Progress Energy

Serial: NPD-NRC-2010-050 10CFR52.79
June 21, 2010

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

LEVY NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 52-029 AND 52-030
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 091 RELATED TO GROUNDWATER

Reference: Letter from Brian C. Anderson (NRC) to John Elnitsky (PEF), dated May 7, 2010, "Request for Additional Information Letter No. 091 Related to SRP Section 2.4.12 for the Levy County Nuclear Plant, Units 1 and 2 Combined License Application"

Ladies and Gentlemen:

Progress Energy Florida, Inc. (PEF) hereby submits our response to the Nuclear Regulatory Commission's (NRC) request for additional information provided in the referenced letter.

A response to the NRC request is addressed in the enclosure. The enclosure also identifies a change that will be made in a future revision of the Levy Nuclear Plant Units 1 and 2 application.

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (727) 820-4481.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 21, 2010.

Sincerely,

John Elnitsky
Vice President
New Generation Programs & Projects

Enclosure

cc : U.S. NRC Region II, Regional Administrator
Mr. Brian C. Anderson, U.S. NRC Project Manager

Progress Energy Florida, Inc.
P.O. Box 14042
St. Petersburg, FL 33733

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NRO

Levy Nuclear Plant Units 1 and 2
Response to NRC Request for Additional Information Letter No. 091 Related to SRP Section 2.4.12 for the Combined License Application, dated May 7, 2010

NRC RAI #	Progress Energy RAI #	Progress Energy Response
02.04.12-22	L-0809	Response enclosed – see following pages
02.04.12-23	L-0810	Response enclosed – see following pages
02.04.12-24	L-0811	Response enclosed – see following pages

NRC Letter No.: LNP-RAI-LTR-091

NRC Letter Date: May 7, 2010

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.04.12-22

Text of NRC RAI:

The transmissivity of the upper Floridan aquifer estimated from pumping test responses of wells in the vicinity of LNP Units 1 and 2 ranged from 4000 to 53,000 ft2/d (PEF 2009| ML0921509601L-0363 –RAI response letter NPD-NRC-2009-177|). This is equivalent to a hydraulic conductivity range of 16 to 212 ft/d assuming an aquifer thickness of 250 ft. The map in Figure 10 of the revised DWRM2 groundwater flow model (338884-TMEM-123) shows an upper Floridan aquifer transmissivity range of 7920 to 50,000 ft2/d from model calibration over the flow path between the hypothetical release site and the receptor locations. Provide a discussion of how the calculated seepage velocity reported in FSAR Table 2.4.12-212 and RAI supplemental response NPD-NRC-2009-177, which is based on a horizontal hydraulic conductivity of 54.4 ft/d, represents a conservative estimate or justify its exclusion.

PGN RAI ID #: L-0809

PGN Response to NRC RAI:

The response to this RAI is presented in two parts:

1) Clarification of LNP FSAR RAI 02.04.12-11 Table 1, and

2) Discussion of the calculated seepage velocity for the LNP site.

<u>Clarification of LNP FSAR RAI 02.04.12-11 Table 1</u>

Using the computer model MLU (Multi-Layer Unsteady state) to analyze pumping test responses of wells in the vicinity of LNP Units 1 and 2, the hydraulic conductivity of the Upper Floridan aquifer was simulated to be 120 to 130 ft/day, as shown in Table 1 of the response to RAI 02.04.12-11. This hydraulic conductivity range equates to a transmissivity range of 62,400 to 67,600 ft^2/day based on an Upper Floridan aquifer thickness of 520 feet, which is the minimum estimated thickness of the Upper Floridan aquifer at the Levy site.

The transmissivity values of 3000 to 53,000 ft^2/day shown in Table 1 of the response to RAI 02.04.12-11 correspond to specific intervals of the Upper Floridan aquifer simulated in MLU and are only applicable to those intervals, which range in thickness from 25 to 445 ft.

<u>Discussion of Calculated Seepage Velocity</u>

The seepage velocities calculated in LNP FSAR Subsection 2.4.12 and presented in LNP FSAR Table 2.4.12-212 are ultimately used in the transport model discussed in LNP FSAR Subsection 2.4.13. This FSAR section utilizes several conservative assumptions including those listed below.

