UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)		
	)	Docket Nos.	52-029-COL
Progress Energy Florida, Inc.	)		52-030-COL
	)		
(Combined License Application for	)		
Levy County Nuclear Plant, Units 1 and 2)	)	ASLBP No.	09-879-04-COL

PRE-FILED DIRECT TESTIMONY OF
WILLIAM J. DUNN, PH.D.
REGARDING ENVIRONMENTAL IMPACTS FROM ACTIVE DEWATERING DURING CONSTRUCTION AND OPERATION OF LEVY NUCLEAR PLANT, UNITS 1&2

I. BACKGROUND AND PROFESSIONAL QUALIFICATIONS

Q.1. Please state your name and business address

A.1. My name is William J. Dunn. My business address is 3731 NW 23rd Place, Gainesville FL.

Q.2. Please state your employer and position

A.2. I am a founder and partner with Dunn, Salsano & Vergara Consulting, LLC. I am the firm's principal scientist.

Q.3. Please describe your professional qualifications

A.3. I have a Bachelor of Science degree in Biology from Tufts University, a Master of Science degree in Botany from the University of Florida, and a Doctorate of Philosophy degree in Systems Ecology also from the University of Florida.

I have 35 years of professional experience as an environmental scientist and project manager for environmental and water resource management projects. For 20 years, from 1986 through 2006, I was a senior environmental scientist at CH2M HILL in its Gainesville, Florida office. At CH2M HILL my project assignments included water resource management projects on the east coast from Florida to New Jersey, and on the Gulf coast from Florida to Texas. During this tenure I was a technology leader for wetland and aquatic sciences, watershed management, and water resource and

environmental management services. I started Watershed Connections, Inc. in 2006 to provide senior environmental sciences support to the St. Johns River Water Management District (SJRWMD)[1] and other clients. The SJRWMD adjoins the Southwest Florida Water Management District (SWFWMD), in which the Levy County Nuclear Power Plant, Units 1 and 2 (LNP) site is located. In 2010, I started with Dunn, Salsano & Vergara Consulting, LLC. During my time with Watershed Connections, Inc. and now with Dunn, Salsano & Vergara Consulting, LLC, I have supported the SJRWMD through a series of contracts in water supply planning, water resource investigations, development of protective environmental thresholds for withdrawals from aquifers and surface water bodies, development of mitigation and impact avoidance strategies, and inter-district coordination on long term water supply planning between the SJRWMD, the South Florida Water Management District (SFWMD), and the SWFWMD. I have also been engaged by the SJRWMD for litigation support as an expert witness.

My areas of expertise include:

- Application of the output of surface and groundwater models to water resource and environmental management challenges
- Water supply planning investigations and studies and water resource management investigations
- Development and evaluations of environmental thresholds for withdrawals from aquifers and surface water bodies
- Feasibility assessments of major water resource developments and watershed/ecosystem restoration projects
- Watershed assessments and management
- Assessments of cumulative environmental impacts, including impacts to state and Federally listed plant and animal species, and development of impact avoidance strategies
- Development and implementation of permitting programs for complex water resources, watersheds, and infrastructure projects
- Design and implementation of large-scale mitigation and restoration projects
- Project management

My educational and professional experience is summarized in the curriculum vitae

---

[1] PEF301 defines all acronyms used in my testimony as a convenient reference.

included as PEF302.

Q.4. What is the purpose of your testimony?

A.4. The purpose of my testimony is to address Contention 4A, Part A, Sections 1 through 4, and Part C as admitted by the Nuclear Regulatory Commission (NRC) Atomic Safety and Licensing Board in the LNP Combined Construction Permit and Operating License proceeding.

Q.5. Are you knowledgeable of matters related to Contention 4A, Part A, Sections 1 through 4 and Part C?

A.5. Yes. I am knowledgeable of technical issues raised in Contention 4A, Part A, Sections 1 through 4 and Part C related to active dewatering and its environmental impacts to wetlands, floodplains, special aquatic sites,[2] and other waters. I am also knowledgeable regarding the consequential impacts of active dewatering on Federally listed species and other natural resources. I have 35 years of experience assessing potential impacts of public and private sector projects on state and Federally listed plant and animal species, and working with the relevant government agencies to minimize the impacts of proposed actions on protected species. I have worked in the landscape mosaic of uplands, wetland ecosystems (referred to in my testimony as "wetlands") and aquatic ecosystems (the freshwater ecosystems associated with springs, lakes, ponds, streams, rivers, and floodplains) found on and in the vicinity of the LNP site and similar landscapes throughout Florida for those 35 years. The landscape of pine flatwoods, interspersed with cypress and mixed hardwood swamps, marshes and wet prairies, streams, rivers springs and lakes covers most of peninsular Florida north of the Everglades A significant portion of my work in the last 20 years has focused on water resource and ecosystem management issues related to evaluating historic impacts and/or predicting likely future impacts to wetlands and aquatic ecosystems from consumptive uses of ground and surface waters.

Over the last two decades I have: (1) performed environmental reviews of permit

---

2 The Pre-Filed Direct Testimony of Dr. Mitchell Griffin defines "special aquatic sites" as the following: sanctuaries and refuges; wetlands; mudflats; vegetated shallows; coral reefs; and riffle and pool complexes. PEF001, at p. 6. Of these six, only wetlands are present at and in the vicinity of the LNP site. Dr. Griffin explains that all wetlands on the LNP site and the wellfield property to the south are regulated as "Class III waters" by the State of Florida and are therefore not considered "special aquatic sites" under Florida surface water quality standards. Id. Accordingly, there are no special aquatic sites that would be impacted by dewatering attributable to the LNP.

requests for the SJRWMD; (2) assisted clients in obtaining water use permits for a number of groundwater withdrawals; (3) led efforts to project likely impacts in large scale groundwater supply planning processes; (4) developed water table drawdown criteria to protect wetlands and aquatic ecosystems; (5) developed drawdown impact screening approaches for lakes and wetlands in landscape settings in which the Upper Floridan Aquifer (UFA) lacks an overtopping confining unit, as in the LNP site region; and (6) developed and implemented wellfield monitoring plans. I am very familiar with the hydrogeology[3] of the LNP site and surrounding area.

Q.6. What has been your experience in Florida in karstic landscapes?

A.6. I also have extensive experience working in wetlands and aquatic ecosystems in karstic landscapes similar to the LNP site. The karst features of the LNP site and surrounding area are described in the Pre-Filed Direct Testimony of Jeffrey Lehnen. PEF200, at pp. 8 to 9. I reviewed the Final Safety Analysis Report (FSAR) sections pertaining to the karst characteristics and features for the LNP. I have performed a number of environmental reviews of potential impacts of groundwater withdrawals on wetlands and aquatic ecosystems in karstic landscapes in Florida. I am currently leading an environmental review of a proposed groundwater withdrawal in Marion County, the county adjacent to Levy County, in an area highly influenced by karst features that are also found on and in the vicinity of the LNP site, such as depressional cypress wetlands, artesian springs, and lack of a confining layer over the UFA. I have also worked jointly with SWFWMD and SJRWMD staff to develop impact prevention screening methods for karstic landscapes for the border area between the two districts in Lake, Marion, and Levy Counties. These methods use drawdown constraint values to protect wetlands and aquatic ecosystems and their underlying aquifers from impacts due to groundwater withdrawal. The area of concern included the Withlacoochee River basin and much of the Gulf Hammock region. In this region, the UFA is typically unconfined and thus the surficial aquifer system (SAS) has a direct hydraulic connection to the UFA. This work has been published as a technical guidance document by the SJRWMD. The method has been applied to water supply planning efforts for this border area.

---

[3] Hydrogeology is the study of the occurrence and movement of groundwater, both within the complex subsurface environment as well as to and from hydrologically-connected surface waters.

Q.7. Please describe your experience in applying the output of groundwater and surface water models to assess the potential impacts of a change in hydrological conditions on wetlands and aquatic ecosystems and their underlying aquifers.

A.7. I have been doing this type of environmental assessment for 35 years. I have extensive experience working with surface and groundwater modelers to characterize and evaluate the effects of change in the hydrologic conditions in both groundwater and surface water systems. For the last 20 years I have worked extensively on the assessment of potential impacts of groundwater withdrawals on wetlands and aquatic ecosystems. This has typically been done using the output generated by local and regional MODFLOW groundwater flow simulations. MODFLOW is a three-dimensional groundwater model code developed by the United States Geological Survey (USGS) that is widely used by hydrogeologists and water permitting authorities to simulate the flow of groundwater through aquifers, as well as to predict the effects on hydrologically-connected waters from hydrological changes, such as groundwater withdrawals.

Q.8. Are you familiar with the groundwater model that hydrogeologists and water use permitting agencies would generally use for projects in the vicinity of the LNP site?

A.8. Yes. The SWFWMD is the regional water permitting authority for the LNP site and adjacent areas, part of Levy County, the Withlacoochee River basin, and all or part of 15 counties lying to the east or south of the LNP site. The SWFWMD has developed a regional groundwater model – the District Wide Regulation Model, Version 2 (DWRM2) – based on the MODFLOW groundwater model code, and uses the model to evaluate groundwater on a local and regional scale. Consequently, hydrogeologists use the DWRM2 model for projects within the SWFWMD region. I have worked with output from the DWRM2 model on previous projects to assess the potential effect of proposed groundwater withdrawals on wetlands and aquatic ecosystems and their underlying aquifers. I have reviewed the output of the DWRM2 models used to simulate groundwater use scenarios for the LNP.

Q.9. What has been your role in the LNP relevant to Contention 4A?

A.9. I was engaged by Progress Energy Florida, Inc. (PEF) as a consultant to review issues raised in Contention 4A, Part A, Sections 1 through 4 and Part C. As part of my review of the validity and nature of the contentions, I visited the LNP site and adjacent areas on two occasions with Ms. Martha Burlingame, a senior environmental scientist with CH2M HILL. Ms. Burlingame has an extensive knowledge of the LNP site as well as the surrounding area, the watersheds of the Withlacoochee and Waccasassa Rivers, the

saltmarsh and bay system, and the Gulf of Mexico. My first visit was in the spring of 2008, and my second visit was in the fall of 2011. Both visits focused on overall site inspections of land use and cover, with particular emphasis on assessment of the condition of wetlands and aquatic ecosystems and aspects of the surrounding watersheds including the Withlacoochee River, Lake Rousseau, the Cross Florida Barge Canal (CFBC), Withlacoochee Bay, and Goethe State Forest. See BRD001, at p. 3, and BRD002. During the visits I noted the type and extent of wetlands and aquatic ecosystems, their general indicators of health, any signs of stress or disturbance, their hydrologic conditions, and the dominant plant and animal species present within each type. I also looked for geologic and landform features that could influence the hydrology of the wetlands and aquatic ecosystems and their underlying aquifers, including karstic landscape features such as sinkholes, other unusual subsidence or depressional features, or exposed limestone from the upper formation of the UFA. I saw only mature karst terrain and did not observe any active sinkholes. I reviewed in detail the results of the groundwater modeling conducted for PEF by CH2M HILL, with a particular focus on the effects of the proposed groundwater withdrawal on wetlands and aquatic ecosystems and their underlying aquifers, and the surficial drainage network. I am familiar with and reviewed carefully relevant sections of the Draft Environmental Impact Statement (DEIS), Final Environmental Impact Statement (FEIS) (NRC001), the FSAR, and the Conditions of Certification (COC) issued to PEF for the LNP pursuant to the Florida Electrical Power Plant Siting Act, F.S. §§ 403.501 – 518 (PPSA) (PEF303), last modified January 25, 2011 (PEF005). I also reviewed PEF's Aquifer Performance Testing (APT) Plan (PEF304) and PEF's Environmental Monitoring Plan (EMP) (PEF305) for the raw water wellfield created by PEF as required by the COC. Throughout my review, I applied my more than 35 years of education, training, experience and expertise to provide my analysis and opinions.

II. OVERVIEW

Q.10. Please summarize your testimony.

A.10. My testimony confirms and supports the FEIS's analysis, and characterization, of the magnitude, extent and duration of the direct, indirect and cumulative environmental impacts from active dewatering during construction and operation of the LNP. The FEIS

concludes that the potential impacts due to operation of the LNP are SMALL[4] (NRC001, Section 5.2.2.2, at p. 5-8), or in the case of impacts from LNP operations on terrestrial ecological resources, including wetlands and listed species, SMALL to MODERATE[5] (NRC001, Section 5.3.1.6, at p. 5-47). It is my professional opinion that the proposed active dewatering will not result in any impacts that are greater than SMALL on the wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site. As the FEIS concludes, testing, monitoring and mitigation measures required by the LNP's water and wetland permits, particularly the COC, will prevent active dewatering due to operation of the LNP's raw water wellfield from ever resulting in LARGE[6] impacts. Id.

