require dewatering for the CFBC.

**Q138. Where in the FEIS did you consider indirect impacts from LNP dewatering to the biota of the CFBC and freshwater springs?**

A138. (ALM, MTM) Building and operation effects from dewatering are discussed in Sections 4.3.2 and 5.3.2 of the EIS. Dewatering activities that will occur on site were assessed by determining impacts of building and operation to groundwater resources as described in Part II, A44 for indirect effects on biota in the CFBC and connected freshwater springs. Building-related dewatering is expected to be temporary and occur over a small portion of the LNP site and along cooling water pipeline corridors. NRC001A at 4-22; 4-23 (Figure 4-1). Therefore, building-related activities are not expected to indirectly affect the biota of the CFBC and connected freshwater springs. Groundwater pumping activities for service water are predicted to have a highly localized area influence that will not be evident in the estuarine, marine, or freshwater habitats of the CFBC and connected freshwater springs. Id. at 5-8; 5-6 (Figure 5-1).

**Q139. Where in the FEIS did you consider cumulative impacts from LNP dewatering to the biota of CFBC and freshwater springs?**

A139. (ALM, MTM) Cumulative effects from dewatering are discussed in Section 7.3.2. Cumulative actions include refurbishment, modification and continued operation of the existing Crystal River Energy Complex (CREC), the proposed power uprate of CREC Unit 3, current operation of the Inglis Quarry, widening of the US-19 bridge across the CFBC, a proposed hydropower project on the Inglis Lock bypass channel spillway, the proposed Tarmac King Road Limestone Mine, decommissioning of CREC Units 1 and 2, development of a Port District along the CFBC, and natural environmental stressors such as weather and climate flux. NRC001 at 7-29 to 7-30. Past, present, and reasonably foreseeable future dewatering activities are described in Section 7.2.1.2 and provide the basis for assessing CFBC and freshwater springs impacts in addition to impacts from other activities and natural phenomena. Groundwater resources as managed by SWFWMD for past, present, and projected usage is relatively minor when compared to the local-scale groundwater flow model domain. Id. at 7-14. Dewatering through active and passive means at the LNP site is limited, and is not likely to noticeably affect planning for the region in the future. Id. Therefore, cumulative impacts to the biota of the CFBC and freshwater springs, including incremental impacts from LNP dewatering, are not likely to be noticeable.

**Q140. Did you rely on the groundwater modeling effort to assess the impact of LNP dewatering on the biota of these waterbodies?**

A140. (ALM, MTM) The analyses and conclusions described in EIS Sections 4.2.2, 5.2.2.2, and 5.2.3.2, were used for determination of impacts to the CFBC and the freshwater springs associated with this waterbody. NRC001A at 4-25; 5-8; 5-16. Groundwater withdrawal and subsequent dewatering impacts for aquatic biota were based largely but not exclusively on modeling and simulations described in Part II, A44 and Section 5.2.3.2 of the FEIS. Id. at 5-16.

**Q141. What was your conclusion concerning the direct, indirect and cumulative impacts due to LNP dewatering to the biota of these other waters?**

A141. (ALM, MTM) In 4.3.2.6 of the EIS we state "Based on the information provided by PEF and the review team's independent evaluation, the review team concludes that the impacts of construction and preconstruction activities on the freshwater, estuarine, and marine aquatic biota and habitats, including impacts on aquatic threatened and endangered species and other important species onsite, offsite, and within the transmission-line corridors would be SMALL, and no additional mitigation measures are proposed at this time." Id. at 4-79. The impact is properly characterized as SMALL and is not MODERATE or LARGE because the dewatering impact from building activities on aquatic resources would be minor and undetectable and not noticeable or destabilizing.

In 5.3.2.5 of the EIS we state " The staff has reviewed the proposed operational activities for proposed LNP Units 1 and 2 and the potential impacts on aquatic biota in the freshwater, estuarine, and marine aquatic biota and habitats, specifically the CFBC, OWR, Gulf of Mexico, and rivers and perennial/seasonal streams crossed by transmission-line corridors, and including impacts on aquatic threatened and endangered species and other important species onsite, offsite, and within the transmission-line corridors. Based on this review, the Staff has determined that the impacts resulting from the proposed operational dewatering activities would be SMALL, and any mitigation beyond what is already described above would not be warranted." Id. at 5-61. The impact is properly characterized as SMALL and is not MODERATE or LARGE because the direct and indirect dewatering impact from operations to aquatic resources would be minor and undetectable and not noticeable or destabilizing.

In 7.3.2 of the EIS we state "Cumulative impacts on aquatic ecology resources are estimated based on the information provided by PEF and the review team's independent review. The review team concludes that the cumulative impacts of past, present, and reasonably foreseeable future activities on the aquatic resources of Crystal Bay would be SMALL to MODERATE, primarily due to the continued operation of CREC. However, the review team concludes that the incremental contribution to this assessment of impact from the NRC-authorized activities related to construction and operation of LNP 1 and 2 would be SMALL." NRC001B at 7-34. The effects of dewatering from the building and operating of the LNP on surface waters will not be sufficient to alter aquatic habitat; therefore, no effect on populations of aquatic biota in the geographic area of interest is anticipated. The Staff finds that the contribution to the cumulative impact to aquatic biota and habitat associated with LNP dewatering in the geographic area of interest SMALL. The direct, indirect and the contribution to cumulative impacts due to dewatering at the LNP site is properly characterized as SMALL and is not MODERATE or LARGE because the impact to aquatic resources from dewatering would be minor and undetectable and not noticeable or destabilizing.

## B. Contention Subpart A2

**Q142. What is Subpart A2 of this contention?**

A142. (ALL) In Contention 4A and specifically Subpart A2 the Intervenors state ”The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. A. Impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with dewatering, specifically: 2. Impacts resulting from the connection of the site to the underlying Floridan aquifer;”

**Q143. What is the Staff’s understanding of this subpart of the contention?**

A143. (JPD, LMA) For wetlands and terrestrial resources, it is the Staff’s understanding that Contention 4A, Subpart A2 alleges that the FEIS did not adequately consider how the close connection of the land surface to the underlying Floridan aquifer might exacerbate the potential dewatering effects on wetlands and other terrestrial and aquatic habitats addressed in Part III under the discussion of Subpart A1 of the contention. Because of the connection of the LNP site and surrounding landscape to the underlying Floridan aquifer, without a confining unit separating the surficial and Floridan aquifer systems, impacts to the Floridan aquifer can be expected to directly influence the hydrology, and hence the vegetation composition and ecological function, of wetlands positioned on the surface.

(ALM, MTM) For aquatic resources it is the Staff’s understanding that Contention 4A challenges the Staff’s analysis of impacts associated with dewatering activities in the CFBC for in-water work for barge facility, intake and pumphouse, and the blowdown pipeline installation. These potential impacts are not directly associated with the underlying Floridan aquifer but the physical dewatering of the surficial aquifer related to excavations associated with the above identified structures. The Staff interprets the Contention’s challenge to dewatering related impacts to the underlying Floridan aquifer on aquatic ecology to reflect alteration of groundwater and surface water flow that affect surface water habitats.

### 1. Supporting hydrological assessments

**Q144. Describe the Floridan aquifer and its relation to the LNP site**

A144. (VRV,DOB,LWV,RP) The Floridan aquifer system is described in detail in Section 2.3.1.2 of the FEIS (NRC001A beginning at 2-22) and Part II of this testimony. At the LNP site, the Floridan is separated into an upper and lower aquifer. The top of the upper Floridan is overlain by the unconsolidated sands of the surficial aquifer, which is on average 50 ft thick. No confining unit exists between the surficial and Upper Floridan aquifer system and, as a result, the units are hydraulically connected. At the LNP site, the Upper Floridan is estimated to be 520 ft thick and is separated from the Lower Floridan by a low permeability middle confining unit. Id. at 2-25. During building, excavation will occur into the top of the Upper Floridan and during operation, water will be supplied to LNP from the proposed wellfield which will pump groundwater from the Upper Floridan. Site specific characterization data indicated that water flows vertically downward from the surficial aquifer and into the Upper Floridan where the direction of groundwater flow is generally west-southwest away from the site.

**Q145. Explain what is meant by Karst environment and its relation to the site**

A145. (VRV,DOB,LWV,RP) Karst is a terrain in which near-surface carbonate rocks have been partially dissolved by rainwater and groundwater, producing large solution openings that can readily transmit groundwater and where sinkholes can provide easy connections between the surface and groundwater. NRC001A at 2-25. In the vicinity of the LNP site, the Upper Floridan aquifer is composed entirely of the Avon Park formation, which consists primarily of dolomitized limestones. Dolomitized limestone is resistant to dissolution and aquifer properties at the site are consistent with other regional descriptions (NRC018 at 14) and indicate that the site is not located within an area of well-developed karst. NRC001A at 2-25.

**Q146. What information did you consult to develop your understanding of the aquifer at the site?**

A146. (VRV,DOB,LWV,RP) In order to develop a thorough understanding of site groundwater aquifers, the Staff reviewed and confirmed data from site characterization activities performed by the Applicant and in applicable RAI responses, and compared the findings to descriptions provided in local and regional studies. This field data included cores from borings (NRC001A at 2-25), slug and pumping test data (Id. at 2-26) and water level data. Id. at 2-28. Cores were used for characterization of contact depths, thickness and extent of hydrogeologic units beneath the site, slug and pumping test data were used to determine aquifer hydraulic properties and water level data were used for determination of natural water level variability and flow directions. These datasets, along with more regional information provided by other studies, were used to create conceptual models of the groundwater system and to assess the interaction of the groundwater system and the environment. These datasets were reviewed by the Staff and are described in Part II, A31—A35 of this testimony. Staff reviewed numerical models which were created to support impact determinations, which is described in Part II, A36—A38 of this testimony.

**Q147. Will the LNP use water from the Floridan aquifer during building or operations?**

A147. (VRV,DOB,LWV,RP) Yes. Raw water for building activities (e.g., soil compaction, dust and erosion control, and concrete mixing) will be withdrawn from on-site water supply wells completed in the Upper Floridan aquifer. This groundwater usage under average and maximum use conditions is expected to be 275,000 gpd and 550,000 gpd, respectively. NRC001A at 3-21. During operations, PEF has estimated that groundwater usage from the Upper Floridan aquifer to supply general plant operations will average 1.58 Mgd, with a potential daily maximum withdrawal of 5.8 Mgd. Id. at 5-7.

### 2. Impacts to floodplains from dewatering associated with the connection of the site to the underlying Floridan aquifer.

**Q148. Is the site connected to the underlying Floridan aquifer?**

A148. (VRV,DOB,LWV,RP) The LNP site is connected to the underlying Floridan aquifer. The surficial aquifer at the LNP site consists of unconsolidated sediments. The underlying carbonate rock aquifer is called the Floridan aquifer system. No confining unit exists between the surficial and the Upper Floridan aquifer and therefore the two aquifers (surficial and the Upper Floridan) are hydraulically connected. Id. at 2-23 (Figure 2-10). The Upper Floridan aquifer is estimated to be 750 ft thick in the region near the LNP site and around 520 ft thick at the site. Id. at 2-22; 2-25. The Upper Floridan aquifer is separated from the Lower Floridan aquifer by a low-permeability carbonate rock sequence called the middle confining unit. Id. at 2-25.

**Q149. What effect does the connection of the site to the underlying Floridan aquifer have on floodplains?**

A149. (RP,DOB,LWV,VRV) Because the Floridan aquifer is hydraulically connected to the surficial aquifer (no confining unit exists between the two) at the LNP site, a lowering of groundwater level in the Floridan aquifer would also lead to a lowering of the groundwater level in the surficial aquifer. Given a lowering of groundwater levels in the surficial aquifer, the aquifer would be capable of storing a larger amount of infiltration during rainfall events before reaching capacity, leading to reduced runoff which may result in smaller floodplains.

**Q150. How did you determine the impacts of dewatering on floodplains because the site is connected to the underlying Floridan aquifer?**

A150. (RP,DOB,LWV,VRV) The testimony we presented in Section III regarding Subpart A1 of this contention described the Staff's hydrologic evaluation of impacts from active and passive dewatering. This portion of Contention 4A challenges the Staff's analysis in the FEIS of impacts from dewatering due to the site's connection to the underlying Floridan aquifer system. Our analysis described in Section III, regarding Subpart A1 of the contention took into account the connection of the site to the underlying Floridan aquifer system. Therefore, our analysis above is applicable to this portion of Contention 4A.

(RP,DOB,LWV,VRV) As stated in Part III, A113, active dewatering from groundwater withdrawal during operations would not result in an appreciable change in the fraction of runoff from a 100-year, 24-hour rainfall event. As stated in Part III, A114, because the groundwater use during building would be smaller than that during operations, active dewatering because of groundwater withdrawal during building would also not affect the floodplain. As stated in Part III, A115, because the stormwater ponds have sufficient capacity to retain the increased runoff from the paved and impervious areas, which will subsequently recharge the aquifer, passive dewatering due to changes in land cover and drainage design at the LNP site will not result in noticeable aquifer dewatering; consequently, the effect on the floodplain will also not be noticeable. Because the excavated area is (and thus the obstructions from the subsurface portions of structures therein are) small compared to the portion of the aquifer upgradient of the LNP site, changes in subsurface flow properties in the excavated zone would not noticeably change regional groundwater flow in the aquifer; consequently, the recharge to the Floridan aquifer would not change noticeably and, therefore, the effects on floodplains will be unnoticeable.

### 3. Dewatering Effects on Wetlands Associated with the Connection to the Underlying Floridan Aquifer

**Q151. Does the analysis of possible dewatering effects on wetlands in the FEIS consider the presence of karst and the connection of the LNP site to the Floridan aquifer?**

A151. (JPD, LMA, VRV) Yes, the analysis of possible active and passive dewatering effects on wetlands reported by the Staff in Sections 4.3.1.1 and 5.3.1.1 of 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 flow paths 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). 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 pathways are not expected. 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. The analyses presented in the above FEIS sections relied in part on groundwater modeling performed by PEF and described in Section 2.3.1.2 of the FEIS. NRC001A at 2-25 to 2-30.

**Q152. Does the connection of the site to the underlying Floridan aquifer alter any of the Staff's responses to the questions posed in response to Subpart A1 of Contention 4A of this testimony?**

A152. (JPD, LMA) No, responses in Part III, Subpart A1 of this testimony addressing the impacts to wetlands from active and passive dewatering account for the connection of the LNP site and surrounding landscape to the underlying Floridan aquifer. The evaluation of the possible wetland response to modeled groundwater drawdown discussed in Part III of this testimony regarding Subpart A1 of the contention relies in part on a literature review of water table drawdown effects on wetlands produced by the Southwest Florida Water Management District (SWFWMD). NRC041. This paper was prepared by SWFWMD specifically to assist in evaluating groundwater drawdown impacts to wetlands in Florida. Although the paper relies on observations collected mostly from southern and central Florida, and may therefore not reflect certain hydrogeological conditions unique to the region surrounding the LNP site, it is useful because most wetlands in those parts of peninsular Florida are also situated in low, flat landscapes overlying carbonate formations (limestone and dolostone) with a shallow water table. Additionally, the Applicant will be required by the FDEP Conditions of Certification to perform detailed monitoring of wetlands on and close to the LNP site. PEF005 at 42 to 43. This monitoring is expected to detect adverse wetland impacts that might not be predictable using the groundwater modeling results and the SWFWMD literature review.

**Q153. Do the terrestrial ecology conclusions presented in the FEIS reflect the specific hydrogeological conditions present at the LNP site and surrounding landscape?**

A153. (JPD, LMA) Yes, the conclusions presented in Sections 4.3.1.8, 5.3.1.6, and 7.3.1.3 of the FEIS reflect groundwater modeling that accounts for local geological conditions. Uncertainty in the modeling and its interpretation is one reason for the Staff's conclusion of MODERATE for terrestrial ecology impacts from building and developing the LNP, SMALL to MODERATE for terrestrial ecology impacts from LNP operations, and MODERATE for cumulative impacts. NRC001A at 4-71; 5-47; 7-29, respectively. As noted in the response to Q106, The Staff did not conclude that the impacts would be LARGE because the FDEP

Conditions of Certification require the Applicant to monitor potentially affected wetlands for possible adverse effects over the first ten years of LNP operations. PEF005 at 42 to 43. The Staff considers these intensive monitoring requirements to be capable of detecting impacts capable of destabilizing terrestrial ecology resources in the region in time to allow preventative rectifying action.

### 4. Aquatic ecology impacts to special aquatic sites from dewatering associated with the connection of the site to the underlying Floridan aquifer.

