Progress Energy

Serial: NPD-NRC-2009-239 10CFR52.79
December 14, 2009

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. 070 RELATED TO BASIC GEOLOGIC AND SEISMIC INFORMATION

Reference: Letter from Brian C. Anderson (NRC) to Garry Miller (PEF), dated November 2, 2009, "Request for Additional Information Letter No. 070 Related to SRP Section 2.5.1 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.

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 December 14, 2009.

Sincerely,

John Elnitsky
Vice President
Nuclear Plant Development

Enclosures/Attachments

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. 070 Related to SRP Section 2.5.1 for the Combined License Application, dated November 2, 2009

NRC RAI #	Progress Energy RAI #	Progress Energy Response
02.05.01-46	L-0584	Response enclosed – see following pages
02.05.01-47	L-0586	Response enclosed – see following pages
02.05.01-48	L-0587	Response enclosed – see following pages
02.05.01-49	L-0588	Response enclosed – see following pages
02.05.01-50	L-0590	Response enclosed – see following pages

NRC Letter No.: LNP-RAI-LTR-070

NRC Letter Date: November 2, 2009

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.01-46

Text of NRC RAI:

The response to RAI 2.5.1-12 discusses information related to whether large dissolution voids occur in the subsurface. The response states that the diameter of shallow dissolution features observed at the surface is not indicative of the size of subsurface karst cavities and cites a reference (Sinclair and Stewart, 1985) to support this conclusion. However, a summary of the basis for this conclusion as derived from the cited reference is not provided in the response.

In order for the staff to assess the basis for the statement that the diameter of shallow dissolution features observed at the surface is not indicative of the size of subsurface karst cavities, please summarize the logic for this conclusion as derived from Sinclair and Stewart (1985).

PGN RAI ID #: L-584

PGN Response to NRC RAI:

A direct quote from Sinclair and Stewart (1985) (Reference 2.5.1-317) is as follows:

> "Solution sinkholes occur in areas where limestone is exposed at the land surface or is covered by thin layers of soil and permeable sand [see FSAR Figure 2.5.1-240]. Solution is most active at the limestone surface and along joints, fractures or other openings in the rock that permit water to move easily into the subsurface. Dissolved limestone and some insoluble residue are carried downward by percolating water along enlarged openings as solution of the limestone progresses. Large voids commonly do not form because subsidence of the soil layer occurs as the surface of the limestone dissolves. The result is a gradual downward movement of the land surface and in development of a depression that collects increasing amounts of surface runoff as its perimeter expands. This type of sinkhole usually forms as a bowl-shaped depression with the slope of its sides determined by the rate of subsidence relative to the rate of erosion of the walls of the depression from surface runoff. Surface runoff may also carry sand and clay particles into the depression, which may form an impermeable seal in the bottom. A marsh or lake forms when water is ponded because infiltration is restricted by the clayey seal."

This process produces an undulating topography characterized by shallow depressions and is common over large parts of Florida.

As shown on Revised Figure 2.5.1-237 (see Attachment 02.05.01-30A to PGN RAI #L-0585; NPD-NRC-2009-240), the LNP site lies completely within the area dominated by solution sinkholes (Reference 2.5.1-317). This type of sinkhole is recognized at the LNP site and is likely to develop over a long timeframe as slow dissolution of the carbonate (dolostone) surface occurs. As discussed in the Response to RAI 02.05.01-08 (see NPD-NRC-2009-151 dated July 20, 2009), the development of karst features in the Avon Park Formation in the LNP area is limited due to dolomitization. The Avon Park Formation carbonates were dolomitized in the Oligocene (FSAR Reference 2.5.1-231) limiting the dissolution of the carbonates. FSAR

Subsection 2.5.4.1.2.1, page 2.5-193, states, "Once limestone has been converted to dolomite (dolostone), there is less potential for future dissolution of the rock by groundwater."

Associated LNP COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures to Response to NRC:

None.

NRC Letter No.: LNP-RAI-LTR-070

NRC Letter Date: November 2, 2009

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.01-47

Text of NRC RAI:

The response to RAI 2.5.1-31 discusses available information related to whether underground conduits capable of accommodating rapid groundwater flow occur at or near the Levy site, and provides a figure modified from Maddox (1993) which clearly indicates there are no caves reported near the site. The response states that no caves exist which could act as conduits capable of accommodating rapid groundwater flow within the Avon Park Formation in the outcrop area of Levy County and Citrus County. The response also states that Dr. S. Upchurch concluded there are no springs of any noticeable magnitude with the LNP site vicinity, but no reference is cited to document his conclusion.