- The closest receptor is located at the property boundary and in the direction of groundwater flow.
- Transport occurs in the upper 250 feet of the Upper Floridan aquifer. This assumption is based on observations during the onsite field investigation program that 1) the surficial

aquifer is approximately 50 feet thick, and 2) the most productive interval of the Upper Floridan aquifer is at depths between approximately 100 and 300 feet, resulting in a thickness of 250 feet (50 to 300 feet in depth). As discussed above, the minimum estimated thickness of the Upper Floridan aquifer at the LNP site is 520 feet, however, the assumption of a thinner aquifer is conservative.

The direction of groundwater flow in the Upper Floridan aquifer at the LNP site is generally west-southwest. Attachment 02.04.12-22A presents a larger scale (i.e., "zoomed-in") version of Figure 10 from LNP ER RAI 05.02.02-04, Attachment 05.02.02-04A (338884-TMEM-123, "Revised Groundwater Model Evaluation of Simulated Drawdown Water Impacts, Levy Nuclear Plant, Rev 0"), to clarify the DWRM2 transmissivity values near the LNP site in the direction of groundwater flow. As shown on Attachment 02.04.12-22A, the transmissivity of the Upper Floridan aquifer simulated by the revised DWRM2 model between LNP 1/LNP 2 and the property boundary in the direction of groundwater flow is primarily between 7,920 and 29,429 ft^2/day.

As discussed in the response to LNP FSAR RAI 02.04.12-10, analyses of slug test results at seven LNP monitoring wells screened within the Upper Floridan aquifer were used to determine an in-situ permeability or hydraulic conductivity of the upper 250 feet of the Upper Floridan aquifer at the LNP site. The full thickness of the Upper Floridan aquifer was not used for the slug test analysis method because of the limited aquifer influence of the slug testing method. Using this method, hydraulic conductivity values were observed to range from 2.4 to 54.4 feet/day and transmissivity values were observed to range from approximately 600 to 13,600 ft^2/day in the Upper Floridan aquifer.

As discussed in the response to LNP FSAR RAI 02.04.12-12, because of regional and local variability within the Upper Floridan aquifer, use of the hydraulic conductivity estimate of 54.4 ft/day, as shown in LNP FSAR Table 2.4.12-212, is considered conservative when utilized as a single value to characterize the site. However, an alternative analysis of transport conditions has been performed using values of hydraulic conductivity up to 130 ft/day, which are considered more conservative than representative site conditions. The results of this bounding analysis are presented in the response to LNP RAI 02.04.13-13.

Associated LNP COL Application Revisions:

No COLA changes have been identified associated with this response.

Attachments/Enclosures:

Attachment 02.04.12-22A – Revised TMR Model Upper Floridan Aquifer Transmissivity

NRC Letter No.: LNP-RAI-LTR-091

NRC Letter Date: May 7, 2010

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.04.12-23

Text of NRC RAI:

The use of a homogeneous porous media conceptual model for the Upper Floridan Aquifer results in a relatively high estimated effective porosity being applied for seepage velocity calculations reported in FSAR Table 2.4.12-212. Calculation of seepage velocity in FSAR Table 2.4.12-212 uses an effective porosity of 0.15 based on values published in textbooks and the "Groundwater Protection and Siting Ordinance" of Hernando County, Florida. Site-specific measurements of effective porosity at the LNP site at the scale of the transport calculation do not appear to have been provided by the applicant. Published information indicates that there is a possibility of preferential groundwater flow through fractures or solution cavities in the Upper Floridan aquifer in western Florida (|USGS WSP-2475 and USGS WRIR 93-4171|). The "shallow" tracer test at the Old Tampa Well Field (|USGS WRIR 93-4171|) was conducted in the upper 90 feet of the Upper Floridan aquifer over a distance of 200 feet and resulted in an estimated effective porosity of 0.003 based on the early arrival of the tracer. The short travel time and low effective porosity was attributed to secondary aquifer porosity caused by fractures in the limestone. Another tracer test in the Upper Floridan aquifer near Port Malabar resulted in an estimated effective porosity of 0.05 (Burklew 1989). Although the matrix porosity is greater, potential transport through secondary porosity features could result in faster travel times and less decay of radionuclides before reaching an offsite well. Provide a discussion of how an effective porosity of 0.15 represents a conservative value for use in the seepage velocity calculation, or justify its exclusion.