**Q154. What effect does the connection of the site to the underlying Floridan aquifer have on special aquatic sites and other waters?**

A154. (ALM, MTM) This portion of the contention challenges the magnitude of the effects of dewatering due to the connection of the site to the Floridan aquifer on aquatic biota inhabiting special aquatic sites and other waters. Analysis of the hydrological effects of dewatering is addressed above in A119 and A134, which discuss the hydrologic characterization analyses associated with dewatering. This analysis included the effects of the connection to the Floridan aquifer as discussed in A146 and A150. Therefore, this portion of the contention does not change our analysis regarding dewatering effects to special aquatic sites, and other waters, and the biota associated with these waterbodies as described in A132 and A141.

## C. Contention Subpart A3

**Q155. What is Subpart A3 of this contention?**

A155. (ALL) In Contention 4A and specifically Subpart A3 the Intervenors state "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed

LNP facility. A. Impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with dewatering, specifically: 3. Impacts on Outstanding Florida Waters such as the Withlacoochee and Waccasassa Rivers;"

**Q156. What is the Staff's understanding of this subpart of the contention?**

A156. (RP,DOB,LWV,VRV) From a hydrology perspective, this subpart of Contention 4A alleges that the Staff inappropriately characterized the impacts to OFWs resulting from dewatering related to building and operating the LNP.

(JPD) From a terrestrial ecology perspective, this subpart of Contention 4A alleges that the effects of the LNP project on wetlands could ultimately lead to degradation of associated Outstanding Florida Waters (OFWs), such as the lower reach of the Withlacoochee River. Although most of the wetlands on the LNP site and in the surrounding landscape do not directly adjoin the shorelines of OFWs, many are hydrologically connected via surface flow, tributary systems, or the shallow water table.

(ALM, MTM) From an aquatic ecology perspective, this subpart of Contention 4A asserts that the Staff inappropriately characterized the magnitude of the impact to OFWs including the Withlacoochee Riverine and Lake System from LNP related alterations of groundwater and surface water flow.

**Q157. What are Outstanding Florida Waters (OFW)?**

A157. (ALM, MTM) As stated in Section 403.061(a)(27) of the Florida Statutes, the designation, Outstanding Florida Water (OFW), is approved by the Environmental Regulation Commission under the FDEP. Fla. Stat. Ann. § 403.061(a)(27) (2010). An OFW is considered a specific category of waterbody that is worthy of special protection due to its natural attributes such that the waterbody has exceptional recreational or ecological significance. The

Withlacoochee River is an OFW as is the Withlacoochee Riverine and Lake System which includes all portions of the Withlacoochee River. FDEP 2011 at 4. Although Waccasassa Bay is considered an OFW, the Waccasassa River is not considered an OFW by the State of Florida. FDEP 2011 at 3, 4.

### 1. Hydrologic Assessments Review Related to Subpart A3 of Contention 4A

**Q158. Did the analysis of possible dewatering effects in the EIS evaluate the potential impact on water quantity in the OFWs?**

A158. (RP,DOB,LWV,VRV) Yes. The Staff's evaluation of the effects of active and passive dewatering during building and operating the LNP facilities is described in A111—A116 of Staff's testimony, and it includes possible dewatering effects on water quantity in the OFWs.

(RP,DOB,LWV,VRV) As stated above in A114 of the Staff's testimony, active dewatering during building of the LNP facilities would occur due to groundwater withdrawals from the four production wells, dewatering of the excavations where LNP facilities would be built, dewatering in the CFBC associated with installation of the intake structure, barge unloading facility, and laying of the portion of blowdown discharge pipeline where it crosses the CFBC. During building activities, the estimated average and maximum groundwater use would be 275,000 gpd and 550,000 gpd, respectively. NRC001A at 3-21. The same four production wells that would be used for groundwater withdrawal during operations would be used during building activities. As stated above in A113, active dewatering during operation of the LNP facilities will result from LNP groundwater withdrawal. During operations, LNP will withdraw an annual average of 1.58 Mgd using its production wells. Id. at 3-30.

(RP,DOB,LWV,VRV) The LNP groundwater withdrawal during operations, 1.58 Mgd, is 0.8 percent of the total regional water flux, 208 Mgd. NRC001A at 5-8. The LNP groundwater withdrawal would 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. The Withlacoochee River has an annual mean discharge of 970 cfs (627 Mgd) above Lake Rousseau near Holder, Florida. Id. at 2-19. The discharge through Lake Rousseau to the lower Withlacoochee River via the Inglis Lock bypass channel and spillway varies from 923 cfs (597 Mgd) in May and June to 1110 cfs (717 Mgd) in September. Id. at 2-39. Therefore, the reduction in groundwater discharge, 0.4 Mgd, even if it were to affect only the OFWs (lower Withlacoochee River and Lake Rousseau), is minor. Consequently, active dewatering from LNP groundwater withdrawal during operations would have a minor effect on OFWs. Id. at 5-8. Because the LNP groundwater withdrawal during the building activities would be smaller than the LNP withdrawal during operations, the Staff concludes that the impact of LNP groundwater withdrawal on OFWs during building activities will also be minor.

(RP,DOB,LWV,VRV) As stated in A114, because the rainfall loss to the excavation pits is a small fraction of the rainfall, the active dewatering of the excavation pits would not result in noticeable dewatering of the aquifer; thus, rainfall loss to excavation pits would not have a noticeable effect on OFWs.

(RP,DOB,LWV,VRV) The impact of other dewatering activities (dewatering of the excavations where LNP facilities would be built, dewatering in the CFBC associated with installation of the intake structure, barge unloading facility, and laying of the portion of blowdown discharge pipeline where it crosses the CFBC) would all be temporary and located in the CFBC, which is not an OFW. As stated in A114, because of the small areas these additional activities would occupy, dewatering of the aquifer would be minor.

(RP,DOB,LWV,VRV),Because active dewatering will only have a minor effect on the aquifer and therefore the impact on water quantity in OFWs (Lake Rousseau and lower Withlacoochee River) from dewatering would also be minor and unnoticeable.

(RP,DOB,LWV,VRV) As described in Part II or our testimony above, the Staff's evaluation of possible effects caused by passive dewatering focused on stormwater flow changes caused by an increase in the area of impervious surfaces, site grading, and the construction of stormwater drainage ditches to direct runoff to three stormwater ponds. The ponds would be retention/infiltration ponds designed to retain a 25-year, 24-hour rainfall event and to drain within 5 days. NRC021 at 5-16. Rainfall exceeding the capacity of the stormwater ponds would be pumped to the cooling tower blowdown basin and discharged with blowdown to the Gulf of Mexico or released through emergency spillways to spreader swales that would in turn release the runoff as sheet flow to adjoining natural wetlands and would not affect nearby OFWs. Id.

As described in Part II, A55 and A56, during normal conditions site groundwater levels will be beneath the bottom elevation of stormwater ponds causing runoff captured by these ponds to infiltrate into the surficial aquifer. Seepage from groundwater into stormwater ponds would only occur during the wettest season of the normal year causing seepage from groundwater into the storm ponds to be minimal. As a result, loss of water due to passive dewatering from groundwater seepage into stormwater ponds would be uncommon and minimal, limiting any impact to groundwater inflows into OFWs.

**Q159. Did the analysis of possible dewatering effects in the FEIS evaluate the potential impact on water quality within the OFWs?**

A159. (RP,DOB,LWV,VRV) Yes. The Staff evaluated the potential impacts to water quality of OFWs because of potential reduction in water quantity and a potential increase in salinity or sediment from the LNP site. As stated above in A134, the impact on water quantity in OFWs

(Lake Rousseau and lower Withlacoochee River) from dewatering during building and operating the LNP plant would be minor and unnoticeable. Consequently, the effect on salinity in OFW's from a reduction in water quantity would be unnoticeable.

(RP,DOB,LWV,VRV) During building activities, a stormwater management program will be in place to minimize sediment concentrations in stormwater runoff. NRC001A at 4-25 to 4-26. During operations, three stormwater ponds would receive runoff from the area where LNP facilities will be located, including increased runoff from paved and impervious areas. Id. at 3-8 (Figure 3-4). These stormwater systems will minimize sediment runoff to nearby aquatic features including the OFWs. Therefore, the impacts on OFWs will be unnoticeable.

### 2. Effects on OFWs from Wetland Impacts caused by Dewatering

**Q160. Did the FEIS consider the connection of wetlands on and around the LNP site to OFWs?**

A160. (JPD, LMA) Yes, the analyses of potential dewatering effects on wetlands reported by the Staff in Sections 4.3.1, 5.3.1, and 7.3.1 of the FEIS consider effects at a regional scale. Id. at 4-31 to 4-35; 5-26 to 5-31; 7-21 to 7-26, respectively. The regional-scale analyses cited above encompass a consideration of effects on wetlands in the region with surface and/or groundwater connections to the Withlacoochee River and other Outstanding Florida Waters.

**Q161. Did the wetland impact analyses reported in the FEIS extend to all wetlands potentially capable of influencing OWFs, including wetlands determined to be "isolated" from navigable waters by the USACE for purposes of Clean Water Act jurisdiction?**

A161. (JPD, LMA) Yes, the wetland impact analyses reported by the Staff in Sections 4.3.1 and 5.3.1 of the FEIS, as well as the consideration of cumulative terrestrial impacts in Section 7.3.1, extend to all potentially affected wetlands, including those wetlands determined by the

USACE to be “isolated” and not under jurisdiction of the Clean Water Act because of the lack of a documentable nexus to navigable waters and interstate commerce. NRC001A at 4-28 to 4-72; 5-18 to 5-47 and NRC001B at 7-20 to 7-29.

**Q162. How can adverse effects on wetlands distant from surface water bodies designated as OFWs ultimately affect those waters?**

A162. (JPD, LMA) Wetlands can be connected to surface water bodies by surface flow, groundwater flow, or both. For example, wetlands can help detain surface flow before interception by surface waters, thereby reducing scour in the surface waters, modulating water depths in the surface waters, and reducing nutrient, sediment, and toxicant loads entering surface waters. Activities that disturb wetlands are therefore capable of disturbing the ecological properties of associated surface water bodies. The USACE states “Examples of ways in which hydrology can significantly affect downstream waters include, but are not limited to, transport of water and materials and compounds carried by the water (e.g., suspended materials, dissolved compounds), water retention, as a medium for the movement of aquatic organisms such as fish and invertebrates, and water discharge (e.g., release of retained water to other waters).” NRC047 at 9.

**Q163. Does the presence of Outstanding Florida Waters in the regional landscape surrounding the LNP site affect the Staff’s conclusions in the EIS?**

A163. (JPD, LMA) Yes, the proximity of Outstanding Florida Waters, in particular the lower reach of the Withlacoochee River, to the potentially affected wetlands is one contributing factor to the overall conclusion of MODERATE regarding potential adverse effects from construction of the LNP project on wetlands and other terrestrial habitats (NRC001A at 4-70) and SMALL to MODERATE regarding potential adverse effects from operation of the LNP project on wetlands and other terrestrial habitats. Id. at 5-46. However, the Staff did not conclude that the impacts would be LARGE because the FDEP Conditions of Certification require the Applicant to monitor wetlands for possible adverse effects over at least the first five years of LNP operations. PEF005 at 42 to 43. The Staff considers these monitoring requirements capable of detecting adverse wetland impacts in time to prevent ecological destabilization of the surrounding landscape, including OFWs in that landscape.

### 3. Characterization and assessment of the impacts to aquatic biota from dewatering impacts on OFWs

**Q164. Are there any OFW in the geographic area of interest that could potentially be affected by dewatering associated with the construction and operation of LNP?**

A164. (ALM, MTM) Yes, the Withlacoochee Riverine and Lake System is defined as an OFW, and would include Lake Rousseau, the OWR, and the LWR below the bypass channel.

**Q165. Where is the Withlacoochee Riverine and Lake System located in reference to the LNP site?**

A165. (ALM, MTM) A portion of the Withlacoochee River above Lake Rousseau, Lake Rousseau, the Old Withlacoochee River, and the lower portion of the Withlacoochee River are the closest waterbodies to the LNP site within the Withlacoochee drainage system and are located approximately 3 mi south of the LNP site. NRC001A at 2-1; 2-3 (Figure 2-2); NRC017 at 1.

**Q166. What guidance did you rely on to assess the impact of dewatering associated with LNP on the biota of the OFW?**

A166. (ALM, MTM)

- We used NUREG-1555, ESRP 2.4.2 with respect to the affected environment such that the aquatic ecological systems and biota are described in sufficient detail to assess proposed construction, building, and operation
- We used NUREG-1555, ESRP 4.3.2 with respect to assessment of onsite and offsite construction and building activities to include transmission line corridors.
- We used NUREG-1555, ESRP 5.11 with respect to identifying past, present, and future Federal, non-Federal, and private actions that could have cumulative impacts with the proposed action on aquatic ecology.

**Q167. Where in the FEIS did you consider direct impacts to Outstanding Florida Waters from planned dewatering?**

A167. (ALM, MTM) Building and operation effects from dewatering are discussed in Sections 4.3.2 and 5.3.2 of the FEIS. In-water installation activities that require dewatering are planned for the CFBC for the installation of a barge facility, intake and pumphouse installation, and placement of the blowdown pipeline. The CFBC has not been designated an OFW. No building activities are planned for any of the segments of the Withlacoochee Riverine and Lake System OFW. Operation of LNP will not have any detectable direct effects on the Withlacoochee Riverine and Lake System OFW.

**Q168. Where in the FEIS did you consider indirect impacts to Outstanding Florida Waters from planned dewatering?**

A168. (MTM, ALM) Dewatering activities that will occur on site such as stormwater management and groundwater pumping were assessed for indirect effects on the Withlacoochee Riverine and Lake System OFW in Section 4.3.2, 5.2.2.2, and 5.3.2 of the FEIS.

**Q169. Where in the FEIS did you consider cumulative impacts to Outstanding Florida Waters from planned dewatering?**

A169. (ALM, MTM) Cumulative effects from dewatering are discussed in Section 7.3.2. NRC001B at 7-29. Past, present, and reasonably foreseeable future dewatering activities are described in Section 7.2.1.2 (Id. at 7-13) and provide the basis for assessing Withlacoochee Riverine and Lake System OFW impacts in addition to impacts from other activities and natural phenomena. Cumulative actions considered include refurbishment, modification and continued operation of the existing Crystal River Energy Complex (CREC), the proposed power uprate of CREC Unit 3, current operation of the Inglis Quarry, widening of the US-19 bridge across the CFBC, a proposed hydropower project on the Inglis Lock bypass channel spillway, the proposed Tarmac King Road Limestone Mine, decommissioning of CREC Units 1 and 2, development of a Port District along the CFBC, and natural environmental stressors such as weather and climate flux.

**Q170. What would be the cumulative impacts from LNP dewatering to the biota of OFW?**

A170. (ALM, MTM) Section 7.2.1.2 discusses the past, present and reasonably foreseeable future usage of groundwater resources as managed by SWFWMD and concludes that the past, present, and projected usage is minor when compared to local-scale groundwater flow model domain. NRC001B at 7-14. Dewatering through active and passive means at the LNP site is limited, and is not likely to noticeably affect future planning for the region. Id. Therefore, no noticeable cumulative impacts from LNP dewatering is expected to the aquatic biota of the Withlacoochee Riverine and Lake System OFW. In Section 7.3.2 of the FEIS, we state "Cumulative impacts on aquatic ecology resources are estimated based on the information provided by PEF and the review team's independent review. The review team concludes that the cumulative impacts of past, present, and reasonably foreseeable future activities on the aquatic resources of Crystal Bay would be SMALL to MODERATE, primarily due to the continued operation of CREC. However, the review team concludes that the incremental contribution to this assessment of impact from the NRC-authorized activities related to construction and operation of LNP 1 and 2 would be SMALL." Id.

**Q171. What would be the impact to the distribution and abundance of biota in the Withlacoochee River as a result of LNP dewatering?**

A171. (ALM, MTM) Building and operation effects from direct dewatering are discussed in Sections 4.3.2 and 5.3.2 of the EIS. In-water installation activities that require dewatering are planned for the CFBC for the installation of a barge facility, intake and pumphouse installation, and placement of the blowdown pipeline, and are not planned for any OFW. The Staff assessed impacts from onsite dewatering activities during building and operation to groundwater resources as described in A44 for indirect effects on biota in the Withlacoochee Riverine and Lake System OFW. Building-related dewatering is expected to be temporary and occur over a small portion of the LNP site and along cooling water pipeline corridors. NRC001A at 4-22; 4-23 (Figure 4-1). Therefore, building-related dewatering activities are not expected to directly or indirectly affect the Withlacoochee Riverine and Lake System OFW. Groundwater pumping activities for service water are predicted to have a highly localized area of influence that will not be noticeable for the Withlacoochee Riverine and Lake System OFW. Id. at 5-8; 5-6 (Figure 5-1). Since all indirect dewatering activities associated with the LNP site would not be noticeable to water resources within the Withlacoochee Riverine and Lake System OFW, no effects are expected to biota inhabiting the Withlacoochee Riverine and Lake System OFW.