As I will discuss in more detail later, two groundwater models were performed for the LNP project by CH2M HILL The first, which I will refer to as Model 1, was performed to support the Environmental Report (ER) that PEF filed as part of its Combined Construction Permit and Operating License Application in this proceeding. PEF also used Model 1 to support the LNP application for water use authorization as part of the Site Certification Application under the PPSA. The second model, which I will refer to as Model 2, was a recalibrated version of Model 1 prepared at the request of the NRC Staff. Both models demonstrate that the amount of groundwater withdrawn during construction and operation of the LNP is only a very small percentage of the regional groundwater flow through the UFA in the vicinity of the LNP site. Both models also show that changes in groundwater flow into adjacent surface waters and nearby springs would be similarly small. Therefore, it is my professional opinion that the proposed active dewatering will not result in adverse impacts on the aquifer or surface water bodies.

The groundwater models also estimate water table changes: Model 1 predicts a

---

[4] "SMALL" is defined by the NRC as follows: "Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource." NRC001, Section 1.1.1.1, at p. 1-3.

[5] "MODERATE" is defined by the NRC as follows: "Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource." NRC001, Section 1.1.1.1., at p. 1-3.

[6] "LARGE" is defined by the NRC as follows: "Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource." NRC001, Section 1.1.1.1., at p. 1-4

cumulative drawdown of no more than 0.5 feet (ft) after a 60-year pumping period, while Model 2 predicts a cumulative drawdown of less than 2.5 ftat the wells and progressively less farther away from the wells over that same period. Generally, different types of wetlands and aquatic ecosystems can differ in their sensitivity to the effects of drawdown, so it is important to characterize the type of system that may be impacted by the drawdown. The most common wetland types on the LNP site and adjacent areas are cypress swamp, wet planted pine, mixed wetland forest (cypress, pine, cabbage palm), mixed wetland hardwood, and wet prairie. These wetland types have been well-studied in the last two decades by the SWFWMD and the SJRWMD. From this research, protective environmental thresholds for hydrologic change have been developed and applied by the SWFWMD and the SJRWMD, which allow hydrogeologists and environmental scientists to evaluate the potential impact of proposed new water uses on wetlands and aquatic ecosystems. The SWFWMD evaluated the impact of the active dewatering in connection with the construction and operation of the LNP and determined that it would not result in unacceptable adverse impacts on wetlands or aquatic ecosystems or their underlying aquifers on and in the vicinity of the LNP site. On that basis, the SWFWMD recommended approval of the LNP's water use in accordance with the COC imposed under the PPSA. I concur with the SWFWMD's determination. In order to confirm the results of the groundwater modeling, the COC require PEF to conduct aquifer performance testing and environmental monitoring. If that testing or monitoring were to identify unacceptable adverse impacts, the COC require PEF to implement mitigation measures. This three-step process – modeling, testing/monitoring, mitigation – is a best practice in the fields of ecological and natural resource management and typically required by water use permitting agencies such as SWFWMD.

In summary, based on my education, experience, and knowledge of the natural and water resources on the LNP site and in the region, I concur with the conclusions reached by PEF in the ER and the NRC in the FEIS regarding the magnitude and extent of the direct, indirect and cumulative impacts of the proposed active dewatering during construction and operation of the LNP to wetlands, floodplains, special aquatic sites, and other waters (including Outstanding Florida Waters (OFWs)). These conclusions are based on my own evaluations, supported by site-specific data and computer modeling, and comport with standards of professional practice in the field of environmental and water resource management.

Q.11. Please describe the LNP site.

A.11. The LNP site lies in a rural portion of Levy County, Florida. The power plant will be located on a 3,105 acre parcel that is sometimes referred to as the north property, because PEF also owns the adjacent property to the south (also known as the South Property, an additional 2,114 acres). In general, when the FEIS refers to the "LNP site" the FEIS is referring to the north property only. I will continue with that convention in my testimony.[7] However, the groundwater supply wells will be located on the South Property, and the heavy haul road, pipelines, and transmission corridors move through the South Property. See BRD001, at p. 3.

The LNP site and South Property lie within the Gulf Coastal Lowlands physiographic zone of Florida, just west of the boundary of the Gulf Coastal Lowlands with the Brooksville Ridge, which is a relict dune system running parallel to the Gulf's coastline. NRC001, Figure 2-30, at p. 2-178. The Withlacoochee River divides the northern and southern sections of the Brooksville Ridge. This divide is known as the Dunnellon Gap and is just downstream of the confluence of the Rainbow and Withlacoochee Rivers. The area is referred to by locals as Gulf Hammock and labeled as such on the USGS quadrangle maps. Historically, the LNP area was a mosaic of pine and wet flatwoods interspersed with wetlands, particularly both isolated and interconnected cypress swamps. Wetlands are characterized by periodic saturated or inundated soil conditions and a plant community that is adapted to these conditions. Wetlands include swamps, marshes, bogs, and similar areas. Much of the flatwoods and wet flatwoods in this area were converted over time to commercial pine tree plantations, which are managed as short rotation silviculture operations (tree farms). The whole Gulf Hammock landscape is naturally a fire-maintained system with fires resulting primarily from lightning strikes. Dr. Kevin Robertson addresses the potential impacts of LNP dewatering on the frequency and severity of wildfires onsite and offsite at the LNP in his Pre-Filed Direct Testimony. PEF400.

Wetlands on the LNP site and South Property were delineated in accordance with current federal and state definitions and guidelines. As stated in the FEIS, four separate jurisdictional approvals have been issued by the United States Army Corps of Engineers

[7] For purposes of my testimony, I use the term "onsite" to refer to the LNP site and South Property together. "Offsite" therefore includes those properties that are other than the combined LNP site and South Property.

(USACE) between April 2009 and November 2011 concerning the LNP site, the South Property and offsite areas. NRC001, Section 2.4.1.1, at p. 2-49. FEIS Figure 2-4 shows general land use and cover, including wetlands, for the LNP site and the surrounding area (NRC001, at p. 2-6). The predominant types of wetlands on the LNP site and South Property include cypress swamp, wet planted pine, mixed wetland forest (cypress, pine, cabbage palm), mixed wetland hardwood, and wet prairie. The FEIS notes that the wet planted pine designation was developed by PEF to account for forested wetland areas in which native vegetation was cleared and then converted to pine plantation. NRC001, Section 2.4.1.1 , at p. 2-45. The FEIS also describes another wetland type altered by logging, the treeless hydric savanna. NRC001, Section 2.4.1.1, at p. 2-46. I examined a series of ten sets of aerial photos covering the time period 1994 to 2012 of the LNP site and South Property. This time sequence clearly shows that the forested wetland sites that were logged and cleared were primarily cypress swamp before logging and clearing. Based on this evaluation, I include the two silviculturally-altered wetland types (wet planted pine and treeless hydric savanna) in the cypress swamp wetland type. PEF306 provides an acreage summary of each of the six federal jurisdictional wetland types on the LNP site and South Property: the LNP site and South Property contain an estimated 2,888 acres of wetlands, of which 2,819 acres are under federal jurisdiction under Section 404 of the federal Clean Water Act, 33 U.S.C. § 1344. PEF307 is a figure depicting the federal jurisdictional wetlands on the LNP site and South Property. Described in FEIS Section 2.4.1.1, the wetlands are characterized by low topographic relief and a seasonally fluctuating high water table. NRC001, at pp. 2-41 to 2-51. Average water depths for cypress communities in this region exhibit a range from estimated average dry season lows of up to 24 to 48 inches below ground surface, to 16 to 24 inches above ground surface in the wet season. Most of the wetlands are connected by surface water during high water periods. In the wet season and other periods of high rainfall, the wetlands fill. When filled to capacity, surface water moves downgradient and offsite in overland flow. All of the wetlands on the LNP site and South Property have been impacted by road construction, planting, logging, and other silviculture activities. Several relic wetlands located along the South Property boundary are of low quality and exhibit signs of pre-existing hydrological stress, such as fallen cypress trees and proliferation of upland plant species.

Overall, the soils on the LNP site and South Property are characterized as being moderately to very poorly drained soils. Wetland areas are typically underlain by poorly

to very poorly drained soils in localized depressions. PEF308 shows the soils series composition of the LNP site and South Property based on the National Resources Conservation Service (NRCS) delineations and highlights the hydric soils. A hydric soil is a soil formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions (the absence of oxygen) in the upper part of the soil. PEF309 provides a tabular summary of the areal extent of each soil series type on the LNP site and South Property. The principal NRCS hydric soils on the LNP site and South Property include the following series: Chobee-Gator complex, Placid and Popash depressional, and Placid and Samsula depressional.

The testimony of Dr. Griffin provides a further description of the LNP site and surrounding area. PEF001, at pp. 4 to 9. Dr. Griffin describes the natural features of the LNP site and South Property, the surrounding landscape, the watersheds of the Waccasassa and Withlacoochee rivers, the coastal saltmarsh and estuarine system, and the Gulf of Mexico. Dr. Griffin also provides a summary of the surface water flow system in the LNP area. PEF001, at pp. 7 to 9.

III. ACTIVE DEWATERING AT THE LNP SITE AND SOUTH PROPERTY AND GROUNDWATER MODELING

Q.12. Please describe the active dewatering at the LNP site and South Property.

A.12. "Active dewatering" and "passive dewatering" are not terms normally used by environmental scientists; therefore, I will use the definitions of these terms provided in the testimony of Dr. Griffin, PEF001, at p. 9. Dr. Griffin defines passive dewatering as the removal of water through non-mechanical means (no pumping involved). Dr. Griffin defines active dewatering as the removal of water using pumps or other mechanical means. In this context, the potential for passive dewatering associated with the LNP site and South Property is through stormwater management. Active dewatering will take place during both construction and operation of the LNP. The remainder of my response will address active dewatering during construction and operation of the LNP.

As described in the FEIS, groundwater from four onsite production wells will be used to supply water from the UFA for general plant operations, including service-water cooling, potable water supply, raw water to the demineralizer, fire protection system, and media filter backwash. NRC001, Section 2.4.1.2, at p. 2-55. Groundwater will not be used for cooling the reactors. The four production wells will be installed on the South Property, as shown on BRD001, at p. 2. The wells will be located a minimum of 2,500

feet from each other to minimize groundwater drawdown around each well. After an initial investigation by PEF, the wellfield was relocated to the South Property to take advantage of the relatively high transmissivity (a measure of the ability of water within an aquifer to move through pore spaces or fractures in the geologic formation) of the UFA in the area. This is expected to reduce drawdown beneath nearby wetlands. Additionally, the wellfield is located in an area of fewer and more degraded wetlands compared to the original wellfield location to the northeast of the nuclear island. Groundwater use for operations was estimated at 1.26 million gallons per day (mgd); however, this figure was adjusted to 1.58 mgd to include a 25% contingency factor as a conservative measure. PEF200, at pp. 14 to 15. The COC authorize 1.58 mgd of groundwater withdrawal. PEF005, Section C.II., at p. 41. Additionally, a maximum pumping rate of 5.8 mgd is conservatively assumed to occur once per year for one week, during a nuclear plant shutdown. PEF200, at pp. 14 to 15.

Q.13. What active dewatering will occur during construction?

A.13. The active dewatering during construction is described in the testimony of Dr. Griffin (PEF001, at pp. 29 to 31) and Mr. Lehnen (PEF200, at pp. 15 to 16).

The construction dewatering will be a temporary activity, not a long-term operational condition Based on previous work, PEF estimates that construction activities at the site will require an average groundwater withdrawal of 0.275 mgd and a maximum withdrawal rate of 0.55 mgd. NRC001, Section 3.3.1.7, p. 3-21. As discussed by Mr. Lehnen, in comparison to the regional flow of groundwater through the UFA of 450 mgd in Model 1 and 208 mgd in Model 2 (as described in more detail below), these withdrawals are very small, representing 0.06% and 0.12%, and 0.13% and 0.26%, respectively, of the regional groundwater flow. PEF200, at pp. 15 to 16.