References:

USGS WSP-2475: Knochenmus, Lari A., and Robinson, James L. 1996. Descriptions of anisotropy and heterogeneity and their effect on ground-water flow and areas of contribution to public supply wells in a karst carbonate aquifer system. U.S. Geological Survey Water-Supply Paper 2475, 46 p.

USGS WRIR 93-4171: Robinson, J. L. 1995. Hydrogeology and results of tracer tests at the old Tampa well field in Hillsborough County, with implications for wellhead-protection strategies in west-central Florida. U.S. Geological Survey Water-Resources Investigations Report 93-4171, 63 p.

Burklew 1989: Burklew, Lori M. 1989. Characterization of the Upper Floridan Aquifer System, Including Field Dispersivity Tests and Analytical Modeling, in the Vicinity of Port Malabar, Florida. Masters Thesis. University of Florida, Gainesville, FL.

PGN RAI ID #: L-0810

PGN Response to NRC RAI:

In USGS WSP-2475 and USGS WRIR 93-4171, effective porosity values ranging from 2% to 48% (14 values, average 19%, mean 19%) are reported for the Avon Park Formation, the formation corresponding to the Upper Floridan aquifer at the LNP site.

LNP FSAR Subsection 2.4.12 uses an effective porosity value of 0.15 (15%) to develop the Upper Floridan aquifer seepage velocities presented in LNP FSAR Table 2.4.12-212. This effective porosity value is derived from the Groundwater Protection and Siting Ordinance of Hernando County (Reference RAI 02.04.12-23 01). The purpose of the Ordinance is to protect the groundwater quality of the Floridan aquifer by providing criteria for land uses and the siting of facilities which use, handle, produce, store, or dispose of regulated substances. This ordinance identifies an effective porosity value of 0.15 for the Upper Floridan aquifer. Compared to USGS WSP-2475 and USGS WRIR 93-4171, the Ordinance is more applicable to the LNP site because:

- USGS WSP-2475 and USGS WRIR 93-4171 examine wells located in Pinellas, Hillsborough, Pasco, and Polk Counties. The Ordinance applies to wells within Hernando County. The LNP site is located in Levy County, approximately 30 to 50 miles north of Hernando County and approximately 50 to 140 miles north of Pinellas, Hillsborough, Pasco, and Polk counties. Because hydrogeologic conditions vary spatially, the hydrogeologic conditions of Hernando County are more likely to be applicable to those of the LNP site than those of Pasco, Pinellas, Hillsborough, and Polk Counties.
- The Upper Floridan aquifer is confined by the Hawthorn Formation at the locations of the wells examined in USGS WSP-2475 and USGS WRIR 93-4171. In the majority of Hernando County and at the LNP site the Upper Floridan aquifer is unconfined.

In addition, an effective porosity value of 0.15 is more conservative (results in a faster seepage velocity and therefore faster transport) than the average or mean effective porosity value calculated for the Avon Park Formation from the effective porosity values presented in USGS WSP-2475 and USGS WRIR 93-4171.

USGS WRIR 93-4171 also discusses tracer studies that were performed in the Suwannee and Ocala Limestones of the Upper Floridan aquifer to evaluate the affects of secondary porosity on transport in these formations. These tracer studies determined that an effective porosity of 21% accurately predicted the tracer arrival through the porous media; however, effective porosities between 0.3% and 1.5% were required to numerically model tracer arrival through secondary porosity features (fractures, solution features, etc.). The results of these tracer studies cannot be extrapolated to the LNP site for the two reasons listed below.