To put the Levy operational groundwater withdrawals in perspective with respect to the Withlacoochee Riverine and Lake System OFW, the Staff compared the LNP operational groundwater withdrawal flow to the flow of the Withlacoochee River below Lake Rousseau. The

Staff conservatively assumed that the entire LNP operational groundwater withdrawal requirements (1.58 mgd or 2.45 cfs annual daily average total withdrawal and 5.8 mgd or 9.0 cfs potential maximum daily withdrawal) was withdrawn from the Withlacoochee River near the production wellfield. Id. at 3-30. USGS streamflow records over the last 37 years reported an average daily discharge of 687 mgd or 1064 cfs through the bypass channel to the lower Withlacoochee River. Id. at 5-8. Even if the entire annual average daily withdrawal of 2.45 cfs and the potential maximum daily withdrawal of 9.0 cfs at the LNP site were non-mechanistically withdrawn from the Withlacoochee River basin in the vicinity of the LNP wellfield, it would only represent 0.2 percent of the annual mean flow and 0.8 percent of the potential maximum groundwater daily withdrawal of the Withlacoochee River below Lake Rousseau. The anticipated reduction in flow would have no detectable impact on the distribution and abundance of aquatic biota inhabiting the Withlacoochee Riverine and Lake System OFW.

**Q172. What was the review team's conclusion concerning the direct, indirect and cumulative impacts of dewatering on the aquatic biota of OFW?**

A172. (ALM, MTM) In Section 4.3.2.6 of the FEIS we state "Based on the information provided by PEF and the review team's independent evaluation, the Staff concludes that the impacts of construction and preconstruction activities on the freshwater, estuarine, and marine aquatic biota and habitats, including impacts on aquatic threatened and endangered species and other important species onsite, offsite, and within the transmission-line corridors would be SMALL, and no additional mitigation measures are proposed at this time." Id. at 4-79. The recognition of the OFW designation for the Withlacoochee Riverine and Lake System does not alter the Staff's conclusion that LNP dewatering will not detectably alter the biota inhabiting these waterbodies.

In Section 5.3.2.5 of the FEIS we state "The staff has reviewed the proposed operational activities for proposed LNP Units 1 and 2 and the potential impacts on aquatic biota in the CFBC, OWR, Gulf of Mexico, and rivers and perennial/seasonal streams crossed by transmission-line corridors. Based on this review, the staff has determined that the impacts resulting from the proposed operational activities would be SMALL, and any mitigation beyond what is already described above would not be warranted." Id. at 5-61. The impact is properly characterized as SMALL and is not MODERATE or LARGE because the direct and indirect impact to aquatic resources would be minor and undetectable and not noticeable or destabilizing.

In Section 7.3.2 of the FEIS we state "Cumulative impacts on aquatic ecology resources are estimated based on the information provided by PEF and the review team's independent review. The review team concludes that the cumulative impacts of past, present, and reasonably foreseeable future activities on the aquatic resources of Crystal Bay would be SMALL to MODERATE, primarily due to the past and continued operation of CREC. However, the review team concludes that the incremental contribution to this assessment of impact from the NRC-authorized activities related to construction and operation of LNP 1 and 2 would be SMALL." Id. at 7-34.

## D. Contention Subpart A4

**Q173. What is Subpart A4 of this contention?**

A173. (ALL) In Contention 4A and specifically Subpart A4 the Intervenors state "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed

LNP facility. " This section addresses impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with dewatering (A), specifically impacts on water quality and the aquatic environment due to alterations and increases in nutrient concentrations caused by the removal of water (A4).

**Q174. How do you interpret this subpart of the contention?**

A174. (RP,LWV,VV,DOB) From a hydrology perspective, this subpart of Contention 4A alleges that dewatering due to active and passive groundwater withdrawal during the building and operation of the LNP could result in the alteration of groundwater and surface water quality (due to seepage of potentially impacted groundwater into surface water bodies).

(JPD, LMA) From a terrestrial ecology perspective, this subpart of Contention 4A raises the possibility that adverse impacts to wetlands, especially impacts related to the drying of wetlands caused by active and passive dewatering, could indirectly result in increased entry of nutrients into regional waterways.

(ALM, MTM) From an aquatic ecology perspective, this subpart of Contention 4A alleges that dewatering due to groundwater withdrawal during the building and operation of the LNP could result in the alteration of groundwater and surface water flow thereby altering surface water quality.

### 1. Water quality impacts related to effects on wetlands caused by dewatering alterations.

**Q175. Did the evaluation of wetland impacts in the EIS consider possible increased nutrient releases to regional waterways?**

A175. (JPD, LMA) Yes. Even though the FEIS does not specifically address the possibility of nutrient releases caused by dewatering of wetlands, it does demonstrate that the potential effects of dewatering on wetlands are expected to be minimal. Section 4.3.1.1 of the FEIS documents a potential for only minimal effects of active dewatering on wetlands during development of the LNP site. NRC001A at 4-31 to 4-35. Section 5.3.1.1 of the FEIS documents that the effects of active dewatering on wetlands would likely be minimal during operation of the LNP, considering the Applicant's proposed hydrological and ecological monitoring (Id. at 5-26 to 5-31) as well as the monitoring required by the state in the Conditions of Certification (PEF005 at 53). Therefore, there should only be a minimal potential for increased nutrient releases caused by possible drying of wetlands attributable to active dewatering. Effects on wetlands from passive dewatering are also expected to be minimal. Management of surface runoff and sedimentation, which can carry nutrients from developed areas into surface water features, would be accomplished by use of best management practices, described in Section 4.2.3.1 of the FEIS. NRC001A at 4-26.

Losses of wetland functions related to nutrient storage are considered quantitatively in Table 4-9 of the FEIS, which is based on the Applicant's Unified Mitigation Assessment Methodology (UMAM) evaluation presented in Section 4.3.1.7 of the FEIS. NRC001A at 4-49. UMAM is a procedure for quantitatively estimating the relative magnitude of each wetland impact (expressed as a negative number) associated with a project and each wetland mitigation measure (expressed as a positive number) proposed for a project. UMAM was developed by a team of Florida agencies and water management districts specifically for application in Florida. Applicants for permits for actions from Florida state agencies or water management districts affecting wetlands are required to perform a UMAM assessment by Fla. Admin. Code Ann. r. 62-345 (2011).

**Q176. What does the Staff conclude regarding the potential for increased nutrient releases caused by wetland impacts from the LNP project?**

A176. (JPD, LMA) Wetland losses, including losses of functions performed by wetlands such as trapping nutrients, are a factor in the MODERATE conclusion in Section 4.3.1.8 of the FEIS. Uncertainty inherent in the UMAM process factored into the Staff's MODERATE conclusion regarding building impacts in Section 4.3.1.8 of the FEIS. However, the UMAM evaluation demonstrates a net wetland functional gain once the Applicant's proposed mitigation plan is implemented. NRC001A at 4-69. The SMALL to MODERATE conclusion regarding terrestrial impacts in Section 5.3.1.6 of the FEIS is based on the possibility that some temporary noticeable impacts on wetlands could occur if the required monitoring does not predict them before they occur. Id. at 5-47. But because the effects would be temporary, and because the Florida Conditions of Certification call for corrective action as soon as adverse wetland impacts are noticed (PEF005 at 43), the Staff did not find that a LARGE conclusion was warranted.

### 2. Water quality impacts related to loss of historic basin storage provided by the natural landscape on the LNP site.

**Q177. Did you consider how development of the LNP site could affect the ability of the land to capture and detain nutrients carried by surface runoff?**

A177. (JPD, LMA, RP, LWV, DOB) In addition to addressing encroachment into floodplains by LNP facilities, Section 4.3.1.4 of the FEIS addresses possible loss of historic basin storage (HBS). NRC001A at 4-63 to 4-65. As stated above in Part II, A57, HBS is the retention storage below the overflow elevation of natural depressions. HBS can reduce the entry of nutrients into waterways by detaining surface runoff, allowing nutrients to settle to the bottom of the depressions rather than being carried by runoff into waterways. Many of the topographic depressions on the LNP site contain wetlands (predominantly cypress swamps), but not all depressions providing HBS must necessarily contain wetlands.

As stated previously in Part II, A60, the Staff reviewed the Applicant's detailed hydrologic and hydraulic modeling of the LNP site. Because the analysis was conservative (maximized runoff volume and water surface elevation), the Staff concluded that the effect of building LNP facilities on the floodplain in terms of increased flood level would be minor. As stated in Part II, A61, the Applicant has proposed no compensation for floodplain storage and HBS losses. Runoff from the paved and built up areas where HBS losses would occur would be routed by site grading and drainage ditches into stormwater ponds where the runoff from a rainfall up to the 25-year, 24-hour event would be retained and would subsequently infiltrate. The stormwater ponds would provide the retaining and filtration function for nutrients carried with the surface runoff.

### 3. Impacts to special aquatic sites and other waters from water quality impacts related to dewatering alterations in nutrient concentrations.

**Q178. Where in the FEIS did you consider direct indirect and cumulative water quality impacts from LNP dewatering to the biota of special aquatic sites and other waters?**

A178. (ALM, MTM) Building and operation effects from dewatering are discussed in Sections 4.3.2 and 5.3.2 of the FEIS and in Part II, A44. In-water construction activities that require dewatering are planned for the CFBC for the installation of a barge facility, intake and pumphouse installation, and placement of the blowdown pipeline. NRC001A at 4-72. Building-related dewatering in the CFBC is expected to be temporary. Onsite dewatering will occur over a small portion of the LNP site and along cooling water pipeline corridors, (NRC001A at 4-22; 4-23 (Figure 4-1)) and is not expected to affect water quality as described in A177. Therefore, no direct or indirect effects to aquatic biota due to a change in water quality are expected from dewatering activities associated with building and operating LNP.

Cumulative effects from dewatering are discussed in Section 7.3.2. Cumulative actions include refurbishment, modification and continued operation of the existing Crystal River Energy Complex (CREC), the proposed power uprate of CREC Unit 3, current operation of the Inglis Quarry, widening of the US-19 bridge across the CFBC, a proposed hydropower project on the Inglis Lock bypass channel spillway, the proposed Tarmac King Road Limestone Mine, decommissioning of CREC Units 1 and 2, development of a Port District along the CFBC, and natural environmental stressors such as weather and climate flux. NRC001B at 7-29 to 7-30. Past, present, and reasonably foreseeable future surface water quality impacts are described in Section 7.2.2.1 and provide the basis for assessing water quality impacts in addition to impacts from other activities and natural phenomena. Water resources as managed by SWFWMD and FDEP for past, present, and projected usage and water quality are managed to maintain usages and water quality to protect water resources. Id. at 7-17. Dewatering at the LNP site is limited, and is not likely to noticeably affect water quality for the region in the future. Id. The dewatering associated with the building and operating the LNP will not noticeably affect surface or groundwater quality and therefore will have no detectable direct or indirect impact on aquatic biota and will not contribute to the cumulative impact to the resource.

**Q179. What was your conclusion concerning the direct, indirect and cumulative impacts to the biota of special aquatic sites and other waters?**

A179. (ALM, MTM) The Staff in evaluating Subpart A1 of Contention 4A found that the dewatering associated with building and operating the LNP would not noticeably affect surface or groundwater quality and therefore will have no detectable direct or indirect impact on aquatic biota and will not measurably contribute to the cumulative impact to the resource. The Staff concluded that the impact to aquatic biota from water quality related impacts associated with groundwater withdrawals during building in operations is SMALL. The impact is properly characterized as SMALL and is not MODERATE or LARGE because the direct and indirect impact to aquatic resources would be minor and undetectable and not noticeable or destabilizing. The Staff concluded "that the cumulative impacts of past, present, and reasonably foreseeable future activities on the aquatic resources would be SMALL to MODERATE, primarily due to the continued operation of CREC. However, the Staff concludes that the incremental contribution to this assessment of impact from the NRC-authorized activities related to construction and operation of LNP 1 and 2 would be SMALL." Id. at 7-34.

## E. Contention Subpart A5

**Q180. What is Subpart A5 of this contention?**

A180. (ALL) In Contention 4A and specifically Subpart A5 the Intervenors state "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. A. Impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with dewatering, specifically: . . . 5. Impacts on water quality and the aquatic environment due to increased nutrients resulting from destructive wildfires resulting from dewatering;"

**Q181. What is your understanding of this subpart of the contention?**

A181. (JPD, LMA) Contention 4A raises the possibility that wetlands experiencing the drying effects of dewatering would be subject to an increased potential for destructive wild fires. Damages to the wetlands caused by fire could compromise the hydrological and ecological function of the wetlands.

(ALM, MTM) From an aquatic ecology perspective, contention 4A asserts that dewatering related to the building and operating the LNP could lead to more frequent wildfires which could contribute precipitation related increased nutrient loading to surface waters and groundwaters. The increased nutrient loading would presumably adversely affect water quality, which in turn would affect the distribution and abundance of aquatic biota in the receiving waters.

**Q182. Where in the FEIS did the Staff consider possible increased wildfire incidence?**

A182. (JPD, LMA) Section 5.3.1.1 of the FEIS discusses the likelihood of wildfires in the landscape surrounding the LNP site during operation of the LNP facilities. NRC001A at 5-31.

**Q183. How did the Staff evaluate the potential for increased wild fire risk following development and during operation of the LNP facilities?**

A183. (JPD, LMA) In addition to reviewing the possible hydrological effects of active and passive dewatering as described in our responses in Subpart A1, the Staff reviewed information from the Applicant on how naturally vegetated portions of the Applicant's property and the adjoining Goethe State Forest lands would be managed. In particular, the Staff reviewed the Applicant's comprehensive wetland mitigation design document. NRC048. Sections 2.4 and 3.4 of the Wetland Mitigation Plan outline how extensive portions of naturally vegetated property designed for conservation on and south of the LNP site, as well as in adjoining Goethe State Forest lands, would be managed after development of the LNP project. Id. at 21 to 23 and 74 to 81, respectively.

**Q184. Could development and operation of the LNP affect the incidence or severity of regional wildfires?**

A184. (JPD, LMA) The analyses performed by the Staff and reported in Sections 4.3.1 and 5.3.1 of the FEIS (NRC001A at 4-31 to 4-36; 5-26 to 5-31, respectively) support conclusions that the LNP project would be unlikely to cause groundwater drawdown severe enough to affect wetlands over large areas of the landscape, even though approximately 2093 acres of wetlands could become noticeably drier. However, this localized area of possibly drier conditions is unlikely to induce regionally catastrophic wildfires. First, the Applicant can be expected to rapidly suppress any fires in lands close to developed LNP facilities. Id. at 5-31. Secondly, the

Comprehensive Wetland Mitigation Planprepared by the Applicant to comply with the FDEP Conditions of Certification calls for several habitat improvement measures on portions of the LNP site and property to the south owned by the Applicant. These measures include selective thinning of planted pines to more natural densities, targeted plantings of native species to improve species diversity, hydrologic restoration of wetlands (e.g., culvert removal, ditch plugging, and bed removal), control of invasive species, and the establishment of a prescribed fire regime. NRC048 at 21 to 23 and 74 to 81 IComprehensive Wetland Mitigation Plan ExhibitI.

All of these measures can be expected to reduce the potential for catastrophic uncontrolled wild fires in the surrounding area. As noted in the EIS, the ecological function of wetlands on the site has already been substantially degraded by activities such as bedding, planting of slash pine, repeated harvesting, fire suppression, ditching, and road building. NRC001A at 4-68. The measures described above would help restore the hydrological properties and vegetation characteristics that existed under the natural fire cycle that existed prior to forestry activities on the LNP site. Even though the proposed mitigation would not restore the historic fire cycle to the treated wetlands, the proposed prescribed fire regime would help simulate a natural fire cycle that avoids the establishment of conditions conducive to catastrophic uncontrolled wildfires.