The construction dewatering will be temporary and at a much lower usage than withdrawals from the raw water wellfield during operation. In addition, as explained by Dr. Griffin, much of the groundwater withdrawals associated with construction of the LNP will be allowed to percolate back into the aquifer. PEF001, at pp. 29 to 31. Consequently, it is my professional opinion that construction dewatering will not adversely impact the wetlands and aquatic ecosystems on or in the vicinity of the LNP site and South Property. Neither will it have an adverse impact on any other water resources or ecosystems. I conclude that the direct, indirect and cumulative impacts of active dewatering on wetlands, floodplains, special aquatic sites, and other waters, during construction of the LNP and associated facilities will be SMALL.

Q.14. Please briefly describe the hydrogeology of the LNP site and the surrounding area.

A.14. Detailed descriptions of the hydrogeology of the LNP site and the surrounding area are provided in the testimony of Mr. Lehnen. PEF200, at pp.7 to 11. The area's geology, stratigraphy and hydrogeology are also described in Section 2.8 of the FEIS. NRC001, at pp. 2-177 to 2-180. Briefly, the LNP site and surrounding area is generally characterized as having coarse grained unconsolidated sandy sediments of variable thickness overlying the UFA within the limestone and dolostones of the Avon Park formation. See PEF200, at p. 10. The SAS in the vicinity of the LNP site contains freshwater from 1 to 5 ft below land surface to a depth of 30 to 40 ft below land surface before grading into the UFA. Id. The SAS and UFA are hydraulically connected and the UFA is largely unconfined in the vicinity of the LNP site. Mr. Lehnen notes that the hydrostratigraphy of the LNP and surrounding region contributes to high hydraulic conductivity (a measure of the ease with which water can move through the pore spaces or fractures within a geologic formation) and transmissivity, a high rate of recharge over a wide area, and resulting abundant groundwater resources in the area. PEF200, at p. 11.

Of particular significance to my evaluation of the environmental impacts of pumped groundwater withdrawals from the UFA for the LNP is the fact that the LNP site and surrounding area generally lack a confining unit overlying the UFA. This finding is consistent with my experience in the region generally including the LNP site. Without a confining unit in between, the SAS in the vicinity of the LNP site is intimately connected with the UFA, resulting in similar drawdown between the two aquifers when pumping the UFA. By contrast, in other parts of the State to the east and north, there are often thick confining units overlying the UFA, thus providing a high degree of hydraulic separation between the UFA and SAS. Additionally, this region's topography, drainage, and its surface water and groundwater systems have been influenced by karst. I agree with Mr. Lehnen that karstic terrain features facilitate groundwater flow and transport, resulting in highly permeable aquifers that yield large quantities of water. As described in more detail in Mr. Lehnen's testimony, the LNP site and surrounding area show evidence only of mature karst features and no active karst formations have been observed at the LNP site or South Property. PEF200, at pp. 8 to 9. This is consistent with my observations during my site visits.

Q.15. Please describe the groundwater modeling efforts conducted by PEF.

A.15. PEF retained CH2M HILL to conduct groundwater modeling to evaluate direct, indirect, and cumulative effects on local and regional water resources, including groundwater,

wetlands and hydraulically connected surface waters from proposed groundwater withdrawals during operation of the proposed LNP wellfield. As I discussed earlier, CH2M HILL developed two groundwater models for the LNP project. The first, which I refer to throughout my testimony as Model 1, was developed to support the ER and to support the LNP application for water use authorization from the SWFWMD. The second, which I refer to as Model 2, was a recalibrated version of Model 1 performed by CH2M HILL at the request of the NRC Staff. The groundwater modeling conducted by PEF and the results are explained in detail in the testimony of Mr. Lehnen. PEF200, at pp. 21 to 31.

For both models, the drawdown is the steady state, equilibrium condition under a specified withdrawal rate and for a specified simulation period. The models were used to calculate the drawdown for a withdrawal rate of 1.58 mgd for pumping periods of 1 year and 60 years, the longer time period reflecting the expected life of the LNP. CH2M HILL also modeled the maximum withdrawal rate of 5.8 mgd for a 7 maximum day pumping period. The drawdown results are described in two technical memos prepared by CH2M HILL: TMEM-074 for Model 1 (PEF212, at pp. 4 to 7 and Exhibits 7, 8, 9, 10, and 12) and TMEM-123 for Model 2 (PEF210, at pp. 8 to 9 and Figures 20, 21, 22, 23, 26, 27, 28, 29, 32, and 33).

Q.16. What are the modeling results regarding impacts to the groundwater flow through the UFA?

A.16. Model 1 estimates that groundwater flow through a small portion of the UFA, a 20 mile x 20 mile (400 mi^2) portion of the UFA surrounding the raw water wellfield, is approximately 450 mgd. PEF200, at p. 15. In comparison, the LNP's average annual and maximum weekly wellfield pump rates of 1.58 and 5.8 mgd respectively are very small, about 0.35% and 1.3% of the regional freshwater flux. Model 2 estimates a regional groundwater flow of 208 mgd. NRC001, Section 5.2.2.2, at p. 5-8 and Figure 5-2, at p. 5-9. The LNP's average annual and maximum weekly wellfield pump rates represent a similarly small percentage of the regional groundwater flux under this model, 0.8% and 2.8% respectively. Based on these results, in my professional opinion, the direct, indirect, and cumulative impact on the flow regime in the UFA from active dewatering during operation of the LNP will be SMALL.

Q.17. What are the modeling results regarding impacts to the groundwater flow to surface waters and from springs?

A.17. In Model 1, change in flows from the UFA system into adjacent surface waters and from artesian springs was found to be negligible. Modeled inflow to Lake Rousseau and the

lower Withlacoochee River was reduced by 0.9%, and flow reduction from Big and Little King Springs was approximately 0.3%. PEF212, at p. 5 and Exhibit 11. The changes in flow under Model 2 are also small: modeled flow into Lake Rousseau and the lower Withlachoochee River was reduced by 8.6% and flow from Big King and Little King Springs was reduced by approximately 1.0%. PEF200, at p. 26. In the screening criteria used by the SWFWMD and the SJRWMD, a flow reduction in a river of 10% or less is considered a SMALL impact. It is my professional opinion that these reductions in flow will not cause greater than SMALL impacts to surface waters or springs on or in the vicinity of the LNP site and the South Property.

Q.18. Please describe the drawdown impact on the SAS and UFA indicated by the groundwater modeling of the withdrawal rate associated with an annual average pumping day during operation of the LNP.

A.18. Groundwater modeling was used to simulate the effect of both the LNP's and cumulative groundwater usage on the SAS and UFA over 1 year and 60 years of groundwater pumping. Modeling predicts changes in the levels (the potentiometric surface) of the UFA in response to wellfield operation, that is, a drawdown. Since there is a direct hydraulic connection between the SAS and UFA, then under long-term, steady-state conditions the change in UFA levels will be reflected in the SAS and within wetlands on and in the vicinity of the LNP site and the South Property.

The results of Model 1's simulation of incremental and cumulative impacts at a 1.58 mgd pumping rate showed very little impact on the SAS and UFA over both 1-year and 60-year pumping periods. The incremental (LNP only) impacts were no more than 0.5 ft drawdown in the SAS and UFA over the 1 year and 60 year pumping periods throughout most of the South Property. PEF212, Exhibits 7, 8, 13, and, 14. The cumulative drawdown impacts (LNP plus all permitted users) during the 1 year and 60 year periods on the SAS and UFA were 0.4 to 0.5 ft in the vicinity of the well heads (with the exception of a projected 0.6 ft drawdown in the immediate vicinity of a single production well after 60 years of pumping). PEF212, at p. 5 and Exhibits 9 and 10. Model 1 predicted that the greatest impact on adjacent groundwater users would be 0.2 ft of drawdown, which would not be expected to cause any adverse impacts to such users. PEF212, at p. 5. No wetlands within the 400 square mile model domain were projected to experience a cumulative or incremental effect of greater than 0.5 ft drawdown within the 1-year and 60-year pumping periods. PEF212, at p. 7 and Exhibits 13 and 14.

With respect to incremental impacts, Model 2 predicted a 0.5 ft drawdown in the

SAS and UFA in a roughly 1 mile radius from the center of the wellfield during the 1-year pumping period. PEF210, at p. 8 and Figures 20, 21, and 30. This 0.5 ft drawdown radius increased to roughly 3 miles after the 60-year pumping period. PEF210, at p. 9 and Figures 26, 27, and 31; NRC001, at p. 5-27 and Figure 5-5 at p. 5-28. With respect to cumulative impacts, Model 2 yielded a 0.5 ft drawdown in the UFA and SAS in a roughly 1.5 mile radius from the center of each well during the 1 year pumping period (PEF210, Figures 22 and 23), increasing to a roughly 5.5 mile radius at the end of the 60-year pumping period (PEF210, Figures 28 and 29. Table 5-2 in the FEIS provides a summary of the potential range of incremental SAS drawdowns at the end of the 60-year pumping period by wetland type using Model 2. NRC001, at p. 5-29. The FEIS summary projects that: 2,093 acres of wetlands would be within the drawdown contour greater than 0.5 ft; 563.4 acres of wetlands would be within the greater than 1 ft drawdown contour; and 35.5 acres of wetlands would be within the greater than 2 ft drawdown contour.

Q.19. Please describe the drawdown impact on the SAS and UFA indicated by the groundwater modeling of the withdrawal rate associated with a maximum pumping week during operation of the LNP.

A.19. The incremental impacts associated with the maximum pumping week withdrawal of 5.8 mgd were modeled over a one week period. Model 1 predicted a 0.7 to 0.8 ft drawdown in the immediate vicinity of each production well, but the drawdown rate quickly diminished to 0.1 ft at 1 mile from the center of the wellfield. PEF212, at p. 6 and Exhibit 12. Model 2 predicted a 0.5 ft drawdown in the SAS within approximately 0.2 miles of each well, and within approximately 0.6 miles of each well in the UFA. PEF210, at p. 9 and Exhibits 32 and 33. Based on these results and the short duration of the maximum pumping rate, my professional opinion is that the maximum pumping week withdrawal of 5.8 mgd will not cause adverse impacts on wetlands or aquatic ecosystems or their underlying aquifers at on in the vicinity of the LNP site and South Property.

Q.20. What is the relevance of the 0.5 foot drawdown level?

A.20. The 0.5 ft drawdown level in wetlands and aquatic ecosystems and their underlying aquifers has been used by the SWFWMD and SJRWMD as a threshold of concern regarding potential risks of adverse impacts to due to groundwater withdrawals. Over the last three decades, water table drawdown thresholds have been developed by the SWFWMD, the SJRWMD, and the SFWMD for characterizing the potential for a proposed groundwater withdrawal to cause unacceptable harm to water dependent

systems such as wetlands, lakes, streams, springs, rivers and estuaries. For wetlands specifically, general impact prevention screening criteria have been developed and continuously refined from the best available research and field-based observation from the last three decades. These impact screening criteria are used by permit reviewers at both the SWFWMD and the SJRWMD to determine whether a predicted drawdown will be expected to cause, or not cause, unacceptable harm to wetlands or aquatic ecosystems or their underlying aquifers over the long term. Both Districts' environmental review recognizes that some amount of hydrologic regime change can occur without causing unacceptable impacts on wetlands or aquatic ecosystems or their underlying aquifers. Thus a steady state drawdown of less than 0.5 ft in comparison to a reference condition is judged not to cause adverse impacts on wetlands or aquatic ecosystems or their underlying aquifers. Projected SAS drawdowns greater than 0.5 ft typically trigger a more in-depth environmental review by the Districts, with the presumption that the potential risk of adverse impact rises in proportion to the amount of drawdown projected to be greater than 0.5 ft.

Q.21. What rationale and empirical data support the presumption relating to drawdowns of less than 0.5 ft?

A.21. The SJRWMD was the first Florida water district to develop a suite of strategies in the late 1990s to preclude unacceptable impacts to wetlands and aquatic ecosystems due to the withdrawal of surface or groundwater. I was the project manager for the impact avoidance project, working on behalf of the District. From that effort we developed an array of steady state drawdown criteria for different types of wetland and aquatic ecosystems. The criteria were developed from empirical data from a comprehensive review of the literature and field-based studies. The drawdown criteria were used by the SJRWMD in its District-wide planning process in the year 2000. These same drawdown screening criteria have been applied in the SJRWMD's subsequent state-mandated regional water supply planning efforts in 2005 and 2010. The SJRWMD drawdown threshold range for the predominant wetland types that are found on the LNP site and South Property is 0.6 to 1.0 ft. Since its development, the SJRWMD has used the drawdown threshold range as a screening tool for the evaluation of potential for harm for groundwater use permitting.