In order for the staff to assess the basis for the conclusion drawn by Upchurch which is stated in the response to RAI 2.5.1-31 regarding the point that no springs of any noticeable magnitude occur with the LNP site vicinity, please cite an appropriate reference documenting his conclusion that no springs exist.

PGN RAI ID #: L-586

PGN Response to NRC RAI:

The conclusion by Dr. Sam Upchurch was from a personal communication (see Reference RAI 02.05.01-47 01 and Attachment 02.05.01-47A). As part of the communication, Dr. Upchurch reported that his firm, SDII, recently completed the basis documents for the Minimum Flows and Levels (MFL) for the Waccasassa River and its springs publication "MFL Establishment for the Waccasassa River, Estuary and Levy (Bronson) Blue Spring", a technical report from the Suwannee River Water Management District that is available at the following location: http://www.srwmd.state.fl.us/documents/Water%20Resources/Minimum%20Flows%20and%20Levels/waccasassa_final.pdf). Section 2 of this report (Reference RAI 02.05.01-47 02) discusses the geology of the basin and surroundings and presents an analysis of karst and springs in the area. The following statements from the personal communication present his conclusions relative to springs in the area:

> "The springs are limited to the edge of the outcrop belt of the Ocala Limestone. We know of no significant springs within the Avon Park Formation (there are probably some seep springs on bedding planes, but none are of sufficient magnitude to attract attention). I believe that the Levy County springs are within the Ocala Limestone where flow is forced to the surface because of the permeability contrast with the significantly less permeable Avon Park. If you refer to Figure 2-14 in the publication referenced above [see RAI 02.05.01-47 Figure 1, Attachment 02.05.01-47B], Wekiva and Levy Blue Springs fall at the Ocala/Avon Park contact. There are no named springs within the outcrop area of the Avon Park."

The Waccasassa River basin study by Upchurch did not include the LNP site. The LNP site lies to the south of the Waccasassa River basin but geologic conditions are similar.

Springs in the Levy County vicinity are discussed in Scott et al. (2004) (Reference RAI 02.05.01-47 03), which presents the results of research conducted by the Florida Geological Survey (FGS) Springs Teams. These teams found two small (third magnitude) springs, Big King Spring and Little King Spring, near the LNP site. These springs are believed to the result of similar permeability differences as discussed by Upchurch. Big King Spring, Little King Spring and Wekiva Spring are the nearest named springs to the site as shown in RAI Figure 02.05.01-47 Figure 2 (Revised Figure 2.5.1-244 with annotations as shown in Attachment 02.05.01-47C).

References:

1. RAI 02.05.01-47 01, Upchurch, S. Personal Communication via email, November 13, 2009.
2. RAI 02.05.01-47 02, Water Resource Associates, SDII Global Corporation, and Janicki Environmental, Inc., MFL Establishment for the Waccasassa River, Estuary and Levy (Bronson) Blue Spring. Technical Report, Live Oak, Florida, Suwannee River Water Management District, 258p., 2006.
3. RAI 02.05.01-47 03, Scott, T.M., Means, G.H., Meegan, R.P., Means, R.C., Upchurch, S.B., Copeland, R. E., Jones, J., Roberts, T., and Willett, A., Springs of Florida: Florida Geological Survey Bulletin 66, 377 p. plus CD., 2004.

Associated LNP COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures to Response to NRC:

Attachment 02.05.01-47A,	Personal communication, S. Upchurch, November 13, 2009
Attachment 02.05.01-47B,	RAI 02.05.01-47 Figure 1 (Figure 2-14 from Reference RAI 02.05.01-47 02)
Attachment 02.05.01-47C,	RAI 02.05.01-47 Figure 2 (Annotated Revised Figure 2.5.1-244)

NRC Letter No.: LNP-RAI-LTR-070

NRC Letter Date: November 2, 2009

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.01-48

Text of NRC RAI:

The response to RAI 2.5.1-35 presents information used by Rupert (1988) to formulate his lithologic descriptions and estimates of unit thicknesses. The response provides lithologic and drillers logs and resistivity and velocity borehole logs from wells which Rupert (1988) examined, and states that neither lithologic or drillers logs recorded voids in the upper 305 m (1000 ft) of the boreholes. However, examination of these logs reveals zones of "no returns" in some holes (e.g., W-3342 at 130-283 ft, 380-648 ft, and 775-907 ft). It is not clear whether these "no-return" zones may represent actual voids rather than washouts of soft carbonate units, since the criteria applied to draw the conclusion that no voids are recorded in the upper 305 m (1000 ft) of the logs are not stated.