**Q185. Where in the FEIS did you consider direct, indirect and cumulative water quality impacts and alterations from LNP dewatering induced wildfires to the biota of special aquatic sites and other waters?**

A185. (ALM, MTM) LNP dewatering effects to water quality was assessed in Sections 4.3.2 and 5.3.2 of the FEIS and in A177. Based on the low probability of wildfires directly related to dewatering activities, and the fact that the presence of the LNP will significantly improve fire detection and suppression in the vicinity of the site, the likelihood for an increase in fire-related nutrients to surface water run-off and groundwater flow was not considered in the FEIS for other waters and special aquatic sites other than wetlands. Furthermore, the fact that the area has historically experienced periodic naturally initiated wildfires without resulting in significant long term impacts to aquatic resources leads to the conclusion that if a wildfire should occur, the resulting change, if any, in surface water and groundwater quality would be minor and temporary and not result in a long term change to the aquatic resource.

## F. Contention Part B – Analysis of Impacts From Salt Drift and Salt Deposition

**Q186. What is Subpart B of this contention?**

A186. (ALL) In Contention 4B the Intervenors state the "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. B. Impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with salt drift and salt deposition resulting from cooling towers (that use salt water) being situated in an inland, freshwater wetland area of the LNP site;"

### 1. Interpretation of Part B

**Q187. What is the Staff's understanding of this part of the contention?**

A187. (RP,DOB,LWV,VRV) From a hydrology perspective, this part of Contention 4A alleges that because LNP will use brackish makeup water, cooling tower drift would contain salts that will deposit on the ground and may subsequently be discharged into nearby waterbodies with surface runoff. The contention also alleges that the Staff has inappropriately characterized the effect of salt drift and salt deposition.

(JPD, LMA) Subpart B of Contention 4A alleges that fine droplets of brackish or salt water released during operation of the LNP cooling towers could result in the deposition oft salts on wetlands and other terrestrial habitats, including those in the floodplain, causing them damage.

(ALM, MTM) From an aquatic ecology perspective, Contention 4A alleges that because makeup water for the LNP will use brackish water, subsequent drift from cooling towers may contain concentrations of salts that when deposited, could affect special aquatic sites and other waters thus affecting aquatic resources. It also alleges that deposition of salt drift on freshwater waterbodies found inland could affect habitat and aquatic biota associated with those surface waters.

### 2. Supporting Meteorology, Air Quality, and Hydrology Analysis

**Q188. Please describe the circulating water cooling system for the proposed LNP project.**

A188. (RP,DOB,LWV,VRV) The cooling system structures are described in FEIS Section 3.2.2.2. NRC001A at 3-7 – 3-11. Makeup water is withdrawn from the CFBC through the proposed intake structure. Id. at 3-7. The makeup water flows through a pipeline to the cooling towers. Each reactor unit would be served by a multi-cell cooling tower and each tower would be 1,000 ft long and 56 ft high. Id. Blowdown from the cooling towers would flow via pipelines to the Crystal River Energy Complex discharge canal where it would be discharged into the Gulf of Mexico. Id. In Table 3-4 of the FEIS, the Staff summarized the flowrates associated with the makeup intake, evaporation, drift, and blowdown discharge as 84,780 gpm, 28,255 gpm, 5 gpm, and 57,923 gpm, respectively. Id. at 3-39 to 3-40.

**Q189. Where was salt deposition analyzed in the EIS?**

A189. (LKB) The salt drift analysis is presented on pages 5-85 and 5-86 of the EIS. NRC001A. Based on the estimated total dissolved solids in the Cross Florida Barge Canal (CBFC), flow rates through the cooling system, application of drift eliminators, surface meteorological data collected at Gainesville, Florida, and upper air meteorological data collected at Jacksonville, Florida we concluded that the maximum offsite salt deposition would be 6.81 kg/ha/mo along the site boundary west of the cooling towers, and as large as 10.75 kg/ha/mo within the LNP site. Id. at 5-86). The estimates of the drift were computed using the EPA-approved AERMOD model, which is commonly used for dispersion applications. The AERMOD model and a general description of how we performed the analysis is discussed in more detail above in Section II of the Staff's testimony in A82 to A88.

**Q190. How did you analyze salt deposition in the EIS?**

A190. (LKB) The analysis that we presented in the EIS was focused on the salt deposition associated with the operation of the LNP cooling towers. Salt deposition is defined as the salt that is deposited on the surface as a result of salt drift. Salt drift, in turn, refers to the salt-containing water drops that escape from the operating cooling towers. In the case of the LNP, the salt in the cooling system is largely due to make-up water taken from the Cross Florida Barge Canal.

**Q191. What accounts for the difference in the stated salt deposition rates?**

A191. (LKB) The rate of 6.81 kg/ha/mo is the largest value of predicted off-site salt deposition, while 10.75 kg/ha/mo is the maximum on-site deposition rate. Salt deposition decreases rapidly with distance from the cooling towers due to the rate at which particles are deposited to the surface and the natural mixing and dispersion in the atmosphere. An example of these dispersive processes is the behavior of the smoke from a common campfire. Near the fire, the smoke can be very intense, but the plume is only as wide as the fire itself. Further away from the fire, the smoke plume becomes diluted and there might only be a slight odor. At this point, however, the smoke plume is much wider, or more disperse, than the smoke plume near the campfire.

**Q192. How are the deposition rates calculated?**

A192. (LKB) As described in section 5.3.3.1 of the ESRP (NRC014 at 5.3.3.1-1 to 5.3.3.1-9), the determination of the salt drift should consider drift characteristics in regards to the drift rate at full load, the expected size distribution of the drift droplets, and the concentration of dissolved and suspended solids to provide annual plus seasonal and/or monthly amounts of salt deposition.

In our analysis, there were several steps involved in the calculation of the salt deposition rates. These steps are described in more detail in section II of the Staff's Testimony, in A82 to A88. The first step is to generate the source-term, which is the amount of salt drift that occurs with the operation of the cooling towers. Important factors include the flow rate of water through the cooling system (NRC001A at 3-28), the total amount of dissolved solids in the cooling water, the total amount of water that escapes as drift, and the size of the water drops that escape from the cooling towers. In our case, as outlined in section 5.3.3.1 of the ESRP (NRC014 at 5.3.3.1-3), the size distribution of the drops was obtained from the general literature. Once the source term is determined, the US EPA preferred/recommend AERMOD modeling system (described in Part A) is used to simulate the dispersion of the salt drift in the atmosphere. These simulations make use of both onsite and offsite meteorological data to predict the salt deposition rate in the vicinity of the LNP site. The annual estimates of the salt deposition were not included in the EIS because they are much smaller, on a monthly basis, than the peak monthly deposition rates.

Focusing on the maximum monthly deposition rates makes the analysis more conservative. For example, the maximum annual deposition computed using AERMOD was 30.9 kg/ha/year, or only 2.8 kg/ha/mo (based on meteorological data from 2004).

**Q193. Are there any methods used at Nuclear Power Plants that limit cooling tower drift?**

A193. (LKB) The majority of water losses associated with the operation of mechanical draft cooling towers is associated with water vapor that condenses as it leaves the cooling tower. Some water drops escape from the cooling tower and are referred to as cooling tower drift. In contrast to the pure water vapor leaving the tower that is associated with the evaporation of the cooling water, the water drops that make up the cooling tower drift contain dissolved salt present in the cooling water that is then deposited to the land surface. In modern cooling tower installations, drift eliminators are used in the cooling towers to significantly limit the number of drops that are able to escape from the cooling tower.

**Q194. What abatement methods will the LNP employ?**

A194. (LKB) As part of their application for an air permit from the Florida Department of Environmental Protection, the Applicant states that the cooling towers will employ the Best Available Control Technology (BACT) and "shall be designed and maintained to achieve a drift rate of 0.0005% of the circulating water flow" (PSD-FL-403). PEF504 at 4. As stated in the FEIS, the total circulation water flow rate through the cooling system will be 1,062,200 gallons per minute (gpm), utilizing the drift eliminator reduces the total drift to 5.32 gpm or 115.7 lb/hr of salt for normal operating conditions. NRC001A at 3-28. The drift abatement proposed by the Applicant follows BACT and has been considered in the computation of the cooling tower drift and associated salt deposition described in A86 to A87 of the Staff's testimony above.

**Q195. What are the sources of naturally occurring salt?**

A195. (LKB) Most of the naturally occurring salt particles in the environment originate from the surface of the World's oceans. Salt particles are released from the ocean surface via a number of physical processes that have been described using relatively simple models by Monahan or as applied in complex climate models by Gong. NRC050 and NRC051. One of the most common processes is bursting air bubbles associated with whitecap waves that appear frequently on the ocean surface. NRC051 at 3816-3816; NRC050 at 167. When these air bubbles burst, salt particles are released to the atmosphere. Salt particles are also released from the ocean surface during precipitation, but this impact is highly intermittent due to the large amount of variability in rain. For example, on a research platform in the North Sea, Marks investigated the influence of rain on the concentration of sea-salt particles along the Dutch coast and found increased amounts of salt particles associated with periods of rain. NRC052 at 22299. Using different instrumentation, Noble and Prather saw increased amounts of sea-salt further inland that were related to rain. NRC053 at 2753.

**Q196. How long do naturally occurring salt particles stay in the atmosphere?**

A196. (LKB) In the environment, particles accumulate on the surface due to their natural fall speed. This process is also known as dry deposition. Alternatively, particles can be removed from the atmosphere by precipitation, which is also known as wet removal or wet deposition. The rate at which particles undergo dry deposition is a function of the size of the particle, with large particles being deposited more quickly than small particles. In their book, *Sea Salt Aerosol Production*, Lewis and Schwartz indicate that a particle 10 micrometers in diameter could have a lifetime in the atmosphere on the order of 10 hours, while a particle 2 micrometers in diameter might have a lifetime of approximately 1.5 weeks. NRC054 at 76. Salt particles in the atmosphere can vary widely in size from approximately 0.001 micrometer (1 nanometer) to 10 or more micrometers. Using measurements of the sea-salt particles collected on Oahu, Hawaii, during a Shoreline Environment Aerosol Study, Clarke found that the majority of the sea-salt particles are between 0.01 and 1 micrometers in size. NRC055 at 1367-1368. Most of the sea-salt particle mass is associated with particles larger than 1 micrometer in diameter. For example, an individual sea-salt particle 1 micrometer in diameter contains as much salt as 1,000 particles 0.1 micrometer in diameter. These large particles have a short lifetime in the atmosphere because of their large dry deposition rate. NRC055 at 1367-1368; NRC051 at 3816-3816; NRC054 at 76. This behavior leads to a rapid decrease in the deposition of large sea-salt particles as the distance away from the coastline increases, as documented by Wigington for forests in the Oregon Coast Range. NRC056 at 1039-1042. Smaller salt particles have a smaller deposition rate than large particles and can be seen at great distances from any coastline. NRC053 at 2753.

**Q197. Are naturally occurring salt particles included in the calculated salt deposition?**

A197. (LKB) Given that the LNP site is approximately 15 km from the coast, and the relatively small wind speeds that are typically observed at the site [the average wind speed at the LNP site is approximately 5 m/s (11 mph)], it is unlikely the deposition of large sea-salt particles would be a significant source of salt deposition at the site. Because of their small deposition rate, and long residence time [ranging from days to weeks] in the atmosphere, the deposition of small particles at LNP would not be significantly different than the rest of inland Florida, which is subject to the same or similar weather patterns and deposition of small salt particles. NRC054 at 76. For these reasons, we excluded the deposition of naturally occurring salt from our analysis.

**Q198. How did you assess impacts from cooling tower salt drift?**

A198. (RP,DOB,LWV,VRV) From the hydrology perspective, the Staff estimated the effects of the cooling towers' salt drift and subsequent salt deposition on surface water salinities. Waters obtained from the Gulf of Mexico and spring flow into the CFBC would be used to supply makeup water for normal plant operations. NRC001A at 5-7. Because of the freshwater flow into the CFBC from springs, the makeup water obtained from the CFBC would have a lower salinity than waters of the Gulf of Mexico. The Staff's independent assessment is based on estimating the likely salinity of runoff from the LNP site. Because the estimated runoff salinity is much smaller than that of brackish water, the Staff concluded that the runoff from the LNP site would not adversely affects nearby waterbodies and aquatic features.

**Q199. How did you estimate the salinity of runoff from the site where cooling tower drift would result in salt deposition?**

A199. (RP,DOB,LWV,VRV) To estimate the effect on surface water resources, the Staff performed an analysis to conservatively estimate the expected salinity of runoff from areas of the LNP site that may receive the maximum estimated salt deposit of 10.75 kg/ha/mo. NRC001A at 5-20. The Staff postulated that salt would accumulate during a month to reach its maximum deposition density of 10.75 kg/ha/mo and would then completely dissolve in the lowest regional mean monthly precipitation of 1.62 in. and be transported downstream in a single runoff event; evaporation and transpiration losses of precipitation during the postulated event were ignored. The Staff-estimated salinity of surface runoff from this postulated scenario would be maximized because the maximum estimated monthly salt deposit is assumed to dissolve in the lowest amount of monthly precipitation. The Staff estimated the runoff salinity as 0.026 part per thousand (ppt) (1.62 in. [0.041148 m] of rainfall over one hectare equals 411.48 $m^3$ of volume; 411.48 $m^3$ of water weighs 411,480 kg; dissolving 10.75 kg of salt in 411,480 kg of water would result in a concentration of 0.026 part-per-thousand). Id. at 5-24. Because waters with salinity of less than or equal to 1 ppt can be classified as freshwater, the Staff concluded that runoff from the LNP site carrying the maximum estimated salt deposition would not result in a noticeable increase in salinity of nearby aquatic features.

**Q200. Is your analysis conservative?**

A200. (RP,DOB,LWV,VRV) Yes. The salt deposition of 10.75 kg/ha/mo is for onsite areas. NRC001A at 5-86. The maximum offsite deposition is 6.81 kg/ha/mo. Id. The salt deposition decreases rapidly with distance from the plant. Id. Therefore, the Staff's use of the maximum onsite deposition of 10.75 kg/ha/mo for both onsite and offsite areas is conservative. The set of meteorologic stations' records used to derive the lowest regional mean monthly precipitation shows that a period of three months or longer without rain has never occurred. There are three instances of two-month dry periods and 66 instances of one-month dry periods. Because two-month dry periods can be considered rare, the Staff used the more commonly occurring one-month dry period for the runoff salinity analysis. The average rainfall in the month following the dry month was 3.04 in. The Staff used lowest regional mean monthly precipitation of 1.62 in. is approximately 53 percent of the average rainfall that follows a dry month. The Staff's use of a smaller amount of rain than the average resulted in a greater salt concentration in the runoff (same amount of salt dissolved in a smaller volume of water).

(RP,DOB,LWV,VRV) In the Staff's independent analysis, the maximum estimated salt deposit was dissolved in the lowest mean monthly precipitation, maximizing salinity of the runoff because it uses the minimum volume of runoff and maximum amount of salt available. The Staff's assumption that the lowest regional mean monthly precipitation will occur in a single event at the end of the accumulation month also maximizes the salinity of runoff because it allows for the salt accumulation to reach its maximum monthly areal density. Evaporation and transpiration losses of precipitation during the postulated event were ignored. The average annual precipitation in the region is about 53 in. Even though evapotranspiration could reduce the precipitation available for dilution of deposited salt and therefore increase salinity of runoff, the Staff concluded that the relative abundance and greater frequency of precipitation would result in dilution greater than and runoff salinity less than that estimated above (0.026 ppt). Therefore, the Staff's analysis is conservative.

(RP,DOB,LWV,VRV) For further context for why this analysis is conservative, a salinity of 1 ppt is the threshold above which water can be considered brackish; sea water nominally has a salinity of 35 ppt and freshwater has salinity below 1 ppt. To get the salinity of the runoff from the LNP site to equal 1 ppt for the one-month dry period followed by 1.62 in. of rain, the 10.75 kg of salt would have to be dissolved in 0.042 in. of runoff. Equivalently, nearly 1.58 in. of the 1.62 in. rainfall amount (97.4 percent) would need to be lost to interception and evaporation so only 0.042 in. of rain reaches the ground to dissolve the deposited salt. The estimated loss of 97.4 percent is unlikely and therefore the Staff concludes that runoff from the LNP site would not be brackish. The driest spell in the set of meteorologic stations' record used was a two-month dry period followed by 0.4 in. of rain in the third month. In the month previous to the two completely dry months, the last rain occurred on the 20th day. In the month following the two completely dry months, the first rain occurred on the 27th day. The dry period was 98 days long extending from the month pervious to the two completely dry months into the month following. In this case, the runoff salinity (ignoring evaporation and transpiration losses) would be less than 0.34 ppt. To get to a runoff salinity of 1 ppt in this rare scenario, the interception and evaporation losses would need to be 65.7 percent, which is also unlikely.