1. These tracer studies were performed in the Suwannee and Ocala Limestones, not the Avon Park Formation. USGS WSP-2475 explains that:

   "One mechanism for development of the heterogeneous layering of higher permeability zones in carbonate aquifer systems is chemical dissolution in response to changes in sea level. As water levels in the ocean rise and fall, base-levels change and subaerial karstification is cyclically renewed, creating various horizons of extensive secondary porosity development throughout the carbonate sequence. Chemical dissolution is most aggressive along zones of weakness in carbonate sequences. Horizontal zones of weakness tend to be at lithologic interfaces of differing types, at a specific lithologic boundary where a concentration of impurities such as sand, silt, and shell exists, and where cyclic changes such as laminations occur within a lithology. The lithologic heterogeneity within the Floridan aquifer system resulted from deposition in warm shallow seas over periods of geologic time where even slight changes in depositional conditions and diagenetic alterations resulted in textural and mineralogical changes described above. Vertical fracturing and heterogeneous layering of the carbonate rocks have resulted in variable horizontal and vertical permeabilities in the Upper Floridan aquifer (Williams, 1985). Subtle variations can affect porosity and permeability, resulting in a highly heterogeneous carbonate aquifer system."

Because the tracer tests discussed in USGS WRIR 93-4171 were not specific to the Avon Park Formation the results cannot be extrapolated to the LNP site.

2. The tracer tests discussed in USGS WRIR 93-4171 were performed between wells located up to only 200 feet apart. The ultimate use of the seepage velocities calculated in LNP FSAR 2.4.12 is in application of the transport model discussed in LNP FSAR Subsection 2.4.13. LNP FSAR Section 2.4.13 utilizes the conservative assumption that the closest receptor is located at the property boundary, a distance of 1.2 miles (6336 feet) southwest of LNP 1 and LNP 2, even though the nearest resident in the direction of groundwater flow is 1.7 miles (8976 feet) southwest of LNP 1 and LNP 2. USGS WSP-2475 notes that flow through secondary porosity features, such as fractures, may dominate when small volumes of a karst carbonate aquifer are stressed, such as during aquifer tests. However, karst carbonate aquifers may tend to behave as an equivalent porous medium when larger volumes of the aquifer are stressed. This characteristic of karst carbonate aquifers further prevents extrapolation of the tracer test results to the LNP site where considered distances are more than an order of magnitude greater than those of the tracer tests.

As discussed above, an effective porosity value of 0.15 is considered representative of LNP site conditions. However, an alternative analysis of transport conditions was performed using values of effective porosity as low as 0.05, which are considered more conservative than representative site conditions. The results of this bounding analysis are presented in the response to LNP RAI 02.04.13-13.

References

Reference RAI 02.04.12-23 01

Groundwater Protection and Siting Ordinance of Hernando County. www.epa.gov/nps/ordinance/documents/hernando_fa.pdf. *Accessed May 17, 2010.*

Associated LNP COL Application Revisions:

Reference RAI 02.04.12-23 01 will be added to a future revision of the FSAR.

Attachments/Enclosures:

None.

NRC Letter No.: LNP-RAI-LTR-091

NRC Letter Date: May 7, 2010

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.04.12-24

Text of NRC RAI:

Provide a discussion of the effects of alterations to the groundwater flow system, including the effects of storm water runoff caused by the new structures and facilities. In addition, discuss how these will impact groundwater levels near the safety-related SSCs with respect to the DCD site parameter on maximum groundwater elevation.

PGN RAI ID #: L-0811

PGN Response to NRC RAI:

Alterations to the groundwater flow system at the LNP site include:

- Construction of a surface water drainage system,
- Construction of impervious areas,
- Changes to the existing drainage pattern,
- Dewatering, and
- Raw water pumping.

Each of these potential alterations to the groundwater flow system is discussed below along with the potential impacts of each alteration. The effect of the potential impacts to the groundwater flow system on groundwater levels near the safety-related SSCs, with respect to the DCD site parameter on maximum groundwater elevation, are further addressed at the end of this response.

- Surface Water Drainage System - As discussed in LNP FSAR Subsection 2.4.2.3, the LNP site will include a drainage system designed to remove runoff from up to a 50-year precipitation event by conveying water from roof gutters and/or scuppers, as well as runoff from the LNP site and adjacent areas, to catch basins, underground pipes, or directly to open ditches and then ultimately to onsite retention ponds. If needed, stormwater from the retention ponds will be pumped to the cooling water tower basins. Cooling tower blowdown from Units 1 and 2 will directly discharge to the Gulf of Mexico through the Crystal River Energy Complex Discharge Canal. If the onsite drainage system becomes blocked, the LNP site can be drained by overland flow directly to the Lower Withlacoochee River or the Gulf of Mexico.