In addition, the response to RAI 2.5.1-44 discusses how the presence of deep voids was investigated and states that low-recovery zones reported in the boreholes generally reflected soft carbonate layers interbedded with more competent units in the Avon Park Formation, rather than significant voids or filled voids. The response also indicates that quick drilling, loss of drilling fluid, minimal to no recovery, and rod drop events as recorded in FSAR Tables 2.5.4.2-205A and 2.5.4.2-205B are common due to the presence of poorly-indurated, soft carbonate beds in the materials being drilled which wash out during drilling, resulting in misinterpretation of such descriptions in the drilling logs as voids or filled voids. It is not clear how materials encountered in boreholes could be precisely classified as soft carbonate layers when there is no recovery based on information shown in Tables 2.5.4.2-205A and 2.5.4.2-205B.

In order for the staff to understand characteristics and properties of subsurface zones described in the drilling logs as exhibiting "no recovery" and "no returns", please discuss the criteria applied to determine that washout of soft carbonate layers produced these zones rather than dissolution voids or filled voids.

PGN RAI ID #: L-587

PGN Response to NRC RAI:

An examination of the drilling notes presented on the boring logs along with a visual inspection of the cores collected during the LNP COLA site investigation reveals the highly variable nature of the carbonate sediments encountered in the vicinity of the LNP site. The alternating beds of very hard to soft dolostone and limestone are characteristic of the Eocene formations. Core recovery is often difficult due to drilling conditions combined with attempts to recover core as quickly as possible. Poor drilling practices such as coring too quickly and coring with too much drilling fluid pressure or drilling downforce, will often produce cores that lack preserved soft zones. Loss of soft materials during drilling can occur in both sonic and rotary drilling methods in the LNP geologic formations. Rotary core drilling has the potential to recover the most complete cores from soft rock formations when drilling is performed with a concentration on core recovery rather than speed. Comparison of closely spaced cores that are drilled concentrating on core recovery with those drilled to quickly recover core can be dramatic.

Recovery from cores drilled too quickly may be as low as 25%, while core drilled for high recovery may exceed 80%. (References RAI 02.05.01-48 01 and RAI 02.05.01-48 02 and Attachments 02.05.01-48A and 02.05.01-48B)

During the COLA investigation at LNP, the geotechnical rock coring work was accomplished using mud rotary techniques with wireline core barrels. The core barrel size was typically NQ (nominal 2-inch [50.8] mm core diameter), although a few borings were cored with HQ (nominal 2.5-inch [63.5 m] core diameter) sized core barrels. Hydraulic downforce was typically used in addition to the weight of the drill string to core the rock. Circulating fluid pressures were also typically high to clear cuttings and to lubricate the rapidly rotating core barrel bit. The run time for each 5 foot coring run was timed and recorded on the boring log. Driller comments regarding the nature of the drilling such as "hard zone, soft zone, fast drilling" were also recorded on the boring logs. In addition, the amount of drilling fluid circulation, rates of fluid loss and rock cutting returns in the mud tub were also monitored. Reviewing this information, zones of "no recovery" where soft rock was penetrated but washed away could be distinguished from voids or cavities.

A visual examination of the LNP cores by Dr. Tom Scott, Assistant State Geologist at the time of his visit to the LNP site, indicated that the speed of the core drilling at the site was very detrimental to core recovery. He notes in a personal communication (Reference RAI 02.05.01-48 01 and Attachment 02.05.01-48A):

> "Loss of recovery, loss of circulation and drill rod drop may indicate the presence of voids but attention needs to be paid to the drilling conditions discussed above [see Attachment 02.05.01-48A]. Loss of circulation can occur in very porous carbonate. Rod drops can occur in the soft sediments particularly at depth when the weight of the drill string can be excessive."

A review of the "Summary of Karst Features Encountered in Boreholes at South Reactor" (FSAR Table 2.5.4.2-205) compared to boring logs documentation indicates that many of the events originally interpreted as "infill zones" or other potential karst features were likely soft sediment/rock zones, which had been washed out and not recovered due to the drilling process. (References RAI 02.05.01-48 01 and RAI 02.05.01-48 02 and Attachments 02.05.01-48A and 02.05.01-48B)

To support the foundation design, supplemental borings are currently being conducted at the LNP site by Rizzo and Associates. Several offset borings are being performed adjacent to COLA geotechnical boring locations which displayed low recoveries to further evaluate rock properties. The drilling and coring methods used are different than the COLA drilling program in that a larger diameter PQ (nominal 3.378-inch [85.8 mm] core) core barrel is being utilized to attempt to recover more intact cores. The drilling methods also include using minimal downpressure and lower drilling fluid pressures, as well as slower drilling rates, concentrating on highest percent core recovery possible.