### 3. Impacts to wetlands from salt drift and salt deposition.

**Q201. Where in the EIS did the Staff consider potential impacts to wetlands from salt drift?**

A201. (JPD, LMA) Potential impacts to terrestrial ecological habitats from salt drift generated by operation of the LNP cooling towers are addressed in Section 5.3.1.1 "Impacts of Cooling-Tower Operations." NRC001A at 5-19 to 5-26. The analysis considers potential salt drift impacts on all terrestrial habitats on the LNP site and in the surrounding landscape, including wetlands, uplands, and terrestrial habitats situated in the 100-year floodplain.

**Q202. How did the Staff define salt drift for purposes of analysis of possible impacts to terrestrial habitats in the EIS?**

A202. (JPD, LMA) The Staff's evaluation of possible salt drift impacts on terrestrial habitats recognizes salt drift as deposition of dissolved solids in fine droplets released to the atmosphere during operation of the LNP cooling towers. The Staff recognizes that "[t]Through the process of evaporation, total dissolved solids (TDS) in the CWS [cooling water system] are concentrated. A small percentage of the water in the CWS would unavoidably be released into the atmosphere as fine droplets (i.e., cooling-tower drift) containing elevated levels of total dissolved solids that can be deposited on nearby vegetation." NRC001A at 5-20.

**Q203. What guidance did the Staff follow?**

A203. (JPD, LMA) The Staff followed NUREG 1555, ESRP 5.3.3.2, which addresses possible impacts to terrestrial ecosystems from operation of heat-discharge systems from nuclear power plants. NRC013. Among the issues addressed by ESRP 5.3.3.2 are potential effects of cooling tower drift on vegetation and possible soil salinization. NRC013 at 5.3.3.2-4 and 5.3.3.2-5. The technical basis underlying the evaluation of potential salt drift effects on terrestrial ecosystems in ESRP 5.3.3.2 is drawn from Section 4.3.5.1 of NUREG-1437, the Generic Environmental Impact Statement for License Renewal of Nuclear Plants, which addresses the effects of cooling tower drift on terrestrial ecology. NRC057 at 4-42 to 4-45. Following a comprehensive review of scientific literature addressing salt drift impacts on terrestrial habitats, NUREG-1437 states "[m]onitoring results from the sample of nuclear plants and from the Chalk Point plant, in conjunction with the literature review and information provided by the natural resource agency and agricultural agencies in all states with nuclear power plants, have revealed no instances where cooling tower operation has resulted in measurable degradation of the health of natural plant communities." NRC057 at 4-45.

**Q204. Did the Staff search for relevant scientific literature published subsequent to NUREG-1437 and NUREG 1555, ESRP 5.3.3.2?**

A204. (JPD, LMA) Yes, the Staff searched scientific literature published after the GEIS for newer documentation addressing salt drift effects on vegetation and terrestrial habitats. The only relevant literature found by this search is a report summarizing the results of a 14-year salt-drift monitoring study completed during operation of cooling towers at the nearby Crystal River Energy Complex (CREC), situated approximately 10 miles southwest of the LNP site. NRC058. The report focuses on presenting the results of the final monitoring year (1993-1994). It concludes that salt drift from operations of the cooling towers is not high and that occurrences of salt drift injury appear to be isolated events where injury is limited to a narrow band of vegetation close to the cooling towers. Id.

The CREC report contains the geographically closest recorded observations of possible salt drift injury to vegetation relative to the LNP site. Other than the tidal marshes east of the CREC facilities, the terrestrial habitats near the CREC cooling towers include many of the same vegetation cover types (plant communities) as those occurring in the landscape encompassing the LNP site. NRC001A at 5-23. However, because the CREC is situated on the coast instead of the inland setting of the LNP site, the Staff used the CREC report as supplemental evidence only for purposes of conservatism. The CREC report does not form the primary basis of the Staff's analysis.

**Q205. Can you summarize the Staff's analytical approach to assessing potential salt drift impacts on wetlands and other terrestrial habitats?**

A205. (JPD, LMA) To meet the objectives stated in ESRP 5.3.3.2 for evaluating potential salt drift impacts on terrestrial habitats, the Staff overlaid estimated salt drift deposition rates over a map of terrestrial habitats on the LNP site and surrounding landscape. The deposition rates were estimated by meteorologists on the Staff using the EPA-approved AERMOD model, as described in Section 5.7.2 of the EIS. NRC001A at 5-85 to 5-86. Following guidance in ESRP 5.3.3.2, the Staff interpreted rates of 1 to 2 kg/ha/mo as generally not damaging to plants, rates approaching or exceeding 10 kg/ha/mo during the growing season as capable of causing leaf damage to many plant species, and rates of hundreds or thousands of kg/ha/mo as causing significant damage to terrestrial ecosystems warranting possible reevaluation of tower design or operational parameters. NRC013 at 5.3.3.2-5.

**Q206. Did the Staff consider how salt drift not intercepted by vegetation but allowed to reach the ground surface might introduce salt to runoff thereby increasing the salinity of receiving wetlands and waters?**

A206. (JPD, LMA, ALM, MTM) Yes. The Staff considered whether salt drift deposition to lands near the cooling towers could increase the salinity of fresh surface water, including surface water in wetlands, receiving runoff from those lands. Hydrologists with the Staff quantitatively estimated the concentration of salt in runoff from areas shown by the AERMOD modeling to receive the highest rates of salt deposition. The quantitative estimates relied on salt deposition rates from the AERMOD modeling and precipitation data for the region containing the LNP site. The AERMOD modeling is discussed further in Part II of our testimony above. The impact to terrestrial habitats including wetlands of this runoff is discussed in response to A208. Impacts to aquatic resources are discussed in A219 to A225 of the Staff's testimony.

**Q207. What key assumptions did the Staff rely upon in interpreting the salt drift modeling for purposes of assessing possible salt drift effects on terrestrial habitats?**

A207. (JPD, LMA) For evaluating possible impacts to terrestrial habitats, the Staff relied on several key assumptions inherent to the salt drift modeling. First, the AERMOD modeling assumes that makeup water would be drawn from the Cross Florida Barge Canal with a salinity of 25 ppt consisting only of salts. NRC001A at 5-20; 5-85. A salinity of 25 ppt constitutes brackish water; the typical salinity of fresh water is generally less than 0.5 to 1.0 ppt and the typical salinity of sea water is approximately 35 ppt. The modeling also assumes that drift eliminators installed on the cooling towers would limit drift to less than 0.1 percent of the water flowing through the cooling towers. Id. at 5-20; 5-86. Input into the model regarding meteorological conditions was based on five years (2001 through 2005) of surface observations collected at Gainesville, Florida and of upper air observations collected at Jacksonville, Florida. Id. at 5-86. The Staff also assumed that operation of the LNP cooling towers would concentrate salts in the makeup water by 1.5 times prior to discharge as blowdown water (1.5 cycles of concentration). Id. at 5-20. For conservatism in the interpretation of possible effects on terrestrial habitats, the Staff used results from that year, specifically 2004, out of the five-year range considered resulting in the highest modeled deposition rates. Id. at 5-21.

**Q208. What key assumptions did the Staff assessing terrestrial habitat impacts rely upon regarding the calculation of estimated salt concentrations in runoff entering nearby surface water features, including wetlands?**

A208. (JPD, LMA) The salt drift rates used in the calculations rely on the AERMOD modeling and associated assumptions described in the response to the previous question. The

Staff also used a conservative precipitation estimate of 1.62 inches per month, which corresponds to the lowest value in a range for mean monthly precipitation for the region varying from 1.62 to 9.79 inches per month. NRC001A at 2-21; 5-24. Use of the lowest value in the range is conservative because the salinity in runoff can be expected to be greatest when precipitation is lower.

**Q209. What other key assumptions underlie the Staff's analysis of salt drift effects on vegetation?**

A209. (JPD, LMA) The approach in ESRP 5.3.3.2 for interpreting the effects of salt drift on terrestrial habitats relies on reports in the scientific literature for possible injury to foliage. NRC057 at 4-42- 4-45. The threshold for foliar injury of 10 kg/ha/mo, presented in NRC013 at 5.3.3.2-5, is based on scientific literature reports, summarized in Sections 4.3.4.1.2 and 4.3.5.1 of NUREG 1437, demonstrating visible foliar injury of certain of the more sensitive plant species exposed to salt drift. NRC057 at 4-36 to 4-38; 4-42 to 4-45. Use of this threshold constitutes a conservative approach to estimating the response of vegetation to an estimated salt drift rate. The threshold is greater (though by less than an order of magnitude) than rates expected to cause foliar injury on some of the most sensitive plant species investigated, e.g., corn (*Zea mays*) and flowering dogwood (*Cornus florida*), but lower by more than two orders of magnitude for many other plant species considered, e.g., red maple (*Acer rubrum*) and witch hazel (*Hammamelis virginiana*). NRC057 at 4-37.

However, natural plant communities such as those on and surrounding the LNP site are a mixture of plant species that vary in their response to salt drift. Furthermore, visible foliar injury does not necessarily correspond to mortality of the affected plants. Depending on the severity of foliar injury, affected plants can experience reduced growth rates, reduced vigor, and increasing susceptibility to insects and disease. Death would likely occur only after severe foliar injury. ESRP 5.3.3.2 therefore recommends a conclusion of possible significant damage to terrestrial ecosystems only for salt drift rates in the range hundreds or thousands of kg/ha/mo. NRC013 at 5.3.3.2-5. The Staff recognizes that none of the available scientific literature addressing the responses of terrestrial habitats to salt drift is based on observations collected in an interior landscape typical of north-central Florida. The Staff recognizes that this fact introduces a measure of uncertainty into the interpretation process recommended in ESRP 5.3.3.2. Because of this uncertainty, the Staff used a modeled salt drift rate 10 kg/ha/mo as a threshold for concluding noticeable overall impacts to terrestrial habitats, even though this threshold is based only on possible leaf damage to certain plant species. ESRP 5.3.3.2 states that “Deposition rates approaching or exceeding 10 kg/ha/mo in any month during the growing season could cause leaf damage in many species.” NRC013 at 5.3.3.2-5. It also states “Deposition rates of hundreds or thousands of kg/ha/yr could cause damage sufficient to suggest the need for changes of tower-basin salinities or a reevaluation of tower design, depending on the amount of land impacted and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.” NRC013 at 5.3.3.2-5. The Staff believes that using the 10 kg/ha/mo threshold rather than a threshold of hundreds or thousands of kg/ha/yr provides additional conservatism to compensate for associated uncertainty.

**Q210. What were the results of the Staff’s salt drift analysis?**

A210. (JPD, LMA) The maximum offsite salt deposition rate predicted using the AERMOD modeling and meteorological conditions for any of the five years considered (2001 through 2005) was approximately 6.8 kg/ha/mo., at a location on private property just outside of the LNP boundary near the cooling towers. NRC001A at 5-20 and 5-86. This rate is substantially less than the rate of 10 kg/ha/mo indicative of possible leaf damage in many plant species. NRC013 at 5.3.3.2-5. The modeled maximum offsite salt deposition rate decreases rapidly with increasing distance from the site boundary, approaching only one-third of the maximum offsite rate at a distance of about 3,280 feet from the boundary. NRC001A at 5-19 to 5-22. Based on these results, the Staff concluded that operation of the LNP cooling towers is not likely to affect terrestrial habitats off of the LNP site.

(JPD, LMA) The maximum onsite salt deposition rate predicted using the AERMOD modeling and meteorological conditions for any of the five years considered (2001 through 2005) was 10.75 kg/ha/mo. NRC001A at 5-20 and 5-86. This rate exceeds the rate of 10 kg/ha/mo used by the Staff as a threshold indicating possibly noticeable adverse effects to terrestrial habitats. This exceedance is predicted using only one (2004) of the five years of meteorological conditions considered. Salt deposition rates modeled using 2001, 2002, 2003, and 2005 conditions did not exceed 10 kg/ha/mo anywhere on or off of the LNP site. Id. at 5-21. Based on these results, the Staff recognizes in the EIS that "some vegetation on the LNP site could suffer leaf damage from salt drift in some years." Id.

The salt drift damage would be "limited to vegetation close to the cooling towers (within 3280 ft), primarily in an area encompassing a northeast to southwest diagonal through the proposed cooling towers." Id. at 5-22. The high rainfall common in the region can be expected to wash some of the salt drift off of the leaves, reducing foliar damage. Id. Additionally, much of the affected area consists of what will be developed land surrounding LNP facilities. However, some of the natural habitat remaining on the LNP site after development, including some forested wetlands, might be affected. Based on the only slight exceedance of the 10 kg/ha/mo threshold, the fact that the threshold was exceeded for only one out of five years of meteorological data considered, and the ability of rainfall to wash some of the salt drift off of leaf surfaces, the Staff concludes in Section 5.3.1.1 of the EIS that "the impact on vegetation from salt drift is expected to be minor, infrequent, and limited to the LNP site." Id.

**Q211. How did the Staff interpret the results of the salt drift analysis described in the response to the preceding question?**

A211. (JPD, LMA) The Staff conservatively interpreted modeled salt deposition rates exceeding 10 kg/ha/mo for any of the five years of meteorological data considered as indicative of possible adverse effects on terrestrial habitats. Using this threshold, the Staff interpreted the modeling results as indicating that potential adverse effects to terrestrial habitats off of the LNP site were unlikely. However, the Staff determined that "some vegetation on the LNP site could suffer leaf damage from salt drift in some years." NRC001A at 5-21.

**Q212. What other considerations did the Staff use in evaluating possible effects of salt drift on wetlands and other terrestrial habitats?**

A212. (JPD, LMA) The Staff also considered the results of a 14-year salt-drift monitoring study completed during operation of cooling towers at the nearby CREC facility. Undeveloped lands close to the CREC cooling towers contain many of the same natural wetland and upland habitat types occurring close to the proposed LNP cooling towers. Salt drift from the CREC cooling towers over the monitoring period was recorded at rates in the same general range predicted using the AERMOD modeling for the LNP cooling towers. As presented in Section 5.3.1.1 of the EIS, the CREC monitoring reported minor damage to individual plants attributable to salt drift, such as chlorotic (yellowed) leaves or needles, leaf hypertrophy (abnormal growth attributable to cellular processes), leaf tip or margin (edge) damage, or small or deformed leaves. NRC001A at 5-23. However, the monitoring did not report broad damage to the plant communities near the cooling towers that could be attributable to operation of the cooling towers. Id. The CREC report itself states in its conclusions that "occurrences of salt drift injury appeared to be isolated events which were limited to a relatively few individuals and in a narrow band of forest located west and southwest of the cooling towers along the edge of the transmission line [right-of-way]." NRC058 at 5-1.

The Staff recognizes that the vegetation exposed to drift from the CREC cooling towers is situated near the coast and may therefore be adapted to higher salinity levels than the inland vegetation on and surrounding the LNP site. For this reason, the analysis and conclusions in Section 5.1.1 of the FEIS rely primarily on the Staff's evaluation of the AERMOD results against the threshold of 10 mg/kg/ha for possible foliar injury drawn from ESRP 5.3.3.2. However, the CREC salt drift modeling is the closest and most relevant published data available to the Staff regarding possible effects of salt drift on vegetation. As stated in the FEIS, "CREC shares many of the same plant communities as the LNP site and vicinity, including 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. The Staff therefore believes that the CREC data provides support for our conclusions.

**Q213. What did the Staff conclude regarding possible effects of salt drift on wetlands and other terrestrial habitats?**

A213. (JPD, LMA) The Staff concludes that "the impact on vegetation from salt drift is expected to be minor, infrequent, and limited to the LNP site." NRC001A at 5-22. The maximum modeled salt drift rates for areas off of the LNP site do not exceed a threshold conservatively interpreted as being capable of substantially affecting terrestrial habitats. Even though the maximum modeled salt drift rates for certain areas on the LNP site do exceed that threshold, they exceed it only slightly, and based on only one out of five years of meteorological conditions considered. The FEIS states "[t]he potential for salt-drift impact on vegetation is expected to be moderated by the frequent rainfall the LNP site receives for much of the year (see Section 2.9.1.4), which would wash salt from the leaves and limit the duration of exposure." Id. The Staff's conclusions are further corroborated by the results of a 14-year monitoring program showing that salt drift from cooling towers at the nearby CREC did not substantially affect similar terrestrial habitats.

**Q214. What did the Staff conclude regarding possible introduction of salt from salt drift into surface runoff?**

A214. (JPD, LMA) Based on a maximum projected salt deposition rate of 10.75 mg/kg/ha and ground conditions resulting from the lowest mean monthly precipitation for the region of 1.62 in., the Staff calculated an estimated salinity of 0.026 ppt for runoff. NRC001A at 5-24. This is more than 38 times less saline than what is commonly regarded as the upper limit for fresh water, 1 ppt. The Staff therefore concluded that runoff generated from areas of maximum salt deposition resulting from operation of the LNP cooling towers would be essentially fresh water that would not noticeably increase the salinity of surface water features, including wetlands, receiving that runoff.