At the same time that the SJRWMD was developing drawdown thresholds, the SWFWMD also was developing drawdown criteria to use in water supply planning and water use permitting. This effort was hastened by extensive litigation over the alleged

widespread regional damage to wetlands and lakes in the Northern Tampa Bay area (NTB) due to large-scale withdrawals totaling 160 mgd from a number of very large municipal wellfields in northern Hillsborough and Pasco counties. The imposition of drawdown criteria had long been anticipated based on predictive modeling and, as a result, the SWFWMD had over time required environmental monitoring of wellfields. The SWFWMD's detailed analysis of the wetland monitoring data resulted in the establishment a decade ago of a drawdown limit for isolated cypress swamps in the NTB. The criterion developed is statistically defined based on a historical record of water levels from 36 cypress wetlands in the NTB. All wetlands were assessed for an array of ecological indicators and then scored as being hydrologically stressed or unstressed. The criterion defines an allowable drawdown from the average of the median water level in the unstressed group of wetlands. Background studies by the SWFWMD showed that healthy, unstressed cypress swamps had median water levels (known as "P50") that ranged from 0.7 to 1.8 ft below the normal pool, which is the seasonal high water elevation expected on an average annual basis. The average P50 for this group was approximately 1.0 ft below the normal pool. The SWFWMD's work also demonstrated that the likelihood of a cypress swamp being categorized as stressed was high if the median water level was 1.8 ft or greater below the normal pool. In practice, this implies that a reduction of less than 0.8 ft from the average P50 for the unstressed sites will avoid the occurrence of stress and therefore of harm. The SWFWMD then established the drawdown limit for isolated cypress swamps as 1.8 ft below the normal pool.

While initially developed for isolated cypress swamps, this drawdown limit has been widely used by the SWFWMD as a screening criterion for the likelihood of adverse impacts of a projected decline in SAS levels due to a groundwater withdrawal. This is a conservative approach from a resource protection standpoint, since isolated wetlands are typically more sensitive to water table drawdown than interconnected wetland systems such as those at or near the Levy site.

The research, subsequent investigations and monitoring described above also led the SWFWMD to develop the Wetland Assessment Procedure (WAP) described in the WAP Instruction Manual for Isolated Wetlands (SWFWMD & Tampa Bay Water (TBW), March 2005). PEF305, Appendix A, at pp. 32 to 65. The ecological and hydrologic monitoring protocols in the WAP provide a robust and structured means to detect hydrologic effects of groundwater use and the impacts of hydrologic alterations on wetlands. The objective of the WAP is to collect information on vegetation, hydrology,

soils, and other pertinent variables in monitored wetlands to accurately characterize the ongoing biological condition and health of each wetland. This information can then be used for a variety of water management purposes, including wellfield management considerations, development of impact avoidance strategies, and the assessment of recovery in areas that have experienced historic hydrologic and biologic impacts due to groundwater withdrawals.

Q.22. What drawdown threshold does the SWFWMD typically apply to determine the likelihood for harm to wetlands?

A.22. In practice, water use permit reviews by the SWFWMD staff typically apply a 0.5 ft drawdown as the threshold for concern regarding the likelihood for harm to unimpacted wetlands, that is wetlands not displaying signs of ecological stress due to artificially reduced hydrologic regime (reductions in depth, or duration, or seasonality of inundation), whether they are isolated or interconnected. Projected SAS drawdown greater than 0.5 ft on unimpacted systems warrant more detailed analysis to determine whether harm is likely to occur over time. The SWFWMD's approach also presumes that a water table reduction of less than 0.5 ft will not cause adverse impacts or harm to unimpacted wetlands.

The question as to what level of SAS drawdown due to groundwater withdrawals will cause adverse impacts to wetlands and aquatic ecosystems is still being intensively studied by the SWFWMD in conjunction with the SJRWMD, the SFWMD, and the Florida Department of Environmental Protection (FDEP) in a regional water supply management initiative known as the Central Florida Water Initiative (CFWI). On behalf of the SJRWMD, I am a member of one of the CFWI's technical teams, the environmental measures team (EMT), whose task is to develop SAS drawdown limits for wetlands and aquatic ecosystems. The thresholds will be used for regional water supply planning and eventually for environmental review in the water use permitting process. The EMT has evaluated over 400 wetlands and lakes for indicators of hydrologic stress that could possibly be due to groundwater use. The EMT's work of late has focused on a subset of 33 wetlands and lakes for which there is more than six years of water level records, with most of the sites having more than 12 years of records. All sites were also assessed for the degree of hydrologic stress and rated as either stressed or unstressed. The hydrograph, or time series of water levels, for each site were compared using cumulative frequency distributions, which give the percentage of time a given water level occurs. The EMT's results to date suggest that for wetlands and lakes, including the

types of wetlands on the LNP site and South Property, the probability of being stressed and likely exhibiting unacceptable adverse impacts is:

- low if the historic median water level (P50) is lowered by 0.5 ft or less,
- low to moderate if the median is lowered by 0.5 to 1.5 ft, and
- high if the median is lowered by greater than 1.5 ft.

In summary, the 0.5 ft drawdown level is a widely applied screening tool, establishing a threshold at which a proposed groundwater withdrawal may cause harm to wetlands and aquatic ecosystems. A drawdown greater than 0.5 ft will not necessarily result in adverse impacts. Instead, the potential for a drawdown greater than 0.5 ft indicates that closer scrutiny of the proposed groundwater withdrawal is warranted and that additional actions may be necessary in order for the proposed groundwater withdrawal to avoid causing harm. Actions normally employed in this situation by the SWFWMD, other Florida water management districts, and similar regulatory bodies, include monitoring of the actual impact of groundwater withdrawal and implementation of mitigation measures, if unacceptable adverse impacts are found to be occurring.

Q.23. Given the research you discuss about drawdown levels, are you concerned about operation of the LNP wellfield if the drawdown is as modeled?

A.23. First, for Model 1, the predicted drawdown is below any threshold of concern. Second, no, I am not concerned about the SAS and UFA drawdown contours predicted by Model 2. It is my professional opinion that the COC ensure that active dewatering due to operation of the LNP will not cause impacts that are greater than SMALL to wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and the South Property. Specifically, as I will describe in more detail later in my testimony, the COC impose the following conditions regarding site specific testing, monitoring, and the development if necessary of alternative water supplies, to which PEF has committed:

1. Implementation of an APT Plan that includes site-specific groundwater hydraulic testing to determine if the wellfield can meet the LNP's operational needs and not cause unacceptable adverse impacts to wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and the South Property.
2. Implementation of an EMP that will monitor both hydrological and ecological conditions in wetlands on the LNP site and the South Property and at background study locations.

3. Implementation of an alternative water supply (AWS) plan to identify feasible AWS projects to offset or replace groundwater use from the LNP's raw water wellfield, in the event monitoring were to indicate that unacceptable adverse impacts are likely to occur in the future.

Collectively, these three conditions ensure that no greater than SMALL impacts on wetlands and aquatic ecosystems and their underlying aquifers will ever occur. If unacceptable adverse impacts on wetlands and aquatic ecosystems and their underlying aquifers are predicted to occur in the future based on knowledge gained through the wellfield APT, revised groundwater modeling, or the EMP, then PEF is required under the COC to prevent and/or mitigate such impacts, or implement an approved AWS project. With the resource monitoring conditions of the APT Plan and the EMP in place, PEF will be able to determine if actual drawdown will exceed thresholds for adverse impacts well before any irreversible changes could occur to the wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and South Property.

It is well-documented from studies in Florida and elsewhere that the hydrologic effect of water table drawdown is detectable long before changes are induced in the structure and composition of ecological systems. The UFA, the SAS, and the water table regime within wetlands will quickly equilibrate to the proposed groundwater withdrawal. Experience has shown that the response of wetlands and aquatic ecosystems and their underlying aquifers to hydrologic changes, such as those induced by groundwater pumping, is a function of both the magnitude and the duration of the change. Even if the magnitude of the drawdown is sufficient to induce long-term unacceptable changes, those changes typically take five to ten or more years to manifest. The timetable of change must also be considered in light of the natural adaptation of wetlands and aquatic ecosystems and their underlying aquifers to short- and long-term climatic cycles of drought. PEF will thus be able to detect the potential impacts to any such resources well before any unacceptable harm results. The state-required monitoring, therefore, provides a multi-component early warning system.

Q.24. Are you concerned regarding the impacts to wetlands or aquatic ecosystems or their underlying aquifers from active dewatering during dry or drought periods?

A.24. No, the wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and South Property are adapted to drought conditions. These

systems are organized around hydrologic conditions that maintain the community's structure and composition, responding to the array of flooding and dewatering events that occur naturally through the interplay of the system's water budget, such as rainfall (both high and low), surface inflow and outflow, and seepage inflow and outflow. By way of example, cypress swamps need periodic high flood conditions of sufficient duration to prevent upland species from moving downslope and invading the swamp. Likewise, periodic low water levels are required to allow for seed germination and growth of seedlings.

The hydrologic regime in wetlands and aquatic ecosystems on the LNP site and the South Property, and in the region, is primarily driven by rainfall patterns, which vary seasonally. The wet season is characterized by rainfall amounts in excess of evapotranspiration (ET) (the combined effect of evaporation of water from a water surface or soil and transpiration, which is water loss through the leaves of plants), while the opposite is the case for the dry season. Overlaying this annual wet/dry cycle are moderate and long-term climatic cycles of wetter and drier than average conditions. The shorter of the two climatic rainfall cycles is the well-known El Nino/La Nina southern oscillation. This cycle typically operates over 5 to 10 years. With respect to long-term climatic cycles, the Atlantic multi-decadal oscillation (AMO) has received a great deal of focus over the last 10 years, and its effect on the surface water drainage network in north and central Florida has been documented by the SWFWMD. PEF310. The AMO is characterized as an approximately 60-year cycle with alternate 30-year periods of below-normal rainfall and above-normal rainfall. The pivot point of the last 60-year AMO cycle in north and central Florida was 1970, with the previous 30 years, 1940 to 1970, being wetter than normal, followed by a drier than normal period for 1971 to 2000. Table IV in PEF310 summarizes the differences in rainfall during the two periods of the last AMO for a large number of stations, including two nearby the LNP site. For the two stations, Ocala and Brooksville, the rainfall difference between the respective 30-year wet and dry cycles is approximately 200 inches, or about 7 inches per year. PEF310, at p. 613. Relatively large decreases and increases in river flows, including the Withlacoochee River and adjacent river basins of north Florida, over the AMO were found to be attributable to significant rainfall differences between the multi-decadal periods. Id. Since the hydrology of the wetlands and aquatic ecosystems on the LNP site and the South Property, as well as the surrounding areas, is largely controlled by rainfall, then these systems also are clearly adapted to the widely-varying, multi-decadal rainfall cycles

of the AMO. Thus, the wetlands and aquatic ecosystems on and around the LNP site and South Property are robustly adapted to highly-variable rainfall patterns.

Q.25. Do the models indicate any relevant impact to waters other than the UFA, SAS and wetlands in the vicinity of the LNP site?

A.25. No, the models do not indicate any relevant impact to waters other than the UFA, SAS and wetlands in the vicinity of the LNP site. More specifically, the groundwater modeling does not indicate that active dewatering either during construction or operation of the LNP will have any more than a de minimis impact on other water bodies, such as Lake Rousseau, the Withlacoochee River, the CFBC, the coastal marshes and waters, and the Gulf of Mexico.

Contention 4A, Part A challenges the FEIS's analysis of impacts, onsite and offsite, associated with active dewatering at the LNP to the following: "wetlands, floodplains, special aquatic sites and other waters;" the "Floridan aquifer system;" and "Outstanding Florida Waters such as the Withlacoochee and Waccasassa Rivers." It is my understanding that the FEIS need only analyze those waters where impacts from the LNP are reasonably foreseeable. As described in the testimony of Dr. Griffin, there are no "special aquatic sites" at issue for the LNP site and the South Property. PEF001, at p. 6. The effects of operating the raw water wellfield on the surface water system and the groundwater system are described in detail in Section 5.2 in the FEIS. NRC001, at pp. 5-3 to 5-18. As I discussed earlier in my testimony, water budget simulations show that the magnitude of change due to active and passive dewatering during operation and construction of the LNP are relatively small compared to the flux of water moving through the UFA in the 400 square miles surrounding the LNP wells. This logically leads to the conclusion that the project's zone of environmental impacts is SMALL. This determination is further supported by the very small changes in flow to Lake Rousseau and the Withlacoochee River and from Big King and Little King Springs identified through the groundwater modeling.