  The drainage system will capture and redirect rainfall and surface runoff away from safety-related SSCs to onsite ditches and retention ponds where the water will recharge, evaporate, or be pumped offsite if needed (via the cooling water tower basins). The drainage system will alter the groundwater flow system by reducing the surficial aquifer groundwater elevations near safety-related SSCs. Recharge to the surficial aquifer will occur away from safety-related SSCs because onsite open ditches and retention ponds are unlined.

- Impervious Areas – Construction of the LNP site will include construction of impervious surfaces such as building foundations, including safety-related SSCs, and parking lots.

  The impervious surfaces will alter the groundwater flow system by eliminating rainfall infiltration and significantly reducing the potential for localized groundwater mounding at the safety-related SSCs.

- Changes to the Drainage Pattern – Safety-related SSCs are located in the central portion of the plant site at a pre-construction grade elevation of approximately 12.8 m (42 ft.) NAVD88. The pre-construction grade at the locations of Units 1 and 2 will be filled (raised) to a nominal plant grade elevation of 15.2 m (50 ft.) NAVD88. The site is graded to slope away from safety-related SSCs.

  As discussed in LNP FSAR Subsection 2.4.12.5, site grading has the potential to alter the groundwater flow system by altering the existing surface water drainage pattern. However, as described above, surface runoff will be captured by the onsite drainage system and redirected to onsite ditches and ponds, thereby preventing the development of new surface drainage features. Therefore, alterations to the existing drainage pattern will not alter the site groundwater flow system.

- Dewatering – The site dewatering system is described in LNP FSAR RAI 2.4.12-20. As described in LNP FSAR RAI 2.4.12-20, grouting keyed to the Avon Park Formation will create a low permeability "bathtub" around the nuclear islands and safety-related SSCs.

  The effects of the site dewatering system are discussed in LNP FSAR RAI 2.4.12-18 and details of the alterations to the groundwater flow system are discussed in Calculation Package LNG-0000-XDC-001, "Effect of Grouting on Groundwater Flow Regime, Rev. 2" (Rev. 2, 11/19/08). Results indicate that no impacts to groundwater elevations occur when comparing pre-construction and post-construction conditions.

- Raw Water Pumping – The LNP raw water supply wellfield includes four Upper Floridan aquifer wells located on the southern portion of the LNP property. The average day pumping is predicted to be 1.58 mgd and the peak week pumping rate is predicted to be 5.8 mgd.

  As discussed in LNP FSAR RAI 2.4.12-02, numerical simulation of LNP groundwater withdrawals predicts alteration of the groundwater flow system consisting of a decrease in groundwater levels of up to 0.5 feet in the surficial aquifer and up to 0.2 feet in the Upper Floridan aquifer, with the highest decreases predicted to occur near the wellfield south of safety-related SSCs. Groundwater levels and gradients in the surficial and Floridan aquifers in the vicinity of the safety-related SSCs are not expected to change as a result of pumping the wellfield.

As discussed in LNP FSAR RAI 2.4.12-18, groundwater elevations within the footprint of safety-related SSCs LNP 1 and LNP 2 meet the requirements for the AP1000 design as provided in the DCD. The AP1000 is designed for a normal groundwater elevation up to 0.6 m (2 ft.) below the nominal plant grade. The nominal plant grade elevation for safety-related structures is 15.2 m (50 ft.) NAVD88 and the nominal plant grade floor elevation for safety-related structures is 15.5 m (51 ft.) NAVD88. The highest recorded groundwater elevation during site characterization activities was 12.82 m (42.05 ft.) NAVD88. As discussed above, alterations to the groundwater flow system at the LNP site will not increase the groundwater elevations in the surficial or Upper Floridan aquifers.

Associated LNP COL Application Revisions:

No COLA changes have been identified associated with this response.