**Q215. Did the Staff consider possible salt drift effects on terrestrial wildlife?**

A215. (JPD, LMA) Yes, the Staff concluded in Section 5.3.1.1 of the FEIS that incidents of salt toxicity in animals living in habitat affected by LNP salt drift would be unlikely. NRC001A at 5-25. In making this conclusion, the Staff considered amphibians, which are the species most sensitive to salt exposure because they lay unshelled eggs and have exceptionally permeable skins. Id.

**Q216. What were the Staff's overall conclusions regarding potential salt drift impacts on wetlands and other terrestrial habitats?**

A216. (JPD, LMA) The Staff concluded in Section 5.3.1.6 of the EIS that the overall potential impacts from operation of the LNP on terrestrial ecology would be SMALL to MODERATE. NRC001A at 5-47. The range in the conclusion was extended to MODERATE because of possible terrestrial ecology impacts related to groundwater drawdown. Id. However, the possible effects of salt drift from operation of the LNP cooling towers was not a factor contributing to the possible MODERATE impacts.

**Q217. How did the Staff characterize cumulative impacts from salt drift to wetlands and other terrestrial habitats?**

A217. (JPD, LMA) The only source of salt drift other than the proposed LNP identified for the geographic area of interest evaluated for cumulative impact to terrestrial ecology in Section 7.3.1 of the EIS is continued operation of the cooling towers at CREC. NRC001B at 7-23 to 7-24. However, the LNP cooling towers would be situated approximately 9 miles northeast of the CREC cooling towers, too great a distance for substantially overlapping salt deposition from the two sources. The Staff therefore concluded that "potential cumulative impacts from cooling-tower plumes (salt deposition, fogging, and icing) would be minimal, limited to the CREC and LNP sites, and not expected to noticeably affect terrestrial resources." Id. at 7-24.

**Q218. Why did the Staff not conclude that the impact to terrestrial ecology from salt drift would be LARGE?**

A218. (JPD, LMA) A conclusion of LARGE indicates that the impacts are clearly noticeable and sufficient to destabilize important attributes of the subject resource. As noted in the response to Q210 above, the Staff's salt drift modeling revealed maximum salt drift rates that only slightly exceed thresholds for noticeable foliar injury established in ESRP 5.3.3.2. NRC013 at 5.3.3.2. Based on a comprehensive literature review presented to address impacts from operation of nuclear power plants in the *Generic Environmental Impact Statement for License*

*Renewal of Nuclear Plants*, we were able to concluded that the maximum modeled salt drift rate for any location is 10.75 mg/kg/ha, which only slightly exceeds 10 mg/kg/ha. NRC057; NRC001A at 5-20 and 5-86. ESRP 5.3.3.2 states that rates approaching or exceeding 10 kg/ha/mo could cause leaf damage in many species but does not recommend cooling tower design changes to respond to such a salt drift rate. NRC013 at 5.3.3.2-5. Although leaf damage may be noticeable, minor damage caused by drift rates near the threshold of reported effects would not be expected to destabilize the overall ecological quality of terrestrial habitats.

ESRP 5.3.3.2 goes on to state that:

> Deposition rates of hundreds or thousands of kg/ha/yr could cause damage sufficient to suggest the need for changes of tower-basin salinities or a reevaluation of tower design, depending on the amount of land impacted and the uniqueness of the terrestrial ecosystems expected to be exposed to drift deposition.

NRC013 at 5.3.3.2-5. It is these rates that the ESRP suggests may result in possible destabilizing effects. Terrestrial habitats potentially exposed to the maximum salt drift rate of 10.75 mg/kg/ha are limited to a small area on the LNP site near the proposed location for the cooling towers, and the rate decreases rapidly with distance. NRC001A at 5-22 and 5-86. Even if the terrestrial habitats in the maximally exposed areas were substantially damaged, the overall ecological properties of the landscape would not be substantially altered.

### 4. Impacts to aquatic biota from salt drift and salt deposition.

**Q219. What guidance did you rely on to assess the impact of salt drift on the biota of waterbodies in the aquatic ecology geographic area of interest?**

A219. (ALM, MTM) We used NUREG-1555, ESRP 2.4.2 to describe the aquatic environment in sufficient detail to assess proposed operation. We used NUREG-1555, ESRP 5.3.1.2 with respect to assessment of entrapment, impingement, entrainment, altered circulation patterns, and water quality to predict potential effects on aquatic biota and their habitats, to include ESA species.

We used NUREG-1555, ESRP 4.7 with respect to assessment of cumulative impacts related to operation activities on aquatic ecology.

We used NUREG-1555, ESRP 5.11 with respect to identifying past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have cumulative impacts with the proposed action on aquatic ecology.

**Q220. What other information did you rely upon when conducting your analysis?**

A220. (ALM, MTM) The Staff used hydrology and meteorology assessments as described in Sections 5.3.1.1 and 5.7.2 of the FEIS and as described in A193, A200, and A201. The Staff used deposition rate estimations using the EPA-approved AERMOD model, as described in Section 5.7.2 of the FEIS. Drift estimations are described in Sections 5.3.1.1 and 5.7.2 of the FEIS and are described in more detail above in A87 and A212of the Staff's testimony.

**Q221. What sections of the FEIS discuss these potential effects of salt deposition on the biota of special aquatic sites and other waters?**

A221. (ALM, MTM) Section 5.3.2.1 of the FEIS describes the potential effects of salt deposition on Lake Rousseau and the Withlacoochee River, which are the closest major freshwater waterbodies to the LNP site. Because other waters such as the CFBC and Crystal Bay, are already saline, the effects of salt deposition for these aquatic sites are not discussed.

**Q222. Describe the potential direct impacts associated with the deposition of salt drift from the LNP cooling towers on aquatic biota inhabiting waterbodies in the aquatic ecology geographic area of interest?**

A222. (ALM, MTM) As stated previously in A193 and A212 of the Staff's testimony, the maximum offsite salt deposition rate predicted using the AERMOD modeling and meteorological conditions for any of the five years considered (2001 through 2005) was 6.81 kg/ha/mo., at a location on private property just outside of the LNP boundary near the cooling towers. NRC001A at 5-21 and5-86. The modeled maximum offsite salt deposition rate decreases rapidly with increasing distance from the site boundary, approaching only one-third of the maximum offsite rate at a distance of about 3,280 feet from the boundary. Id. at 5-22. These results suggest that measureable deposition of salt from cooling-tower drift is not expected to reach freshwater waterbodies such as the Withlacoochee River and Lake Rousseau, which are approximately 3 mi to the south of the LNP site. Other major waterbodies within the LNP site vicinity are estuarine or marine, and any salt drift or salt deposition at the rates predicted by the model would not affect aquatic biota residing within these waters.

**Q223. Describe the potential indirect impacts associated with the deposition of salt drift from the LNP cooling towers on aquatic biota inhabiting waterbodies in the aquatic ecology geographic area of interest.**

A223. (ALM, MTM) Deposited salt on vegetation on the LNP site may runoff following precipitation events. As described in Section 5.3.1.1 of the FEIS using conservative maximum salt deposition values and minimum monthly rainfall values, the runoff salinity is estimated at 0.026 ppt as described in A200 Because this value is significantly lower than 1.0 ppt, which is still classified as freshwater, there would be no indirect effects from salt deposition on aquatic biota inhabiting waterbodies near the LNP. Therefore, the Staff properly characterized the impact of salt deposition resulting from the LNP cooling tower drift to special aquatic sites and other waters in the vicinity of the site as SMALL. Any impacts would likely be undetectable, minor and not destabilizing to any attributes of the aquatic resources. Therefore, the impact significance level would not be considered MODERATE or LARGE.

**Q224. Describe the potential direct, indirect and cumulative impacts associated with the deposition of salt drift from the LNP cooling towers on aquatic biota inhabiting special aquatic sites or other waters in the aquatic ecology geographic area of interest.**

A224. (ALM, MTM) No direct or indirect effects are anticipated for salt deposition due to cooling tower drift on aquatic biota in waterbodies near the LNP. Any effects from salt deposition would be more likely attributed to the location of these waterbodies near coastal regions of the Gulf of Mexico. Many of these waterbodies such as the CFBC and portions of the LWR are already characterized as estuarine. Organisms inhabiting these waterbodies are considered euryhaline or salt tolerant. As described in Section 5.7.2 of the FEIS salt deposition from cooling-tower drift is predicted to be a maximum of 10.75 kg/ha/mo onsite. NRC001A at 5-86. Deposition of salt decreases rapidly with increasing distance from cooling towers, and subsequent drift away from site boundaries is essentially freshwater. Therefore, salt drift is not expected to measurably affect the closest major freshwater bodies, which are approximately 3 mi to the south (Lake Rousseau and the Lower Withlacoochee River) from the LNP site. No impact due to salt deposition to aquatic resources inhabiting these waterbodies is predicted.

As described in A224 and A225 the small incremental increase in salinity conservatively predicted by the model would not result in any morbidly or mortality to aquatic biota in nearby special aquatic sites or other waters or the above mentioned waterbodies. Therefore there would be no direct,or indirect impacts to aquatic resources as a result of salt drift from the LNP cooling towers. There would be no contribution to any cumulative impact associated with past, present or reasonably foreseeable future increase in surface or groundwater salinities since the contribution from LNP operation is negligible.

Therefore, the Staff properly characterized the impact of salt deposition resulting from the LNP cooling tower drift to special aquatic sites and other waters in the vicinity of the site as

SMALL because the Staff determined that impacts to waterbodies from salt deposition or runoff would be undetectable or so minor that they will neither destabilize nor noticeably alter any important attribute of the aquatic resource.

**Q225. Why was the impact to biota inhabiting special aquatic sites or other waters from LNP cooling tower salt drift not MODERATE or LARGE as claimed in the Contention?**

A225. (ALM, MTM) A MODERATE impact is sufficient to alter noticeably but not sufficient to destabilize important attributes of the resource. A LARGE impact is one that is clearly noticeable and sufficient to destabilize important attributes of the resource. The Staff has determined that the effect of cooling tower salt drift from LNP operations will not noticeably alter or destabilize the aquatic biota inhabiting special aquatic sites, other waters, the Withlacoochee River, or Lake Rousseau. Therefore under the NRC's standards of significance and the definitions found in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B the Staff finds that the impacts are SMALL.

# IV. Conclusions Regarding Contention 4A

## A. Contention Subpart C1

**Q226. What is subpart C1 of this contention?**

A226. (ALL) In Contention 4C and specifically Subpart C1 the Intervenors state "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. C. As a result of the omissions and inadequacies described above, the Draft

Environmental Impact Statement also failed to adequately identify, and inappropriately characterizes as SMALL, the proposed project's zone of: 1. Environmental impacts;"

**Q227. How does the Staff interpret this subpart of the contention?**

A227. (JPD, LMA, ALM, MTM) For this portion of the contention, we interpret the Intervenors' allegation to be that the characterization of environmental impacts listed in subparts A and B on Contention 4A in the FEIS is inaccurate.

**Q228. Did the Staff use a systematic approach to evaluate possible impacts from the LNP on wetlands and other terrestrial ecology issues?**

A228. (JPD, LMA) Yes. The Staff followed procedures established in multiple ESRPs to evaluate possible effects on wetlands and other terrestrial ecology issues. Specific ESRPs underlying the Staff's evaluation of terrestrial ecology issues include 2.4.1, 4.3.1, 4.7, and 5.3.3.2, 5.11. Specific elements of the Staff's analysis are described in detail in the responses to questions posed in Part III of this testimony. Even though the Staff used information provided by the Applicant in the Environmental Report and responses to Requests for Additional Information, the Staff independently verified technical information obtained from those sources before relying on it to draw conclusions in the FEIS.

**Q229. Was the Staff's consideration of terrestrial ecology impacts from the LNP part of an interdisciplinary evaluation?**

A229. (JPD, LMA) Yes. The Staff terrestrial ecologists assigned to the FEIS communicated frequently with Staff hydrologists and meteorologists. The evaluation of possible effects of active and passive dewatering on wetlands in Section 5.3.1.1 of the FEIS (NRC001A at 5-26 to 5-31) relies in part on the DWRM2 groundwater modeling presented in Section 5.2.2.2 of the FEIS. Id. at 5-7 to 5-8. The evaluation of possible salt drift effects on terrestrial habitats in

Section 5.3.1.1 of the FEIS (Id. at 5-19 to 5-26) relies in part on the AERMOD modeling presented in Section 5.7.2 of the FEIS. Id. at 5-85 to 5-86.

**Q230. Did the Staff conclude that all of the potential impacts to wetlands and other terrestrial habitats were SMALL?**

A230. (JPD, LMA) No. The NRC Staff concludes in Section 4.3.1.8 of the FEIS that the impacts of building and developing the LNP project on wetlands and other terrestrial habitats would be MODERATE. Id. at 4-71. The EIS states:

> Even with implementation of BMPs [best management practices], the proposed wetland mitigation plan, and other mitigation outlined in the Florida Conditions of Certification, the review team believes that the impacts to wetland and upland terrestrial habitats and their associated wildlife would still be noticeable in the surrounding landscape, especially in the short term. Id.

The Staff reached this conclusion following an independent review of the FDEP Conditions of Certification and the Comprehensive Wetland Mitigation Plan. PEF005 and NRC048.

(JPD, LMA) Also, the NRC Staff concludes in Section 5.3.1.6 that the potential impacts from operating the LNP project would be SMALL to MODERATE. NRC001A at 5-47. The range reflects the Staff's recognition of possible uncertainty in the ability of the Applicant to detect possible adverse impacts on wetlands caused by groundwater drawdown before damage occurs and corrective action can be taken. However, the Staff believes that any possible effects on wetlands would be "temporary and localized" as long as the conditions set by the FDEP Conditions of Certification are met. Id. The Staff also acknowledged that the cumulative impacts on terrestrial ecological resources, including wetlands, in the landscape surrounding the LNP project would be MODERATE. NRC001B at 7-29.

**Q231. Why did the Staff not conclude that any impacts to wetlands and other terrestrial habitats were LARGE?**

A231. (JPD, LMA) A conclusion of LARGE would indicate that the impacts might destabilize one or more important attributes of a resource under evaluation. For terrestrial ecological resources, including wetlands, the Staff expects that adverse effects would have to be noticeable across a broadly defined landscape in order to be destabilizing. However, after reviewing the Applicant's design for the power block excavations and other excavations and trenching necessary to build the LNP facilities, the Staff concluded that the effects on wetlands would be temporary and localized. NRC001A at 4-34. The Staff reached a similar conclusion following review of the Applicant's proposed stormwater management facilities. Id. at 5-26. Hydrological modeling reviewed by the Staff suggests that dewatering resulting from operation of the LNP production wells would materially affect only about 2093 acres of wetlands. Id. at 5-27 and 5-29. The Staff concluded that the effects of salt drift from operation of the LNP cooling towers would be "minor, infrequent, and limited to the LNP site." Id. at 5-22. The Staff's MODERATE and SMALL to MODERATE conclusions regarding terrestrial ecology impacts are premised not only on the quantitative analyses noted above but on the fact that the Applicant will be required to monitor and mitigate for dewatering impacts as part of the Conditions of Certification issued by the State of Florida. PEF005 at 43.

**Q232. Did the Staff use a systematic approach to evaluate possible impacts from the LNP on aquatic ecology issues?**

A232. (ALM, MTM) Yes. The Staff followed procedures established in multiple ESRPs to evaluate possible effects on aquatic biota. Specific ESRPs underlying the Staff's evaluation of aquatic ecology issues include 2.4.2, 4.3.2, 5.3.1.2, and 5.11. Specific elements of the Staff's analysis are described in detail in the responses to questions posed in Part III of this testimony. Even though the Staff used information provided by the Applicant in the Environmental Report and responses to Requests for Additional Information, the Staff independently verified technical information obtained from those sources before relying on it to draw conclusions in the FEIS.

**Q233. Was the Staff's consideration of aquatic ecology impacts from the LNP part of an interdisciplinary evaluation?**

A233. (ALM, MTM) Yes. The Staff aquatic ecologists communicated frequently with Staff hydrologists. The evaluation of possible effects of dewatering on aquatic resources in Sections 4.2.1, 4.2.3, (NRC001A at 4-18 to 4-26) 5.2.1, and 5.2.3 (Id. at 5-4 to 5-16) of the FEIS were used to interpret potential effects on aquatic biota. Id. at 4-79 and 5-61.