Dr. Griffin's testimony describes that the only OFW in the vicinity of the LNP site is the lower Withlacoochee River, from the Gulf of Mexico to the Inglis Lock Bypass Channel (but not including that isolated segment of the river between Lake Rousseau and the CFBC). PEF001, at pp. 7 to 8. Groundwater flow at the LNP site and the South Property is to the west-southwest. Although the Waccasassa River is also an OFW, it is located 13 miles northwest of the wellfield and is cross-gradient to the LNP site and the South Property; therefore, I conclude that the Waccasassa River could not be impacted by

active dewatering for the LNP. In contrast, the lower Withlacoochee River is downgradient of the LNP site and the South Property and potentially could be impacted by dewatering. However, under both groundwater models, the impact of dewatering on the groundwater flow to the lower Withlacoochee is SMALL compared to the large surface water flow to the lower Withlacoochee through the Bypass Channel. The 37-year recorded average daily discharge to the lower Withlacoochee is 687 mgd. The simulated reductions of groundwater flow to the lower Withlacoochee River and Lake Rousseau of 1.1 mgd under Model 1 (PEF212, at p. 7) or 0.4 mgd under Model 2 (NRC001, Section 5.3.2.1, at p. 5-58) are insignificant in comparison. Therefore, it is my professional opinion that the direct, indirect, and cumulative impacts of active dewatering on OFW are SMALL. I agree with the NRC Staff's determination that active dewatering for LNP operations will not alter the surface water hydrology of the Withlacoochee River or the Waccasassa River. NRC001, Section 5.2.1, at p. 5-4.

IV. LNP PERMITS

Q.26. What permits have been issued to the LNP regarding water use and impacts to wetlands?

A.26. The Florida Siting Board has authorized the LNP's proposed groundwater withdrawal. Pursuant to the PPSA (PEF303), large electrical power plants submit a Site Certification Application and are certified by the Florida Siting Board (the Governor and Cabinet) (or the FDEP in uncontested cases where no hearing is required to be held). The certification serves as a single license for the power plant, replacing all of the state, regional and local permits otherwise necessary. The substantive requirements of the state, regional and local permitting authorities, including SWFWMD, are embodied in the final certification and accompanying conditions of certification . The LNP project was issued its final certification by the Siting Board on August 26, 2009. PEF005, at p. 96. The certification and the COC have been modified several times, most recently on January 25, 2011. Id. Therefore, for the LNP, the SWFWMD's typical water use permit (WUP) is in the form of a water use authorization under the conditions of certification that are found in Section C.II. of the COC. Additionally, PEF is seeking from the USACE a federal Clean Water Act Section 404 permit, which regulates the discharge of dredged or fill material into wetlands or other waters of the United States. As part of this permitting process, the USACE is also evaluating PEF's proposed groundwater withdrawal and its impact on wetlands. NRC001, Section 5.3.1.4, at p. 5-45.

Q.27. Please describe the pertinent features of the SWFWMD's environmental review in the water use permitting process.

A.27. The SWFWMD follows a very robust environmental review process before issuing a WUP, or in the case of the LNP a recommendation in favor of certification of an electrical power plant project that is subject to the PPSA. The SWFWMD's environmental review follows a three-prong test set forth in Section 373.223 of the Florida Statues (FS) (PEF311), which requires that, in order to obtain a WUP, the applicant must demonstrate that the water use: 1) is reasonable and beneficial; 2) is consistent with the public interest; and 3) will not interfere with existing legal users. Rule Chapter 40D-2 of the Florida Administrative Code (F.A.C.) contains the SWFWMD's regulations for the consumptive use of water. PEF312. Rule 40D-2.301, the Conditions for Issuance of Permits, requires that the applicant demonstrate satisfaction of this three-prong test by providing reasonable assurances, on both an individual and a cumulative basis, that the proposed water use:

(a) Is necessary to fulfill a certain reasonable demand.

(b) Will not cause quantity or quality changes that adversely impact the water resources, including both surface water and groundwater.

(c) Will comply with the provisions of 4.2 of the WUP Basis of Review, incorporated by reference in Rule 40D-2.091, F.A.C., regarding adverse impacts to wetlands, lakes, streams, estuaries, fish and wildlife or other natural resources.

(d) Will not interfere with a reservation of water as set forth in Rule 40D-2.302, F.A.C.

(e) Will comply with the provisions of 4.3 of the WUP Basis of Review, incorporated by reference in Rule 40D-2.091, F.A.C., regarding environmental thresholds for withdrawals from aquifers and surface water bodies.

(f) Will utilize the lowest quality water the applicant has the ability to use, provided that its use does not interfere with the recovery of a water body to any established environmental thresholds for withdrawals and it is not a source that is either currently or projected to be adversely impacted.

(g) Will comply with the provisions of 4.5 of the WUP Basis of Review, incorporated by reference in Rule 40D-2.091, F.A.C., regarding saline water intrusion.

(h) Will not cause pollution of the aquifer.

(i) Will not adversely impact offsite land uses existing at the time of the application.

(j) Will not adversely impact an existing legal withdrawal.

(k) Will incorporate water conservation measures.

(l) Will incorporate use of AWSs to the greatest extent practicable.

(m) Will not cause water to go to waste.

(n) Will not otherwise be harmful to the water resources within the District.

Q.28. How does the SWFWMD determine that the conditions for issuance of a WUP have been met?

A.28. Section 4 of the SWFWMD Water Use Permit Information Manual, Part B, Basis of Review (BOR), (PEF313, at pp. B4-1 to B4-13), provides detailed guidance for determining whether a water use meets the conditions for issuance of a WUP. BOR Section 4.2 states that a proposed withdrawal of water must not cause unacceptable adverse impacts to environmental features. Environmental review for this determination must consider:

- wetland type (e.g., marsh, cypress swamp),
- available data (site assessments, water levels, modeling, etc.),
- nature of the withdrawal (e.g., continuous vs. intermittent), and
- application and interpretation of modeling results.

Field assessments are to be performed as the basis to characterize existing and historic conditions. Models are to be used to predict hydrologic effects of the proposed water use. Potential impacts are mapped to the landscape, and areas of concern are assessed for the likelihood of unacceptable impacts. The assessment relies on hydrologic indicators, surveys of soils, vegetative communities, and faunal populations as may be present.

Additionally, Section 4.2 sets performance standards by ecosystem type (wetlands, lakes, and streams). The performance standards for wetlands require that:

- wet season water levels shall not deviate from their normal range;
- wetland hydroperiods shall not deviate from their normal range and duration to the extent that wetlands plant species and composition and community zonation are adversely impacted;
- wetland habitat functions, such as providing cover, breeding and feeding areas, for obligate (typically occurring only in wetland habitat) and facultative (occurring in both wetland and upland habitats) wetland animals shall be temporally and spatially maintained, and not adversely impacted as a result of withdrawals; and
- habitat for threatened or endangered species shall not be altered to the extent that utilization by those species is impaired.

In summary, the SWFWMD will not issue a WUP (or, in the case of the LNP, recommend certification under the PPSA) unless a detailed environmental assessment is performed and the relevant performance standards are met.

V. TESTING AND MONITORING PLANS REQUIRED BY THE LNP PERMITS

Q.29. What testing and monitoring plans are required by the COC to prevent harm to the wetlands and aquatic ecosystems and their underlying aquifers?

A.29. Under the COC, PEF is required to implement the following two testing and monitoring plans:

- APT Plan - This includes site-specific groundwater hydraulic testing to determine if the wellfield can meet the LNP's operational needs and not cause unacceptable adverse impacts to wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and the South Property. (PEF005, Section C.II.A.4, at pp. 45 to 46)
- EMP - This will monitor both hydrological and ecological conditions in wetlands on the LNP site and the South Property and at background locations outside of the area that will be influenced by the modeled drawdown. This plan must utilize the SWFWMD's WAP. (PEF005, Section C.II.A.2.a, at pp. 42 to 43).

Q.30. Describe the APT Plan and its purpose.

A.30. CH2M HILL has prepared an APT Plan for PEF as required by the COC. A draft version of the APT Plan, Draft Revision 0, was provided to the USACE, the NRC, and the SWFWMD for review on April 5, 2012. PEF subsequently revised the draft APT Plan in response to comments from the USACE and submitted APT Plan, Revision 0, dated May 29, 2012 (PEF304) to the USACE for its approval, as well as to the NRC and the SWFWMD, on June 4, 2012. The APT Plan has a singular and important purpose, which is to improve the accuracy of the groundwater model's representation of the groundwater flow system. Specifically, the APT Plan will be used to confirm the UFA transmissivity and leakance values used in Model 1, which is the model the SWFWMD relied upon when it recommended approval of the LNP's water use authorization under the COC. Leakance is the ability of water to move vertically from one aquifer to another.. Groundwater models include some uncertainty. Changes in model inputs or parameters will alter results. For example, as discussed earlier, the different values used by PEF for key aquifer parameters in Model 1 versus Model 2 yielded differences in their estimates of the magnitude and extent of UFA and SAS drawdown under long-term, steady-state

conditions. Aquifer parameterization (the process of deciding and defining the parameters necessary for a complete or relevant specification of a groundwater model) is typically done as a statistical regression process that seeks to minimize overall error in the calibration process. The APT is a site-specific exercise to provide direct estimates of several key parameters. It has been my professional experience in evaluating potential environmental impacts of a proposed groundwater use on wetlands and aquatic ecosystems that APT is used to ensure that the model's calibration is based upon site-specific aquifer characteristics when there is limited site data available beforehand. The groundwater flow model is then recalibrated, as needed, based on the site-specific results.

As part of the COC, PEF is required to develop the APT Plan for the LNP raw water wellfield and submit the APT Plan to the SWFWMD at least six months prior to the construction of the first LNP production well to support operations. As stated above, PEF has already provided the APT Plan to the SWFWMD, the USACE and the NRC. PEF has agreed to seek USACE approval of the APT Plan prior to the USACE's issuance of the Section 404 permit for the LNP. PEF304, Section 1.2.3, at p. 10. As described in the FEIS, the USACE intends to include PEF's implementation of the APT Plan as a special condition in the Section 404 permit. NRC001, Section 5.3.1.4, at pp. 5-44 to 5-45.

The APT Plan is intended to address the specific requirements presented in COC Section C.II.A.4. (PEF005, at pp. 45 to 46) The required testing regime includes single-well step-drawdown tests[8] and multi-well constant-rate pumping tests[9]. The COC specify that two production wells should be constructed and that step-drawdown tests must initially be performed on each well. Multi-well constant-rate (72-hour) pumping tests then must be performed on these two wells. Step-drawdown tests must be performed on each of the four production wells after installation. The COC require PEF to conduct the step-drawdown and multi-well constant-rate tests within six months of completion of the production wells or within six months of the SWFWMD's final approval of the APT Plan, whichever is later. In addition, these tests must be completed at least five years

---

[8] A step-drawdown test is a well pumping test performed at four different pumping rates.

[9] A multi-well constant-rate pumping test is a well pumping test performed at a constant rate, with a series of monitoring wells designed to measure the resulting drawdown.

prior to the initial use of the first production well in excess of 100,000 gallons per day (gpd) (annual average) for production purposes. PEF005, Section C.II.4.a, at p. 45.

All four of the proposed LNP production wells will be installed in the same zone of the UFA using the same methods, and are expected to perform similarly assuming the aquifer characteristics are similar at all of the wells. In the APT Plan, PEF has selected production well locations PW-3 and PW-4 for the 72-hour constant-rate aquifer testing, based on modeled aquifer characteristics. The approximate locations are shown on PEF304, Figure 2, and the exact locations will be determined in the field. PEF304, at p. 8. Production well locations PW-3 and PW-4 are expected to be the most representative of the range of UFA characteristics to be encountered onsite, and they are geographically separated, with one well closer to the Withlacoochee River where the SWFWMD has documented higher UFA permeability.

In addition to the production wells, PEF also will install observation wells pursuant to the APT Plan. One such well will monitor the UFA and will be constructed about 250 feet from the pumping well in the upgradient direction. That well will provide distance drawdown data in the UFA necessary to evaluate transmissivity and leakance. In addition, two SAS observation wells will be positioned based on (1) predicted measurable drawdowns of 0.5 to 1.0 ft; and (2) direction of regional groundwater flow gradients. PEF304, at pp. 8, 12 to 13. In addition to these three observation wells, the APT Plan provides that SAS monitoring wells to be located in nearby wetlands pursuant to the EMP will be monitored by PEF before, during, and after the pumping test to determine if any drawdown can be measured in the SAS related to the pumping test. PEF304, at pp. 8 and 13 and Figure 2 at p. 7.