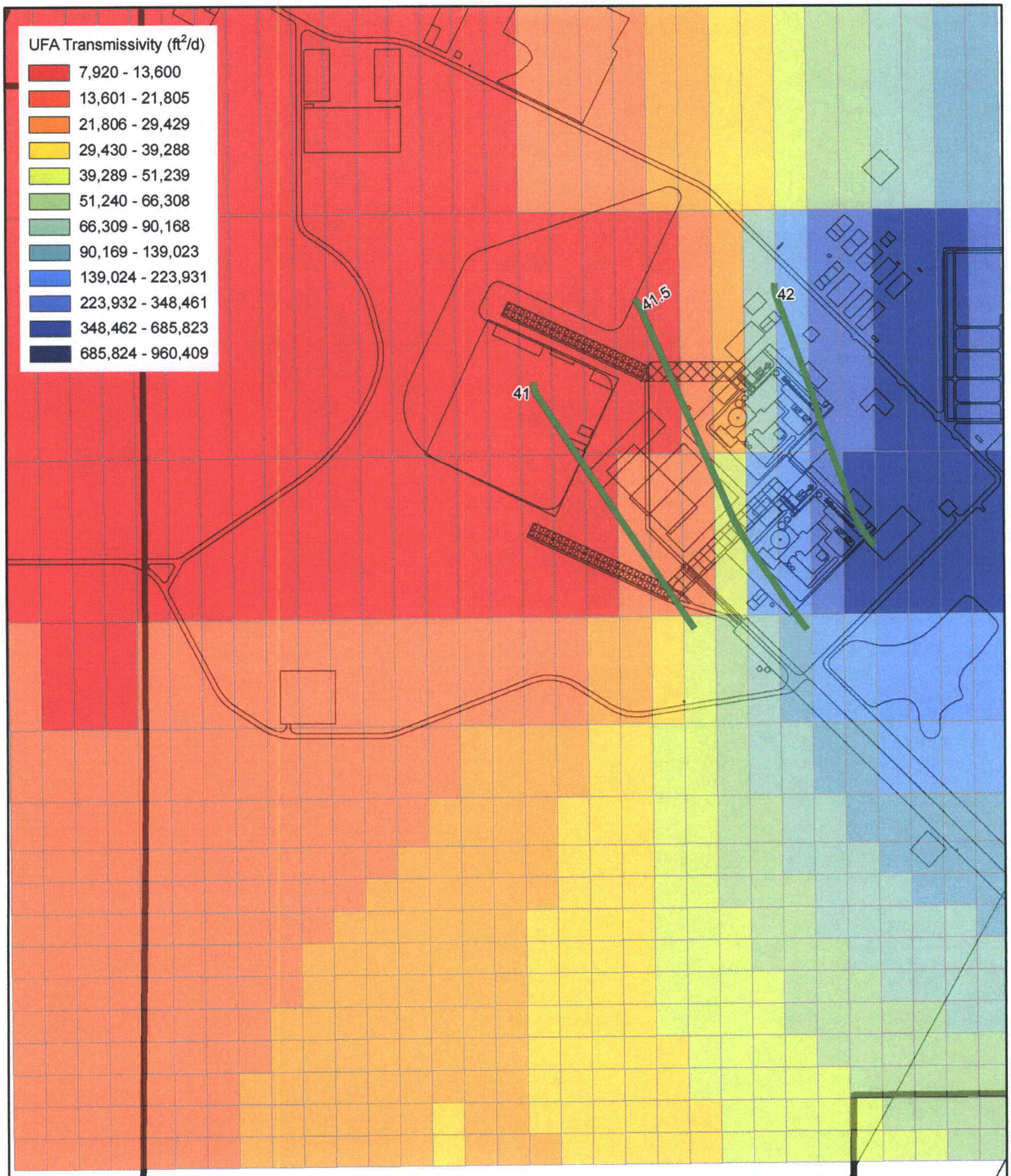
Attachments/Enclosures:

None.

List of Attachments:

1. NRC RAI # 02.04.12-22 [PGN RAI ID # L-0809]:

   Attachment 02.04.12-22A – Revised TMR Model Upper Floridan Aquifer Transmissivity [1 page attached]



LEGEND

Potentiometric Surface Contour
Bedrock Aquifer, March 6, 2007
Contour Interval = 0.5 feet

N
W E
S

0 0.125 0.25
Kilometers

0 0.125 0.25
Miles

Progress Energy Florida
Levy Nuclear Plant
Units 1 and 2

Revised TMR Model Upper Floridan Aquifer Transmissivity

Attachment 02.04.12-22A