**Q234. Did the Staff conclude that all of the potential impacts to aquatic biota and aquatic habitats were SMALL?**

A234. (ALM, MTM) No. The Staff concluded that the cumulative impacts on aquatic ecological resources within the vicinity of the LNP project would be SMALL to MODERATE based on past actions associated with operation of the Crystal River Energy Complex. NRC001B at 7-34.

**Q235. Why did the Staff not conclude that any impacts to aquatic biota and aquatic habitats were LARGE?**

A235. (ALM, MTM) The Staff found that the activities associated with building and operating the LNP would not noticeably affect aquatic habitats, surface or groundwater quality. Therefore, LNP building and operation will have no detectable direct or indirect impact on aquatic biota and will not measurably contribute to the cumulative impact to the aquatic resources. Cumulative impacts on aquatic ecology resources are estimated based on the information provided by PEF and the review team's independent review. The review team concludes that the cumulative impacts of past, present, and reasonably foreseeable future activities on the aquatic resources of Crystal Bay would be SMALL to MODERATE, primarily due to the past and continued operation of CREC. However, the review team concludes that the incremental contribution to this assessment of impact from the NRC-authorized activities related to building and operation of LNP 1 and 2 would be SMALL." Id. at 7-34. Therefore, the incremental impact for building and operating LNP 1 and 2 is properly characterized as SMALL and is not MODERATE or LARGE because the direct and indirect impacts to aquatic resources would be minor and undetectable and not noticeable or destabilizing.

## B. Contention Subpart C2

**Q236. What is Subpart C2 of this contention?**

A236. (ALL) In Contention 4C and specifically Subpart C2 the Intervenors state "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. C. As a result of the omissions and inadequacies described above, the Draft Environmental Impact Statement also failed to adequately identify, and inappropriately characterizes as SMALL, the proposed project's zone of: 2. Impact on Federally listed species;"

### 1. Federally Listed Terrestrial Species

**Q237. Where in the FEIS does the Staff consider impacts of the LNP project on Federally-listed terrestrial species?**

A237. (JPD, LMA) The effects of building and development of the LNP project on Federally-listed terrestrial species are addressed in Section 4.3.1.3 of the FEIS. The effects of operating the LNP project on Federally-listed terrestrial species are addressed in Section 5.3.1.3 of the FEIS. Potential cumulative impacts of the LNP project and other past, present, and reasonably foreseeable actions on Federally-listed terrestrial species are addressed in Section 7.3.1 of the

FEIS. Potential effects on Federally-listed terrestrial species are described in even greater detail in Appendix F of the FEIS under "Biological Assessment – U.S. Fish and Wildlife Service."

**Q238. For what area did the Staff assess potential impacts on Federally-listed terrestrial species?**

A238. (JPD, LMA) The Staff did not limit its analysis to a pre-determined area. Recognizing the general homogeneity of the landscape surrounding the LNP project area, the Staff extended its analysis to encompass any terrestrial habitats shown by dewatering or salt drift models to be potentially affected by LNP activities, regardless of distance from the actual project footprint. The Staff specifically ensured that the analysis encompassed any habitats shown by models to be potentially affected by water withdrawals or salt drift. The analysis also encompassed landscape level impacts such as fragmentation of terrestrial habitats or alteration to surface flow patterns.

**Q239. What Federally listed terrestrial species were included in the Staff's analysis?**

A239. (JPD, LMA) The analysis addresses each of the species presented in Table 2-8 of the FEIS. NRC001A at 2-62 to 2-75. Federally listed species included in the analysis are two mammals, four birds, three reptiles, and six plants. No critical habitats for Federally-listed terrestrial species occur in areas potentially affected by the LNP project. Id. at 2-61.

**Q240. How did the Staff determine which Federally-listed terrestrial species to consider?**

A240. (JPD, LMA) The Staff communicated with and reviewed information available from the Jacksonville Field Office of the U.S. Fish and Wildlife Service (USFWS). The Staff submitted a letter dated November 5, 2008 to USFWS requesting participation in the EIS scoping process and a list of protected species in the LNP project area. The Staff also invited USFWS to participate in the LNP site audit and site tours during the week of December 1, 2008. The Staff also consulted lists maintained by USFWS of Federally-listed species potentially occurring in each county potentially affected by the LNP project.

**Q241. What guidance did the Staff rely on to assess the impact of building and operation of the LNP on Federally listed terrestrial species?**

A241. (JPD, LMA) The Staff used NUREG-1555, ESRP 2.4.1 for guidance in characterizing baseline terrestrial environmental conditions, including describing Federally-listed species and critical habitats, sanctuaries, preserves, refuges, and habitats identified by State or Federal agencies as unique, rare, or of priority for protection. The Staff used NUREG-1555, ESRP 4.3.1 for guidance in assessing impacts from onsite and offsite building and development activities on terrestrial resources, including Federally-listed species. The Staff used NUREG-1555, ESRP 5.3.3.2 for guidance in assessing effects from cooling system operation, including salt drift, on terrestrial biota and habitats, including Federally-listed species. The Staff used NUREG-1555, ESRP 4.7 for guidance in assessing cumulative impacts related to building and development activities on terrestrial ecology, including Federally-listed species. The Staff used NUREG-1555, ESRP 5.11 for guidance in assessing cumulative impacts from operation on terrestrial ecology, including Federally-listed species.

The Staff also used guidance from the Endangered Species Consultation Handbook published by the USFWS and NMFS. NRC066. Specifically, the Staff relied on guidance from Sections 3.1 of the Handbook regarding coordination and informal consultation with the USFWS, Section 3.4 of the Handbook for guidance on preparing the Biological Assessment (Appendix F to the FEIS), and Section 4.2 of the Handbook for guidance on initiating the formal Section 7 consultation process. NRC066 at 3-1 to 3-5, 3-11 to 3-12, and 4-4, respectively.

**Q242. How did the Staff assess the effects of building and development of LNP on Federally-listed terrestrial species?**

A242. (JPD, LMA) The Staff began by reviewing the Applicant's ER and responses to requests for additional information. To assess terrestrial habitat losses, the Staff overlaid the project footprint provided by the Applicant over a habitat map developed from information contained in the ER. The project footprint is shown in Figure 3-4 of the FEIS and the habitat map is shown in Figure 2-15. NRC001A at 3-8 and 2-43, respectively. The Staff evaluated life history data and habitat preferences data for each species from the ER and other scientific literature in light of the habitat impacts presented in Sections 4.3.1.1 and 4.3.1.3 of the FEIS. To assess potential wetland impacts from active dewatering, the Staff reviewed the Applicant's plan for minimizing dewatering during excavation of the power block (see response to Q95 in Subpart A1 of this testimony). To assess potential wetland impacts from passive dewatering, the Staff reviewed the Applicant's proposed best management practices for controlling runoff and stormwater during building and development of LNP facilities (see response to Q108).

After evaluating the possible impacts, the Staff then reviewed the Conditions of Certification imposed on PEF by the Florida Fish and Wildlife Conservation Commission with respect to requirements to survey for and minimize adverse effects on Federally-listed species. PEF005 at 55 to 67. The Staff also reviewed the conceptual and final wetland mitigation plans developed by the Applicant to meet Conditions of Certification and requirements expected to be imposed by the USACE should it issue a permit.under Section 404 of the CWA NRC048. Finally, once they were received, the Staff reviewed the Biological Opinion and associated response letter received by FWS in December 2011. NRC001C at F-195 to F-221.

**Q243. How did the Staff assess the effects of operation of LNP on Federally-listed terrestrial species?**

A243. (JPD, LMA) First, the Staff reviewed the Applicant's ER and responses to requests for additional information. As described in the responses to Q100, Q103, and Q104, the Staff reviewed groundwater data used in the hydrology sections of the FEIS to assess potential impacts caused by active groundwater dewatering on wetlands and species using those wetlands,  As described in A108, the Staff reviewed the Applicant's proposed best management practices for controlling runoff and stormwater to assess potential impacts from passive groundwater drawdown on wetlands and species using those wetlands.  As described A205, the Staff reviewed salt drift modeling data used in the meteorology sections of the FEIS to assess potential salt drift impacts on terrestrial habitats and species using those habitats.  The Staff also evaluated life history data and habitat preferences data for each species in light of the modeled hydrological and salt drift impacts.

After evaluating the possible impacts, the Staff then reviewed the Conditions of Certification imposed on the Applicant by the Florida Department of Environmental Protection with respect to requirements to survey for and minimize adverse effects on Federally-listed species.  PEF005 at 55 to 67.   Finally, the terrestrial ecology Staff reviewed the Biological Opinion and associated response letter received by FWS in December 2011.  NRC001C at F-119 to F-194.

**Q244.  What were the terrestrial ecology Staff's interactions with the USFWS on terrestrial Federally listed species?**

A244. (JPD, LMA) Interaction started with submitting a request for data (informal consultation letter) to the USFWS dated November 5, 2008.  The letter also invited USFWS to participate in the scoping process for the EIS.  Representatives of USFWS participated in a site audit near the LNP site on December 1, 2008.  At the audit, the USFWS representatives joined the NRC terrestrial ecology Staff for a tour of the site led by the Applicant, attended presentations by the Applicant, and asked questions of the Applicant.  After the audit, the terrestrial ecology Staff prepared for inclusion with the draft EIS a Biological Assessment evaluating potential impacts to federally listed species.  NRC001C at F-119 to F-194.  Following review of the Draft EIS and Biological Assessment, USFWS issued a comment letter dated October 25, 2010. NRC terrestrial ecologists met with USFWS on January 4, 2011 to discuss the comments and met with USFWS a second time on March 14 to present an approach for providing the necessary data.

USFWS issued a Biological Opinion and Incidental Take Statement dated December 1, 2011. NRC001C at F-195 to F-221. USFWS determined that the LNP project would have "no effect" or "may affect, not likely to adversely affect" all of the listed species, except for the Florida scrub jay (*Aphelocoma coeruluscens*), for which USFWS made a determination of "may affect, likely to adversely affect." Id. at F-196 to F-198. The Florida scrub jay inhabits specialized upland habitat in peninsular Florida. Id. at F-203 to F-204. The only take anticipated by the USFWS for the LNP project is "a family of scrub jays" that may be "incidentally taken as a result of the destruction of its territory along the Levy to South Central Florida transmission line that will impact occupied scrub jay habitat." Id. at F-215. The Biological Opinion does not express concerns over impacts from groundwater dewatering or salt drift, which are the subjects of this contention. The Biological Opinion closes out Section 7 consultation requirements for NRC's issuance of a combined license for the LNP, but it requires NRC to reinitiate Section 7 consultation using updated targeted survey data collected within 2 years of initial ground disturbance to build the LNP.

**Q245. What were the Staff's conclusions as to the effects of development of the LNP project on Federally listed terrestrial species?**

A245. (JPD, LMA) The Staff's conclusions are those confirmed by the USFWS in Table 1 of the Biological Opinion. NRC001C at F-196 to F-198. The Biological Opinion concludes that the LNP project may affect and is likely to adversely affect, the Florida scrub jay. Id. at F-196. The adverse effects are attributable to clearing of specialized upland habitat to build portions of the transmission lines (see Id. at F-215), not to groundwater drawdown or salt drift.

**Q246. What were the terrestrial ecology Staff's conclusions as to the effects of operation of the LNP project on Federally listed terrestrial species?**

A246. (JPD, LMA) As stated in the response to the previous question, the Staff's conclusions are those confirmed by the USFWS in Table 1 of the Biological Opinion. Id. at F-196 to 198. The Biological Opinion concludes that the LNP project may affect and is likely to adversely affect, the Florida scrub jay. Id. at F-196. The adverse effects are attributable to clearing of specialized upland habitat to build portions of the transmission lines (see Id. at F-215), not to impacts related to the subjects of this contention, i.e., dewatering and salt drift.

### 2. Federally Listed Aquatic Species

**Q247. What is the aquatic ecology geographic area of interest for determining impacts to federally listed aquatic species and how was it determined?**

A247. (ALM, MTM) The geographical region considered for the aquatic ecology review included onsite permanent and seasonal shallow ponds and offsite waterbodies that would or could be affected by the building and operation of the LNP, which includes both onsite or offsite facilities. Offsite waterbodies include, but are not limited to, the CFBC, Lake Rousseau, the Inglis lock and by-pass channel, the OWR, the LWR, the CREC intake and discharge areas, Crystal Bay and the Gulf of Mexico offshore of Levy and Citrus Counties, and streams and other waterbodies in or contiguous to the transmission corridors. We examined aquatic habitats that were on site, near proposed offsite facilities, and associated with transmission line corridors. Hydrological connection of these surface waters with other water sources was also considered in terms of habitat contribution and water quality.

**Q248. What Federally listed aquatic species may be present in the aquatic ecology geographic area of interest that could be affected by the construction and operation of LNP?**

A248. (ALM, MTM) Federally-listed species include the blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), Florida manatee (*Trichechus manatus latirostris*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), gulf sturgeon (*Acipenser oxyrinchus desotoi*), smalltooth sawfish (*Pristis pectinata*), elkhorn coral (*Acropora palmate*) and staghorn coral (*Acropora cervicornis*).

**Q249. How did the review team determine which federally listed aquatic species to consider in its review?**

A249. (ALM, MTM) NMFS provided a list of species known from the LNP site and offsite areas that are afforded Federal protection under NMFS jurisdiction. NRC059. The Staff also consulted lists maintained by USFWS of Federally-listed species potentially occurring in each county potentially affected by the LNP project. Aquatic species listed as potentially occurring on from both the LNP site and potentially affected offsite locations were preliminarily screened based on the probability of occurrence in the geographic area of interest. Based on the geographic region considered for aquatic species in the FEIS, the five species of whales and the two species of coral were not considered further. The habitat in the Gulf near the LNP site is not suitable for these species and, therefore, the species do not occur in the region. In addition, the leatherback sea turtle does not occur along the central Florida Gulf coast, and was also not considered further in great detail. The remaining listed species that were considered for assessment of building and operation impacts are the loggerhead sea turtle, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, smalltooth sawfish, gulf sturgeon, and the Florida manatee.

**Q250. Where in the FEIS are the potential effects described of building and operation and cumulative impacts of LNP on Federally listed aquatic species?**

A250. (ALM, MTM) Potential effects for building and operation of LNP and the cumulative impacts of these impacts and other past, present, and reasonably foreseeable future project on listed aquatic species are presented in Sections 4.3.2.3, 5.3.2.3, and 7.3.3 in the FEIS and described in more detail in Appendix F of the FEIS under "Biological Assessment – National Marine Fisheries Service", and "Biological Assessment – U.S. Fish and Wildlife Service."

**Q251. What guidance did you rely on to assess the impact of construction and operation of the LNP on listed aquatic species?**

A251. (ALM, MTM) The Staff used the Endangered Species Consultation Handbook, procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act. NRC066.

The Staff relied on NUREG-1555, ESRP 2.4.2 to identify and describe the biota of the affected environment in sufficient detail to assess proposed building, and operation related impacts. The ESRP was consulted with respect to describing ESA species, and critical habitats for ESA species, sanctuaries, preserves, refuges, and habitats identified by State or Federal agencies as unique, rare, or of priority for protection.

The Staff used NUREG-1555, ESRP 4.3.2 with respect to assessment of onsite and offsite construction and building activities to include transmission line corridors.

The Staff used NUREG-1555, ESRP 5.3.1.2 with respect to assessment of entrapment, impingement, entrainment, altered circulation patterns, and water quality to predict potential effects on aquatic biota and their habitats, to include ESA species.

The Staff used NUREG-1555, ESRP 4.7 with respect to assessment of cumulative impacts related to construction and operation activities on aquatic ecology.

The Staff used NUREG-1555, ESRP 5.11 with respect to identifying past, present, and future Federal, non-Federal, and private actions that could have cumulative impacts with the proposed action on aquatic ecology.

**Q252. What is the Staff's understanding of the contention as it relates to Federally protected species?**

A252. (ALM, MTM) The contention asserts that because the Staff failed to adequately address impacts associated with dewatering and salt drift and deposition the Staff did not properly assess the impacts on Federally listed species.

**Q253. How did the Staff assess the impact of dewatering on Federally protected aquatic species.**

A253. (ALM, MTM) The Staff examined the distribution abundance, habitat requirements, and life history for each of the protected species that may be affected by the building and operation of LNP. The Staff then evaluated the potential effects on the aquatic environments inhabited by the protected species of a variety of impacts associated with the building and operating of LNP, including dewatering. Finally, the Staff assessed the direct, indirect and cumulative impact to each protected aquatic species. With respect to dewatering, the Staff considered the effect dewatering would have on the habitat of each species.