If, based on the results of this testing and monitoring, PEF finds that transmissivity or leakance values differ significantly from the values used in the groundwater flow model submitted to support PEF's water use authorization request under the PPSA (Model 1), PEF must revise Model 1 to reflect these site-specific values. The COC define "significantly different transmissivity or leakance values" to mean any well having either a transmissivity or leakance value twenty percent higher or lower than those included in Model 1. The revised model must incorporate the new wellfield-specific data, and other modeling parameters may require revisions to reasonably represent aquifer conditions. The revised model must also reflect a groundwater impact analysis including cumulative and incremental analyses to evaluate the pumping effects on other water users, and other analyses to confirm that the withdrawal meets the

SWFWMD's conditions for issuance of WUPs. If this additional modeling is required, then PEF must submit the modeling results, and a full report that meets the SWFWMD's modeling guidelines, to the SWFWMD within 180 days of completion of the APT. The outcome of the APT provides a higher degree of confidence in the parameterization of the flow environment in the UFA, and thus the accuracy of the modeled prediction of drawdown in the UFA and SAS. This is of immense benefit for the environmental review, and the projection of likely and possible impacts of operating the LNP raw water wellfield. Conducting the APT will ensure that aquifer parameters used in the model best reflect site-specific conditions, giving greater confidence to PEF's prediction of likely impacts of wellfield operation on wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and South Property.

Q.31. Describe the EMP and its purpose.

A.31. CH2M HILL has prepared an EMP for PEF as required by the COC. A draft version of the EMP, Draft Revision 0, was provided to the USACE, the NRC, and SWFWMD for review on April 5, 2012. PEF subsequently revised the draft EMP in response to comments from the USACE and, on June 4, 2012, submitted EMP, Revision 0, dated May 29, 2012 (PEF305) to the USACE for its approval, as well as to the SWFWMD and the NRC. The EMP's purpose is to provide a framework for monitoring the hydrology and ecology in the vicinity of the LNP site that could potentially be affected by operation of the LNP raw water wellfield. The EMP is a critical component of the overall strategy of preventing harm to the wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and the South Property.

Pursuant to the COC, PEF must submit the EMP to the SWFWMD no less than three years prior to any production well use in excess of 100,000 gpd (annual average) for production purposes. PEF must implement the approved EMP a minimum of one year prior to initial use of the first production well in excess of 100,000 gpd (annual average) for production purposes. PEF005, Section II.C.A.2.a.i, at p. 42. However, as stated above, PEF has already provided the EMP to the SWFWMD, the NRC, and the USACE. The USACE has made issuance of LNP's Section 404 permit contingent upon the USACE's approval of the EMP. In the EMP, PEF anticipates a special condition in its Section 404 permit requiring continuous monitoring of the impacts, if any, of groundwater withdrawal on wetlands. PEF305, at p. 6.

The EMP was developed using the SWFWMD's very detailed guidance document— the WAP Instruction Manual for Isolated Wetlands (PEF305, Appendix A,

at pp. 32 to 65)[10]. The WAP was developed by the SWFWMD and TBW for the specific objective of evaluating the potential for adverse impacts and/or harm to wetlands from groundwater withdrawals. The monitoring and data collection will be used by PEF to answer the following questions:

- What are the baseline ranges of wetland hydroperiods for systems potentially affected by wellfield operation?
- Is wellfield pumping affecting wetland water levels or hydroperiods?
- Are shifts in vegetation type occurring and are these changes due to observed changes in hydroperiod stage and duration?
- Has there been any evidence of subsidence (sinking of levels) in wetlands attributable to operation of the LNP's raw water wellfield?
- Is the LNP's wellfield pumping adversely impacting wetlands?

PEF305, at p. 11. The EMP makes these questions testable hypotheses, and the monitoring activities will provide the data by which the questions can be answered.

Transect-based field sampling will be used with seven near-field, two far-field, and a minimum of three background transects. PEF305, Figures 2 and 3, at pp. 13 and 14. Transects are wetland monitoring zones established from the historic wetland edge to the deepest point in the wetland interior. The near-field transects will be located within 2,000 feet of the production wells, where the groundwater modeling indicates the potential for highest groundwater drawdown. The far-field transects will be located within 2,000 to 5,000 feet of the production wells, representing areas of moderate modeled groundwater drawdown. Last, the background transects will be located outside of the area that will be influenced by the modeled drawdown. The final location of each monitoring transect proposed by PEF will be approved by the SWFWMD and the USACE before the start of baseline monitoring. PEF305, at p. 12.

Data monitoring parameters and collection and reporting frequencies are specified in Table 1 of the EMP. PEF305, at p. 24. The parameters cover hydrological monitoring and wetland ecological monitoring. Hydrological monitoring will utilize SAS

---

[10] For purposes of the WAP, the SWFWMD defines "isolated" as a system having "no significant and regular channelized inflow." PEF305, at p. 60. This is different than the definition of "isolated wetlands" used by the USACE in jurisdictional determinations. Most wetlands on the LNP site and South Property lack significant and regular channelized inflow; therefore, the WAP is an appropriate guidance document.

monitoring wells, shallow wetland piezometers and staff gauges, and rainfall and pumpage data. PEF305, Section 3.3, at pp. 15 to 18. The wetland monitoring will include a historical assessment, wetland vegetation community data, soils assessments, and observation of wildlife. PEF305, Section 3.4, at pp. 18 to 23.

PEF must submit an annual monitoring report to the SWFWMD and the USACE by January 1st of each year for the preceding water year (October 1 to September 30) following implementation of the EMP. PEF005, Section C.II.A.2.a.v, at p. 43, and PEF305, Section 5.2.3, at p. 29. The COC authorize PEF to request a release from the requirements of the EMP after five years of monitoring following groundwater use rising to more than 1.25 mgd (annual average daily withdrawal quantity) from all the production wells. PEF005, Section C.II.A.2.a.i, at p. 42. Any change to the EMP must be approved by the SWFWMD and the USACE

Section 4 of the EMP, "Adaptive Management," provides a clearly defined, stepwise process by which the monitoring and data collection efforts are linked to the implementation of management strategies to prevent wetland functional losses, if any, resulting from groundwater withdrawals. PEF305, at pp. 25 to 27. Adaptive management (AM) is a type of resource management process used in the fields of ecological and natural resource management. (The application of an AM approach as an impact avoidance and minimization strategy to limit adverse impacts to wetlands and aquatic ecosystems on and in the vicinity of the LNP site and South Property is addressed in more detail in Section VIII of my testimony.) These AM strategies in the EMP would precede a transition to an AWS, if required. The stepwise process of implementing these AM strategies is presented in the decision flowchart included as Figure 5 in PEF305 at p. 27 and is described as follows:

1. The first level of evaluation is quarterly comparison of the wetlands' baseline established normal pool to the p50 for the operational period data set from each wetland piezometer. Decreases in the p50 greater than an established management threshold will initiate an increase in the frequency of data investigations. The hydrologic data will then be compared to background monitoring data sets along with rainfall and wellfield pumpage data to determine if the decreases in the P50 are atypical for the current climatic condition. If the condition persists and the decrease is not attributed to climatic conditions, a management action will be triggered, based on the magnitude of the decrease. The magnitude of the p50 decrease will be compared to management threshold

values established for wetland water levels during the pre-construction (baseline) period.

2. In addition to the routine quarterly hydrologic data evaluations, semi-annual comparison of the baseline plot Wetland Affinity Index (WAI) scores to the operational period WAI scores will be conducted. Statistically significant changes in WAI scores that are not also observed in background monitoring datasets will initiate an evaluation of hydrologic data associated with the transects where the changes in WAI values are detected. AM strategies, as shown in the decision matrix in Figure 5 (PEF305 at p. 27), will then be implemented.

3. The initial management threshold will be established at a level designed to provide an indication of hydrologic changes before ecological harm takes place. At this initial management threshold, monthly monitoring of hydrologic data will continue and monthly data evaluations will be implemented. If the condition persists and is not associated with regional climatic conditions, then monthly data evaluations will continue for a specified period; one additional month during the wet season (May – September) and two additional months during the dry season (October – April). If the p50 rises above the initial threshold during this evaluation period, then normal monitoring and quarterly data evaluations will resume. If the condition persists beyond the specified evaluation period, then a management strategy is triggered.

4. The secondary threshold will be established at a water level within the measured range of water levels for that wetland, and between the initial and tertiary threshold levels. If this level of decrease in the p50 is reached and that decrease is not associated with climatic conditions, a management strategy is immediately implemented. The management strategy will continue to be implemented as long as the p50 value remains below the initial threshold and is above the tertiary threshold described below. If the p50 value rises or falls to exceed other thresholds, then data evaluation and/or a management strategy associated with that threshold will be implemented.

5. The third or tertiary threshold will be established at a water level below which

further harm is expected to occur to wetlands, if the trend is allowed to continue long term. If this threshold is reached, then groundwater pumping in the vicinity of the affected piezometer(s) will be suspended and the transition to an AWS will be initiated.

6. The WAP methodology will be employed to evaluate the wetland transects for evidence of harm. Vegetative species composition and indicators of vegetation stress will be assessed.

The AM component of the EMP also outlines the contingent actions that PEF will consider, if adverse impacts to wetlands due to operation of the wellfield are predicted to occur:

> If water levels fall below any of the thresholds as a result of LNP groundwater withdrawals, based on the evaluations above, PEF will notify the SWFWMD and the USACE, initiate a data review, and implement intervention measures. The general sequence of water level management strategies is as follows:
>
> 1. Reduce groundwater withdrawals or modify pumpage rotation between the production wells.
>
> 2. Evaluate the feasibility of using reuse water to reduce groundwater withdrawals.
>
> 3. Manage water use in the facility to improve efficiency.
>
> 4. Revise the wellfield layout.
>
> 5. Deepen production wells to withdraw from deeper intervals of the aquifer to moderate SAS drawdown, if suitable water quality is found.
>
> 6. Transition to AWS strategies.

PEF305, at p. 26.

It is my professional opinion that the monitoring approach proposed in the EMP is based on accepted protocols that conform to decades of wetland studies and regulatory program development. The lead State agencies that have developed the science and

wetland monitoring criteria are the water management districts. The SWFWMD has studied the impact of groundwater withdrawals on wetlands and lakes and developed the WAP process. The proposed EMP conforms with or exceeds the WAP and accepted management strategies. Since there are no historical quantitative data available for the targeted wetlands, the use of site-specific and reference site data to assess potential changes in land elevations, SAS levels, wetland hydroperiods, and vegetation is the suggested approach. This represents a practicable and cost-effective approach that will best support actionable decision making if adverse impacts occur or are predicted to occur. Use of site data and SWFWMD tools for predicting potential impacts of groundwater withdrawals on wetlands is an accepted protocol for the interpretation of monitoring results. The study design provides for the comparison of monitored wetlands during baseline and operational periods, and further provides for comparisons between near-field and background wetlands. This program will allow the detection of changes to wetlands beyond natural fluctuations.

Q.32. Will the EMP measures be timely to detect and prevent harm to wetlands?

A.32. Yes. Change in the hydrologic regime of a wetland that is of a magnitude sufficient to induce long-term harm will be detectable well before the wetland exhibits the indicators of harm, or is subject to loss of structures, species or functions. First, it is well documented in north and central Florida that the SAS and the UFA respond quite rapidly to a change in conditions in their hydrologic budget, such as a change due to groundwater pumping. This is particularly true in landscape settings such as the LNP site because the UFA is unconfined, and thus in direct hydraulic connection with the water table and SAS. PEF's groundwater analysis has shown the close hydraulic connection between the water table, the SAS and the UFA.

Next, it also well-documented in north and central Florida that the plant and animal communities and physical components such as soils of the wetlands respond slowly to change in hydrologic conditions. Detailed studies by the SWFWMD and the SJRWMD show that these types of responses typically take at least five to ten years, and often longer, to manifest.

The magnitude of hydrologic change must be sufficiently large, persistent and of sufficiently long duration in order for it to alter critical features of the wetlands. The lag time in ecosystem response is in part due to the natural adaptive response of wetlands to seasonal and longer cycles of rainfall. The wetland communities on and in the vicinity of the LNP site are adapted to all of these rainfall cycles—the annual wet season and dry

season, the multi-year cycle of El Nino and La Nina, and the multi-decadal cycles such as the roughly 60 year-cycle for the AMO. Wetlands and aquatic ecosystems in general, and those specifically found on the LNP site and South Property, are adapted to and are maintained by a range of high-water inundation events, moderate levels and low-water drought driven events.

VI. LNP MONITORING AND TESTING PLANS AND CONTINGENT MITIGATION MEASURES AND ALTERNATIVE WATER SUPPLY PLAN

Q.33. If monitoring or testing plans reveal that an unacceptable adverse impact would occur, what actions must PEF take?

A.33. If unacceptable adverse impacts are detected or predicted to occur through the EMP, as specified in COC Section II.C.A.2, or the APT Plan (including additional groundwater modeling), as specified in COC Section II.C.A.4, PEF must either mitigate the adverse impact or implement an AWS as required by COC Section II.C.A.3. PEF005, at pp. 43 to 44.

Q.34. How would an AWS be identified and implemented?

A.34. Section II.C.A.3 of the COC establishes PEF's obligation to identify and provide a design for a contingent AWS to offset all or a part of the groundwater use authorized by the SWFWMD. PEF005, at pp. 43 to 44. The COC define an AWS to include use of seawater desalination, brackish surface or groundwater, water that has been reclaimed after one or more uses, stormwater, and any other water supply source designated as non-traditional. If it is determined that the magnitude of actual water table drawdown would exceed environmental thresholds to a point that unacceptable adverse impacts on wetlands and aquatic ecosystems on or in the vicinity of the LNP site and the South Property would likely occur, then PEF must either mitigate the impact or implement the AWS. With the resource monitoring conditions of the APT Plan and EMP in place, PEF will be able to determine if actual drawdown will exceed environmental thresholds for unacceptable adverse impacts well before any irreversible changes occur to the wetlands and aquatic ecosystems on and in the vicinity of the LNP site and South Property.

COC Sections II.C.A.3.a to II.C.A.3.f also set out the activities and timetable for PEF's selection and implementation of the AWS:

a. Within three years of completion of aquifer testing (under the APT Plan), PEF must submit an AWS Plan for the SWFWMD's review and approval.

b. Within four years of completion of aquifer testing and additional groundwater

modeling under the APT Plan, PEF must submit to the SWFWMD a preliminary design of the AWS project that it intends to implement.

c. Within three years of groundwater use rising to more than 1.25 mgd (average annual daily withdrawal quantity) from all the production wells, PEF must provide the SWFWMD an analysis of environmental conditions as specified in Condition A.4.a. (the APT Plan), unless an extension of time or a waiver has been granted by the SWFWMD.

d. Within four years of completion of aquifer testing under the APT Plan, PEF must submit to FDEP and the SWFWMD an application for authorization to develop and use up to 1.58 mgd of AWS for the LNP, unless an extension of time or waiver has been granted by the SWFWMD.

e. Within four years of completion of the aquifer testing under the APT Plan, PEF must submit to the SWFWMD an AWS implementation schedule detailing when construction will begin and end, and the date when water will be delivered from the project for PEF's use.

f. PEF must comply with the AWS implementation schedule unless it is extended or otherwise modified in writing by the SWFWMD, and provide an annual report to the SWFWMD by March 1st of each year describing the progress made on the AWS implementation schedule.

As discussed in the FEIS, PEF has performed an analysis of the AWS sources that demonstrates that an AWS would be technically feasible, if it were necessary to rely on such an alternative because the APT Plan or EMP reveal "significant drawdown impacts" on wetlands caused by groundwater withdrawal. NRC001, Section 5.3.1.1, at pp. 5-30 to 5-31. Alternate sources would include contributions from seawater desalination by reverse osmosis, stormwater, reclaimed municipal wastewater, municipal water supply, recycling of process water, and brackish water from deep underground wells. Id.

Q.35. What is your conclusion regarding the impact of the testing, monitoring, and mitigation requirements of the COC?

A.35. I agree with the FEIS's assessment that the testing, monitoring, and mitigation requirements of the COC, specifically the APT Plan, the EMP, and the potential implementation of an AWS, ensure that active dewatering during operation of the LNP will not have greater than SMALL impacts on wetlands, or on aquatic ecosystems or their underlying aquifers, no matter what the groundwater modeling results are. NRC001,

Section 9.4.3, at p. 9-250. The NRC Staff concluded, and I concur, that additional mitigation measures beyond those in the COC are not warranted. NRC001, Section 5.3.1.6, at p. 5-47.

VII. THE LNP PERMIT APPROACH TO ACTIVE DEWATERING AND THE ECOLOGICAL AND NATURAL RESOURCE MANAGEMENT PRACTICE OF ADAPTIVE MANAGEMENT

Q.36. What is the chief source of uncertainty identified in the FEIS relating to the impacts of active dewatering?

A.36. Uncertainty is ever present when we try to predict the future through modeling, as is the case when we estimate the impacts of proposed UFA withdrawals on and in the vicinity of the LNP site. The difference in water table drawdown predicted by Models 1 and 2 is one indication of a range of uncertainty.

Q.37. How has uncertainty been handled?

A.37. The COC require testing, monitoring and potential mitigation that will address uncertainties inherent in the modeling of proposed groundwater withdrawals for active dewatering for construction and operation of the LNP and the resulting impacts on wetlands and aquatic ecosystems and their underlying aquifers.

In the FEIS, the NRC Staff explains that while the NRC utilized the results of the recalibrated model, Model 2, in assessing potential groundwater use impacts, the model's results were not the sole basis of the evaluation in the FEIS. NRC001, Section 2.3.1.2, at pp. 2-29 to 2-30. The Staff determined that the groundwater model alone was not sufficient to support a definitive assessment of the impacts on the wetlands for purposes of the FEIS. The Staff found that this determination was consistent with the SWFWMD's groundwater use permitting process in which groundwater models can be used as a scoping-level assessment tool, and SWFWMD can use mandated environmental testing, monitoring and mitigation plans to ensure that no adverse impacts to wetlands occur. The FEIS also notes that the USACE is relying on PEF's groundwater testing and monitoring plans (the APT Plan and EMP) for issuance of the Section 404 permit. NRC001, Section 2.3.1.2, at p. 2-30.

Thus, both the SWFWMD and the NRC in the FEIS properly rely on the COC to ensure that no greater than SMALL impacts to wetlands and aquatic ecosystems will occur. The environmental reviews of the water resource permitting agencies follow a similar process to:

1. Understand, describe and quantify the sources of uncertainty affecting a resource management decision, in this case groundwater use.
2. Develop a management plan to be implemented with specific requirements and conditions including monitoring of conditions and response of the water resource and ecosystems to monitor for actual impacts.
3. Collect monitoring data.
4. Evaluate responses of systems being tracked.
5. Assess whether management goals and performance measures are being met. If not, then revise relevant portions of the management plan.
6. Implement changes to management plan as needed.

In this light, the outcome of the respective environmental reviews of the permitting agencies is a rigorous goal-seeking, self-corrective, adaptive process to preclude occurrence of greater than SMALL impacts. In the FEIS, the NRC subscribes to this approach.

Q.38. How does this AM process conform to regulatory requirements and standards of practice in environmental and water resources management?

A.38. In my professional opinion, the LNP-specific adaptive management strategies conform to regulatory requirements and best practices and the results ensure that environmental impacts are minimized. The field of AM has been developed over the last several decades specifically to deal with the effects of uncertainty in making and implementing resource management decisions, such as the management of water resources on and in the vicinity of the LNP site under the conditions proposed by PEF. The basic tenets of AM are:

1. All resource management decisions and resource management plans have elements of uncertainty, yet management decisions must be made.
2. Decisions should be made based on the best science, knowledge and information available, but clearly identifying sources of uncertainty and accounting for their range of impact on predicted outcomes
3. Uncertainty can be characterized, its effects can be described, and it can be managed, thus allowing prudent water resource decisions using the best available information.
4. Monitoring of the condition of the resource of concern and its response to change is necessary in order to make better-informed future management decisions.

AM framework has become embedded in large ecosystem management and

restoration programs for the Florida Everglades, Colorado River, California Bay-Delta program, Delaware River estuarine fisheries, and many other water resource management programs across North America. The framework for AM is a goal-seeking, six-step adaptive feedback process: 1) assess the problem; 2) design a solution; 3) implement the solution's management plan; 4) monitor the resources of concern; 5) evaluate resource health/condition, and develop resource management adjustments as needed; and 6) implement adjustments to the management plan. This AM process is essentially the same as the environmental review and permitting process followed by the SWFWMD for the water use authorization in the COC and apparently being followed by the USACE for issuance of the Section 404 permit. Thus, these permitting reviews for the LNP follow the strong foundation of AM, which is well documented in ecological and natural resource management practice and its supporting literature.

For the LNP project, the congruence between the environmental permitting process and the classic AM approach provides a framework for prudent use of water resources onsite in ways that will not have unacceptable adverse impacts on the wetlands and aquatic ecosystems and their underlying aquifers on and in the vicinity of the LNP site and South Property. PEF314 provides a tabular summary of the alignment of a classic AM resource management approach and the PEF's COC requirements relative to groundwater use.

Q.39. In your opinion does the step-wise monitoring of the impacts of active dewatering for operation of the LNP required by the COC, followed by the USACE in conjunction with issuance of the Section 404 permit, and relied upon by the NRC in its evaluation of impacts in the FEIS provide reasonable assurance that impacts greater than SMALL will be avoided, or if identified, then can be readily mitigated?

A.39. Yes. The COC and related conditions are specifically designed to prevent greater than SMALL impacts from occurring from the operation of LNP's raw water supply system. The COC and related conditions define contingent actions that PEF is required to take should modeling or monitoring indicate that unacceptable adverse impacts are likely to occur in the future due to operation of the raw water supply system. Section 4, Adaptive Management, of the EMP (PEF305, at pp. 25 to 27) provides a clearly defined, stepwise process by which the monitoring and data collection efforts are linked to the implementation of management strategies to prevent wetland functional losses, if any, resulting from groundwater withdrawals. These management strategies will precede a transition to an AWS, if required. The stepwise process of implementing these adaptive

management strategies is presented in the decision flowchart, included as Figure 5 in PEF305. PEF305, at p. 27. The result of the application of these AM strategies ensures that, as set forth in the FEIS, the impacts to the resources identified in Contention 4A, Part A, Sections 1 through 4 will be, at most, SMALL.

VIII. OTHER IMPACT ALLEGATIONS RAISED BY CONTENTION 4A

Q.40. Will active dewatering have impacts on water quality and the aquatic environment due to alterations and increases in nutrient concentrations caused by the removal of water as asserted in Contention 4A, Part A, Section 4?

A.40. The Contention fails to state the mechanism by which alterations and increases in nutrient concentrations will occur, other than alleging that removal of water by wellfield operation will be the cause. Nutrient concentrations in water, whether surface water or groundwater, are a function of the mass of available nutrient, the volume of water, the solubility chemistry of the chemical species, and the input and output changes to the mass balance of water and nutrient species.

For wetlands and aquatic ecosystems, the nutrients of concern are nitrogen and phosphorus. The main nutrient inputs are through atmospheric deposition and rainfall for both nitrogen and phosphorus, biological fixation[11] within the wetland for nitrogen, and runoff inputs from surrounding uplands for both. Export will occur via surface outflow, and downward seepage for nitrogen and phosphorus, and biological denitrification[12] for nitrogen. In this simple nutrient and water mass balance, the only component that will change slightly due to operation of the LNP's raw water wellfield is that groundwater seepage from the SAS to the UFA will be slightly higher than otherwise; therefore, there will also be a slight increase in the mass of nitrogen and phosphorus moving from the SAS into the UFA, by the amount of nitrogen and phosphorus that is contained in the seepage outflow. The inputs side of the equation - atmospheric deposition, rainfall, and overland flow transport – will not be changed by operation of the LNP wells. There is no clear mechanism for increasing nutrient concentrations within wetlands and aquatic

---

11 Biological fixation is a process in the nitrogen cycle whereby atmospheric nitrogen gas is converted to organic nitrogen by the action of certain microorganisms in wetland soils.

12 Biological denitrification is another process in the nitrogen cycle in which microorganisms in anaerobic wetland soils are able to convert organic and inorganic forms of nitrogen into nitrous oxide or nitrogen gas, with ultimate release back into the atmosphere.

ecosystems and their underlying aquifers on or in the vicinity of the LNP site without adding an external source depositing additional nutrients on the properties and thereby increasing the input side of the equation. Hypothetical examples of such an external source would include runoff from adjacent agricultural operations like dairies, or other confined animal feeding operations, or urban runoff. No such external sources exist on and in the vicinity of the LNP site.