**Q254. What did the Staff determine the impact would be to protected aquatic species from dewatering during the building and operation of LNP?**

A254. (ALM,MTM) The Staff concluded that the Gulf sturgeon, smalltooth sawfish, and sea turtles would not be affected by changes in flow or water quality associated with LNP dewatering. These species inhabit a variety of habitats that are primarily marine and estuarine for sea turtles and the smalltooth sawfish. Gulf sturgeon migrate upriver to freshwater to spawn, but no spawning habitat is present in the Withlacoochee River or the CFBC. NRC001C at F-98. Any changes to the marine or estuarine habitat postulated by LNP dewatering activities would be minor and would not affect these species' distribution or abundance. The Florida manatee is known to inhabit the CFBC. Manatees require a source of freshwater in their environment. It is quite possible that seeps or springs along the banks of the CFBC provide a source of freshwater for manatees in the canal. Dewatering, particularly during operation, may alter the flow in these seeps/springs reducing available freshwater to manatees. Although this effect is possible, it is unlikely to affect the usage of the canal by manatees. Springs or seeps located within and near the mouth of the CFBC would likely not be affected by dewatering activities associated with LNP operations since the canal is outside the predicted area that could be affected by groundwater withdrawal. NRC001A at 5-6 (Figure 5-1). Manatees that venture to the eastern end of the canal have a convenient and steady source of freshwater from the OWR. Additionally aerial overflights of the canal as part of FWS monitoring efforts to estimate manatee populations, has established that the CFBC is not heavily used by the species. NRC060.

Therefore, the Staff concluded that dewatering associated with the building and operation of the LNP would have no detectable effect on the Gulf sturgeon, smalltooth sawfish or sea turtles. Any impact on the Florida manatee due to alteration of springs or seeps in the vicinity of the site would be minor and insignificant. The OWR provides a consistent alternative source of freshwater for the few manatees that visit the eastern portion of the canal.

**Q255. How did the Staff assess the impact of salt drift and salt deposition from the LNP cooling towers on Federally protected aquatic species.**

A255. (ALM, MTM) The Staff examined the distribution abundance, habitat requirements, and life history for each of the protected species that may be affected by the building and operation of LNP. The Staff then evaluated the potential effects of salt drift and salt deposition to the aquatic environments inhabited by the protected species. Finally, the Staff assessed the direct, indirect and cumulative impact to each protected aquatic species based on the effect salt drift and salt deposition from the LNP cooling towers would have on their habitat.

**Q256. What did the Staff determine the impact would be to protected aquatic species from salt drift and salt deposition from the LNP cooling towers operation of LNP?**

A256. (ALM,MTM) The Staff concluded that the Gulf sturgeon, smalltooth sawfish, sea turtles, and the Florida manatee would not be affected directly by salt drift from the LNP cooling towers. Salt drift is an atmospheric phenomenon and does not directly affect the aquatic environment. Therefore the Staff concluded that salt drift, in itself, has no impact on the aquatic environment. Salt deposition, on the other hand, has the potential to affect aquatic resources. The concern is that salt would be deposited in the terrestrial environment reaching relatively high levels. Once there is an intense rainfall event the salts would be dissolved into the rainwater reaching relatively high concentrations. The rainwater would then flow into a freshwater waterbody. The runoff with its elevated total dissolved solids was postulated to adversely affect the biota inhabiting the receiving water. The Staff examined the potential for such a event affecting Federally protected aquatic species inhabiting waterbodies in the vicinity of LNP. The Staff conservatively calculated the increase in salt that would be expected in the rainwater runoff (<u>see</u> A199). The Staff also reviewed the salt tolerance of Federally protected species that potentially could be affected by the runoff from the site. The Staff determined that the increase in salinity from runoff in the vicinity of the LNP cooling towers would be less than 1 psu, an inconsequential increase that would not result in any adverse impact to protected species. All listed species under consideration can tolerate full strength seawater for extended periods of time. The Gulf sturgeon, sea turtles and the manatee are considered euryhaline species which mean they can tolerate a large range in salinities.

Based on the almost undetectable increase in salinity in the runoff due to the salt deposition from the LNP cooling towers and the known salt tolerance of all of the species under consideration the Staff concludes that salt drift and salt deposition would have no detectable effect on the Gulf sturgeon, smalltooth sawfish, sea turtles, or Florida manatee.

**Q257. What were the outcomes of the consultations with the FWS and the NMFS for Federally listed aquatic species?**

A257. (ALM, MTM) As part of NRC's responsibilities under ESA Section 7, the Staff prepared biological assessments documenting potential impacts on the Federally listed threatened or endangered aquatic species as a result of the building activities and operation of the LNP site. The FWS issued a concurrence letter on the FWS biological assessment for all Federally listed aquatic species, agreeing with the determination of may affect, not likely to adversely affect the Florida manatee. NRC001C at F-196. The NMFS issued a concurrence letter for the NMFS biological assessment on November 26, 2010, agreeing that there would be no effect on the leatherback turtle, and with the determination of may affect, not likely to adversely affect loggerhead, green, hawksbill, and Kemp's ridley sea turtles, the smalltooth sawfish, and the Gulf sturgeon. NRC061.

## C. Contention Subpart C3

**Q258. What is Subpart C3 of this contention?**

A258. (ALL) In Contention 4C, and specifically Subpart C3, the Intervenors state ”The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. C. As a result of the omissions and inadequacies described above, the Draft Environmental Impact Statement also failed to adequately identify, and inappropriately characterizes as SMALL, the proposed project's zone of: 3. Irreversible and irretrievable environmental impacts;”

**Q259. How does the Staff interpret the term irreversible and irretrievable environmental impacts?**

A259. (JPD, LMA, ALM, MTM) For this portion of the contention, we interpret the Intervenors' use of the term “irreversible and irretrievable environmental impacts” to be equivalent to the term “irreversible and irretrievable commitments of resources” as used in Section 102(2)(C)(v) of NEPA. 42 USC § 4332. The Staff specifically addresses this topic in Section 10.4 of the FEIS. NRC001B at 10-14 to 10-16. If the Intervenors are concerned about unavoidable impacts form the LNP project, these are evaluated in Section 10.2 of the FEIS. Id. at 10-4 to 10-13.

**Q260. Did you provide impacts determinations for your discussion of irreversible and irretrievable environmental impacts for terrestrial and wetlands ecology?**

A260. (JPD, LMA) No. In Section 10.4.1.3 of the FEIS we provide a summary of irretrievable and irreversible environmental impacts of the proposed action in accordance with Section 10.2 of the ESRP.

**Q261. How did you analyze irreversible and irretrievable environmental impacts?**

A261. (JPD, LMA) For Chapter 10 we summarized and integrated our evaluations from earlier chapters in the FEIS. Specific ESRPs underlying the Staff's evaluation of terrestrial and wetland ecology issues include 2.4.1, 4.3.1, 4.6, 5.3.3.2, 5.10, and 6.5.1. Specific elements of the Staff's analysis are described in detail in the responses to questions posed in Parts II and III of this testimony. Even though the Staff used information provided by the Applicant in the Environmental Report and responses to Requests for Additional Information, the Staff independently verified technical information obtained from those sources before relying on it to draw conclusions in the FEIS.

**Q262. Was the Staff's consideration of irreversible and irretrievable impacts from the LNP related to terrestrial and wetlands ecology part of an interdisciplinary evaluation?**

A262. (JPD, LMA) Yes. Staff terrestrial and wetlands ecologists communicated with Staff land use experts and hydrologists throughout the process. Section 10.2 of the ESRP provides guidance for the Staff to conduct an interdisciplinary evaluation of irreversible and irretrievable commitments of resources related to plant building and operation (specific ESRPs mentioned in the previous answer). The evaluation of possible effects of dewatering on terrestrial and wetland resources described in Sections 4.2.1, 4.2.3, (NRC001A at 4-18 to 4-26) 5.2.1, and 5.2.3 (Id. at 5-4 to 5-16) of the FEIS were used to interpret potential effects on terrestrial and wetland resources. Id. at 4-70; 5-46. Our review was adequate because, as stated in the answers above, we followed NRC guidance to perform an interdisciplinary and thorough review that analyzed past, present and reasonably foreseeable future irreversible and irretrievable environmental impacts to aquatic ecology from the proposed action.

**Q263. What was your conclusion regarding irreversible and irretrievable impacts?**

A263. (JPD, LMA) The Staff concluded that although wetlands would be permanently altered by the LNP, a conceptual mitigation plan would compensate for the loss or impairment of functions of all affected wetlands, therefore, no irretrievable loss of terrestrial habitats would be expected. In addition, although terrestrial flora and fauna in the proposed project footprint would be displaced or suffer mortality, populations of these species would not be adversely affected and no irretrievable losses affecting terrestrial species would be expected. NRC001B at 10-15.

**Q264. Did you provide impacts determinations for your discussion of irreversible and irretrievable environmental impacts for aquatic ecology?**

A264. (ALM, MTM) No. For this portion of the analysis we do not provide impact determinations, but instead, as directed by section 10.2 of the ESRP, we summarize the irretrievable and irreversible environmental impacts of the proposed action.

**Q265. How did you analyze irreversible and irretrievable environmental impacts?**

A265. (ALM, MTM) Our assessment of irreversible and irretrievable environmental impacts in Chapter 10 relied on our evaluations from earlier chapters in the FEIS. Specific ESRPs underlying the Staff's evaluation of aquatic ecology issues include 2.4.2, 4.3.2, 5.3.1.2, and 5.11. Specific elements of the Staff's analysis are described in detail in the responses to questions posed in Parts II and III of this testimony. Even though the Staff used information provided by the Applicant in the Environmental Report and responses to Requests for Additional Information, the Staff independently verified technical information obtained from those sources before relying on it to draw conclusions in the FEIS.

**Q266. Was the Staff's consideration of aquatic ecology irreversible and irretrievable impacts from the LNP part of an interdisciplinary evaluation?**

A266. (ALM, MTM) Yes. The Staff aquatic ecologists communicated frequently with Staff hydrologists. Section 10.2 of the ESRP provides guidance for the Staff to conduct an interdisciplinary evaluation of irreversible and irretrievable commitments of resources related to plant building and operation. The evaluation of possible effects of dewatering on aquatic resources in Sections 4.2.1, 4.2.3, (NRC001A at 4-18 to 4-26) 5.2.1, and 5.2.3 (NRC001A at 5-4 to 5-16) of the FEIS were used to interpret potential effects on aquatic biota. NRC001A at 4-79 and 5-61. Our review was adequate because, as stated in the answers above, we followed NRC guidance to perform an interdisciplinary and thorough review that analyzed past, present and reasonably foreseeable future irreversible and irretrievable environmental impacts to aquatic ecology from the proposed action.

**Q267. What was your conclusion regarding irreversible and irretrievable impacts?**

A267. (ALM, MTM) The Staff concluded that the irreversible and irretrievable impacts on aquatic ecological resources within the vicinity of the LNP project would be minor, temporary and largely mitigable based on use of best management practices for building activities within and near aquatic resources. NRC001B at 10-15. The Staff found that the activities associated with building and operating the LNP would not noticeably affect aquatic habitats, surface or groundwater quality. Therefore, LNP building and operation will have no detectable direct or indirect impact on aquatic biota and will not measurably contribute to the cumulative impact to the aquatic resources.

## D. Contention Subpart C4

**Q268. What is subpart C4 of this contention?**

A268. (ALL) In Contention 4C and specifically Subpart C4 the Intervenors state "The DEIS fails to comply with 10 CFR Part 51 and National Environmental Policy Act because it fails to specifically and adequately address, and inappropriately characterizes as SMALL, certain direct, indirect, and cumulative impacts, onsite and offsite, of constructing and operating the proposed LNP facility. C. As a result of the omissions and inadequacies described above, the Draft

Environmental Impact Statement also failed to adequately identify, and inappropriately characterizes as SMALL, the proposed project's zone of: 4. Appropriate mitigation measures;"

**Q269. Is the Applicant required to perform mitigation measures to offset adverse impacts to wetlands?**

A269. (JPD, LMA) Yes, the Applicant is required to submit a wetland mitigation plan to FDEP as a Condition of Certification. In partial fulfillment of the Conditions of Certification, the Applicant submitted a comprehensive design document in 2011. NRC048. The wetland mitigation plan calls for performing a number of wetland mitigation activities at various locations on and off of the LNP site in a way that achieves no net loss of wetland functional capacity in each affected watershed as quantified using the Universal Mitigation Assessment Methodology (UMAM) developed by FDEP. NRC048 at i.

**Q270. Does the Applicant's wetland mitigation plan address wetland impacts caused by active and passive dewatering?**

A270. (JPD, LMA) No. Section 4.3.1 of the FEIS demonstrates that dewatering during the building phase of the LNP project would result in only minimal effects on wetlands. NRC001A at 4-32 to 4-35. The Staff therefore believes that mitigation specifically targeting wetland impacts attributable to dewatering during the building and development phase of the LNP project is not necessary to prevent adverse impacts. Section 5.3.1 of the FEIS indicates that the Applicant would be required by the FDEP Conditions of Certification to monitor for dewatering impacts and to perform additional mitigation or discontinue well operation and switch to an alternate water source should modeling reveal or predict possible adverse dewatering effects on wetlands. NRC001A at 5-30 to 5-31. The wetland mitigation plan under review by FDEP at this time does not include mitigation for wetland impacts caused by drawdown attributable to the production wells. NRC048.

**Q271. Does the Applicant's wetland mitigation plan address wetland impacts caused by cooling tower salt drift?**

A271. (JPD, LMA) No. The Staff concludes in Section 5.3.1.1 of the FEIS that the impact on vegetation from salt drift would be "minor, infrequent, and limited to the LNP site." NRC001A at 5-22. This conclusion is based on a conservative interpretation of salt drift modeling that was performed using a number of conservative assumptions, as outlined in Section 5.3.1.1 of the FEIS. Id. at 5-19 to 5-26. The Staff therefore believes that wetland mitigation specifically targeting salt drift impacts is not necessary to prevent adverse impacts.

**Q272. Is there a mitigation plan required for impacts to special aquatic sites or other waters?**

A272. (ALM, MTM). No. Building of LNP is expected to have temporary and minor impacts on aquatic resources and therefore no additional mitigation is warranted beyond compliance with the permits, certifications, and the SWPPP, which requires the implementation of best management practices. NRC001A at 4-79 and 4-26. Operation of LNP is not expected to have noticeable effects on special aquatic sites or other waters and therefore no mitigation plans are required. NRC001A at 5-61. However, FDEP and FFWCC both require aquatic resource monitoring during building and operation to determine if mitigation is warranted at that time. NRC001A at 4-79 and 5-61.

**Q273. Does this conclude your testimony?**

A273. (All) Yes.

June 26, 2012

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| (Combined License Application for Levy County Nuclear Power Plant, Units 1 and 2) | ) | |

AFFIDAVIT OF MALLECIA A. SUTTON
CONCERNING PREFILED TESTIMONY ON CONTENTION 4A

I, Mallecia A. Sutton, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC002) 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 26th day of June 2012

June 26, 2012

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

I, Ann L. Miracle, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC003) 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 MICHAEL T. MASNIK
CONCERNING PREFILED TESTIMONY ON CONTENTION 4A

I, Michael T. Masnik, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC004) 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 J. PEYTON DOUB
CONCERNING PREFILED TESTIMONY ON CONTENTION 4A

I, J. Peyton Doub, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC005) 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 TESTIMONY ON CONTENTION 4A

I, Lara M. Aston, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC006) 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 DAN O. BARNHURST
CONCERNING PREFILED TESTIMONY ON CONTENTION 4A

I, Dan O. Barnhurst, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC007) 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 LANCE W. VAIL
CONCERNING PREFILED TESTIMONY ON CONTENTION 4A

I, Lance W. Vail, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC008) 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 RAJIV PRASAD
CONCERNING PREFILED TESTIMONY ON CONTENTION 4A

I, Rajiv Prasad, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC009) 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 TESTIMONY ON CONTENTION 4A

I, Vince R. Vermeul, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC010) 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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| In the Matter of | ) | |
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| 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 TESTIMONY ON CONTENTION 4A

I, Kevin R. Quinlan, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC011) 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
Division of Site Safety and Environmental Analysis
Office of New Reactors
U.S. Nuclear Regulatory Commission
Mail Stop T7-E18
Washington, DC 20555-0001
(301) 415-6809
Kevin.Quinlan@nrc.gov

Executed at Rockville, MD
this 26th day of June 2012

June 26, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

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

I, Larry K. Berg, do declare under penalty of perjury that my statements in the "Prefiled Direct 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 Environmental Contention 4A" and my statement of professional qualifications (Exhibit NRC012) 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.
Senior Research Scientist
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Pacific Northwest National Laboratory
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Executed at Richland, WA
this 26th day of June 2012