For the groundwater system, it is even more improbable that operation of the LNP's raw water wellfield will increase concentrations of nitrogen and phosphorus in either the UFA or SAS in any measurable amount. Chemical species concentrations in the UFA are controlled by the same components of the combined mass balance for water and nutrient species as discussed above; that is, inputs, outputs, and changes in storage of water and nutrients in soils, sediments and geologic materials. As I discussed earlier, the modeled groundwater flow in the area of the LNP site is 450 mgd, which is 164 billion gallons per year, in Model 1, and 208 mgd, which is 75.9 billion gallons per year, in Model 2. The change in groundwater flow due to operation of the LNP's wellfield is miniscule. Because the UFA is an underground river flowing beneath the LNP site and South Property and moving toward the Gulf of Mexico at a flow estimated at 450 mgd or 208 mgd, it is improbable that the additional mass flux of nutrients entering the UFA due to a slight increase in seepage flux from the SAS would ever be detectable in the UFA.

In my professional opinion, there will be no measurable alterations or increases in nutrient concentrations caused by active dewatering during construction and operation of the LNP.

Q.41. Please discuss the significance of anticipated groundwater withdrawals associated with the Tarmac King Road Limestone Mine.

A.41. The anticipated groundwater withdrawal for the Tarmac Mine is discussed in the testimony of Mr. Lehnen. PEF200, at pp. 17 to 18. He states that the SWFWMD has permitted the Tarmac Mine to withdraw freshwater from the UFA at an average rate of 0.123 mgd and a maximal rate of 0.137 mgd. These permitted amounts are far lower than the Tarmac Mine's estimated water use value of approximately 1 mgd discussed by the NRC in the FEIS (NRC001, Section 4.2.1, at p. 4-24). Mr. Lehnen calculates that these withdrawal rates for that mine correspond to roughly 0.03% and 0.06% respectively of the total modeled flow rate through the UFA in the vicinity of the LNP site of 450 mgd under Model 1 and 208 mgd under Model 2, and states that the 0.1 ft drawdown contour associated with the Tarmac Mine withdrawal reaches only a portion of the LNP site.

PEF200, at p. 17. Based on this information, it is my professional opinion that the groundwater use associated with the Tarmac Mine does not change the characterization within the FEIS that the direct, indirect, and cumulative impacts on water resources from active dewatering during operation and construction of the LNP are SMALL.

Q.42. Please discuss the cumulative impacts to wetlands, floodplains, special aquatic sites, and other waters associated with passive dewatering and active dewatering during construction and operation of the LNP.

A.42. The testimony of Dr. Griffin addresses the impacts of passive dewatering and the limited active dewatering during construction and shows that the impacts on the environment will be negligible; therefore, Dr. Griffin concludes that such impacts are properly characterized as SMALL. PEF001, at p. 36. I agree with Dr. Griffin's conclusions. My testimony demonstrates that the impacts of active dewatering during operation of the LNP are also SMALL. Based on this information, it is my professional opinion that the cumulative impacts to wetlands, floodplains, special aquatic sites, and other waters, including the UFA and SAS, from passive dewatering and active dewatering during construction and operation of the LNP are no greater than SMALL.

IX. LNP'S ZONE OF ENVIRONMENTAL IMPACTS, IMPACT ON FEDERALLY LISTED SPECIES, IRREVERSIBLE AND IRRETRIEVABLE ENVIRONMENTAL IMPACTS, AND APPROPRIATE MITIGATION MEASURES

Q.43. Do you agree with Contention 4A, Part C, which states that as a result of the omissions and inadequacies described in Contention 4A, Parts A and B, the DEIS (now the FEIS) 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?

A.43. No, it is my professional opinion that Contention 4A, Part C is without merit. In order for the contention to have merit, the contention by its terms requires an initial determination that the FEIS fails to specifically and adequately address, and inappropriately characterizes as SMALL, direct, indirect, and cumulative impacts, onsite and offsite, to wetlands, floodplains, special aquatic sites, and other waters, associated with 1) dewatering caused by the LNP (Contention 4A, Part A); and/or 2) salt drift and salt deposition from the LNP cooling towers (Contention 4A, Part B). It does not.

As I state in my testimony, regarding Contention 4A, Part A, my professional opinion is that the FEIS adequately addresses and appropriately characterizes as SMALL the direct,

indirect, and cumulative impacts, onsite and offsite, to wetlands, floodplains, special aquatic sites, and other waters from active dewatering during construction and operation of the LNP. Additionally, I found that there would be no measurable alterations or increases in nutrient concentrations caused by dewatering for the LNP. In his testimony, Dr. Griffin concludes that the direct, indirect, and cumulative impacts to wetlands, floodplains, special aquatic sites, and other waters from active dewatering during construction and passive dewatering during construction and operation of the LNP are SMALL. PEF001, at p. 36. Lastly, Dr. Robertson's testimony concludes that there will be no noticeable increase in wildfire frequency attributable to dewatering (active and/or passive) from construction and operation of the LNP, nor will such wildfires (if any) result in increased nutrient concentrations that would adversely impact water quality or the aquatic environment. PEF400, at pp. 12.

Regarding Contention 4A, Part B, Dr. Blancher concludes in his Pre-Filed Direct Testimony that the FEIS adequately describes and appropriately characterizes the impact of salt drift and salt deposition from the LNP's cooling towers. PEF600, at p. 11.

Since Contention 4A, Parts A and B are without merit, the allegations that the FEIS 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, are also without merit.

Q44. Do you have an opinion regarding the substance of the claims set forth in Contention 4A, Part C?

A.44. As I explain above, because in my professional opinion the claims set forth in Contention 4A, Parts A and B are without merit, there is no reason to reach the merits of the consequential claims in Contention 4A, Part C. However, even if it were necessary to reach the substance of the allegations of Contention 4A, Part C, it is my professional opinion that the FEIS adequately identifies and appropriately characterizes as SMALL the proposed project's zone of environmental impacts. The summary of effects of the project's construction and operations on the surface water system and the groundwater system in the FEIS clearly detail the expected changes to the surface and groundwater systems. In particular, water budget simulations show that the magnitude and areal extent of hydrologic change due to active and passive dewatering during construction and operation are relatively small compared to the flux of water moving through the UFA and the surface water system on and in the vicinity of the LNP site. The FEIS also delineates the vertical and horizontal extent of drawdown in the SAS due to active dewatering

during operations and concludes that operational impacts on terrestrial ecological resources, including wetlands, would be, at most, SMALL to MODERATE. However, as I stated earlier, it is my professional opinion that the impacts of dewatering on wetlands and aquatic ecosystems on and in the vicinity of the LNP site and South Property would be SMALL. These findings logically lead to the conclusion that the project's zone of environmental impacts is SMALL. This characterization is further supported by the testimony of Dr. Griffin in regards to the surface water network (PEF001, at p. 36), and Dr. Blancher in regards to the impact of salt drift and salt deposition onsite and offsite (PEF600, at p. 11). Additionally, the salt deposition modeling performed by Dr. George C. Howroyd and described in his Pre-Filed Direct Testimony determined that the maximum offsite salt drift deposition would occur at 1,000 meters from the cooling towers and that the salt deposition rate decreases moving away from the cooling towers. PEF500, at pp. 9 to 11. Therefore, no salt deposition in excess of this rate would be found beyond 1,000 meters from the cooling towers, effectively setting the areal extent of concern regarding salt deposition.

By adequately identifying and appropriately characterizing the LNP's zone of environmental impacts, it is my professional opinion that the FEIS also adequately identified and appropriately characterized the proposed project's zone of (1) impact on Federally listed environmental species; (2) irreversible and irretrievable environmental impacts; and (3) appropriate mitigation measures.

In addition, the FEIS identified only SMALL to MODERATE impacts to Federally listed species. I reviewed the sections of the FEIS regarding Federally listed species. The FEIS contains detailed discussions of the potential impacts on Federally listed terrestrial and aquatic threatened or endangered species during construction (NRC001, Section 4.3.1.3, at pp. 4-47 to 4-58, and Section 4.3.2.3, at pp. 4-76 to 4-78) and operation (NRC001, Section 5.3.1.3, pp. 5-38 to 5-42, and Section 5.3.2.3, p. 5-60) of the LNP. The FEIS discussion concludes that impacts on aquatic Federally listed species from construction and operation of the LNP would be minimal. NRC001, Section 4.3.2.3, at p. 4-78; Section 5.3.2.3, at p. 5-60. The FEIS concludes that impacts to terrestrial ecological resources, which include wetlands and threatened and endangered species, from construction and operation of the LNP would be SMALL to MODERATE. NRC001, Section 4.3.1.8, at p. 4-71; Section 5.3.1.6, at p. 5-47. Impacts to Federally listed species are also discussed in two Biological Assessments (BAs) and a Biological Opinion (BO) for the LNP that are in Appendix F to the FEIS. The NRC, in cooperation

with the USACE, prepared a BA to support their joint consultation with the U.S. Fish and Wildlife Service (USFWS) regarding the impact of construction and operation of the LNP on Federally threatened and listed species. NRC001, Appendix F, at pp. F-119 to F-194. Table 8-1 of the BA lists the Federally threatened or endangered species potentially affected by construction and operation of the LNP. NRC001, at pp. F-184 to F-185. The USFWS issued a BO dated December 1, 2011 based on its review of the LNP and its associated offsite facilities including a heavy-haul road, barge slip, barge slip access road, water pipelines, cooling-water intake structure, and about 180-miles of existing and new transmission lines spanning nine Florida counties and its effects on the Federally threatened and endangered species. NRC001, Appendix F, at pp. F-195 to F-221. In the BO, the USFWS states that its opinion is based on information provided in the DEIS, the BA, and supplemental information provided by PEF. PEF has conducted habitat assessment and appropriate species-specific surveys for Federally listed species, including plants, to clarify the determinations of the BA. NRC001, Appendix F, at p. F-195. The BO lists 25 Federally threatened and endangered species potentially found in the project's action area[13] and sets forth the USFWS' determination of likely impact for 24 of those 25 species of either "No Effect", or "May affect, not likely to adversely affect". NRC001, Appendix F, at pp. F-196 to F-198.[14] The only Federally listed species identified as likely to be adversely affected by construction and operation of the LNP is the Florida scrub-jay. The BO found that limited mortality of the Florida scrub-jay could result from habitat losses caused by the LNP, but that the losses are not expected to appreciably affect overall survival of the species; therefore, the USFWS

---

[13] The BO notes that, while most of the 25 Federally listed species had potentially suitable habitat located within the action area, detailed habitat assessments and species-specific surveys indicated that the wood stork, red-cockaded woodpecker, eastern indigo snake, Florida manatee, Florida scrub-jay, longspurred mint, and Britton's beargrass were the only species documented within the action area.

[14] The NRC and the USACE also prepared a BA to support their joint consultation with the National Marine Fisheries Service (NMFS) regarding the potential impacts on Federally threatened and endangered species under the jurisdiction of the NMFS. NRC001, Appendix F, at pp. F-65 to F-117. Such impacts appear generally to be associated with use of the cooling water system for the LNP and not with dewatering. The review team concluded that the impacts on aquatic Federally listed threatened and endangered species from construction and operation of the proposed LNP site would be minor, and additional mitigation would not be warranted. NRC001, Appendix F, at p.F-106. Table 8-1 of the BA lists 7 such species and includes an impact determination for each of either "No effect" or "May affect, not likely to adversely affect." NRC001, Appendix F, at p. F-106.

issued an incidental take statement for Florida scrub-jays in the BO. NRC001, Appendix F, at pp. F-214 to F-216. The BO specifically notes that, since construction of the project will be delayed until all necessary permits are obtained, additional habitat assessments and surveys will need to be conducted within 2 years of any construction activities. It adds that the USFWS' consultation on this project may need to be reopened and its BO revised to reflect any new information at that time. Based on my review of the FEIS, including the BAs and the BO discussed in my testimony, and my educational and professional experience, it is my opinion that impacts on Federally listed species, including the zone of such impacts, have been adequately identified and appropriately characterized in the FEIS as SMALL to MODERATE.

Lastly, since the FEIS determined that the potential impacts due to dewatering and salt drift are SMALL (or in one case SMALL to MODERATE), the FEIS does not identify any resulting significant "irreversible and irretrievable environmental impacts." Additionally, the FEIS adequately discusses the "appropriate mitigation measures" related to the impacts due to dewatering, such as those required by the EMP and AWS Plan that I have described above.

I, William J. Dunn, swear under penalties of perjury that the foregoing testimony is true and correct to the best of my knowledge and belief.

William J. Dunn

Signature

6-23-12

Date