During the September 2009 NRC geotechnical audit at the LNP site, the original cores obtained from borings A-14 and A-21 were laid out adjacent to the recently completed offset boring for each location, borings O-2 and O-1 respectively. Visual inspection of these cores side-by-side revealed that in softer rock intervals, the recovery rates for the cores obtained from the offset borings were significantly higher than the recoveries measured during the original A-series borings. In many cases, the softer, more porous zones of rock were recovered largely intact from the same intervals where no recovery was obtained in the original COLA borings. Although the offset boring program is not yet complete, the results will be provided to the NRC in January 2010 as noted in supplemental letter NPD-NRC-2009-212.

With regard to zones of "no recovery" listed on driller's logs for wildcat oil exploration borings such as FGS well 3342 and the Scholtz #1 well, driller's logs are typically the only information available for these wells, and details of shallower formations penetrated are often sparse. This is because the potential "pay zones" for oil exploration are several thousand feet below land surface, and the shallower materials were not considered important from that perspective. The drilling rigs used for these deep exploration wells were also typically large, fast-drilling rigs, and were not focused on recovery of cuttings or core from shallower, softer water-bearing formations. Gaps in drilling records are also common in these logs at intervals where casing is being set or holes being reamed for casing. (References RAI 02.05.01-48 02 and Attachment 02.05.01-48B)

References:

1. RAI 02.05.01-48 01, Scott, T. Personal Communication via email, November 13, 2009.

2. RAI 02.05.01-48 02, Scott, T. Personal Communication via email, November 13, 2009.

Associated LNP COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures to Response to NRC:

Attachment 02.05.01-48A, T. Scott personal communication via email, November 13, 2009

Attachment 02.05.01-48B, T. Scott personal communication via email, November 13, 2009

NRC Letter No.: LNP-RAI-LTR-070

NRC Letter Date: November 2, 2009

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.01-49

Text of NRC RAI:

The response to RAI 2.5.1-38 discusses information used to conclude that no faults occur within the site vicinity and cites map sources from 1978, 1979, 1992, 2001, and 2008, none of which indicate that faults exist in the site vicinity. The response states that structure contour maps drawn by Arthur and others (2008) on the tops of the Oligocene Suwannee Limestone, the Upper Eocene Ocala Limestone, and the Middle Eocene Avon Park, presented in the response to this RAI, show that no faults affect the Ocala and Avon Park horizons. However, the response does indicate that Arthur and others (2008) postulated two potential faults to account for abrupt thickness changes in the Suwannee Limestone as located on their structural contour map drawn on the top of the Suwannee. It is not clear why abrupt thickness changes in the Oligocene Suwannee Limestone are postulated as being due to potential faults when older rock layers underlying that unit (i.e., the Upper Eocene Ocala Limestone and Middle Eocene Avon Park Formation) are reported to show no faulting based on similar maps.

In order for the staff to understand why proposed faults which cut younger (i.e., overlying) Suwannee Limestone do not affect the older underlying Ocala Limestone and Avon Park Formation, please explain the basis for the interpretation that faults occur in the Suwannee Limestone but not in the older units that underlie the Suwannee.

PGN RAI ID #: L-588

PGN Response to NRC RAI:

At the time of publication of Arthur et al. (Reference RAI 02.05.01-49 01), the database of well coverage was not sufficient to allow the authors to project the faults into the deeper, older geologic units. Dr. Jon Arthur, State Geologist and senior author states in a personal communication (Reference RAI 02.05.01-49 02, and see Attachment 02.05.01-49A): "The faults mentioned in the report are inferred and whether or not to include them was a subject of debate among some report authors. The comments below [NRC statements for RAI 02.05.01-49] regarding the possible faults are certainly valid; however, we did not have sufficient well control to support delineation of faults in subjacent units. Geologically it is certainly reasonable that if the Suwannee Limestone faults are present, that the subjacent units would be affected as well. Given that the Suwannee Limestone faults are inferred, and given the aforementioned lack of well control, we opted to not perpetuate the inference beyond the Suwannee features thereby making it implicit that the areas merit further study."

The authors of the report and editors at the Florida Geological Survey discussed the inclusion of the faults without sufficient data to map the faults in the deeper Eocene formations (Reference RAI 02.05.01-49 03, and see Attachment 02.05.01-49B). The senior author, Arthur, argued to include the inferred faults in the Suwannee Limestone. There is no recognized surface expression of the inferred faults of Arthur et al. (Reference RAI 02.05.01-49 01) documented in current Florida geologic literature. This indicates that the faults, if they do exist,

are post-Early Oligocene and pre-Quaternary (the age of the undifferentiated sediments overlying the Suwannee Limestone).

References:

RAI 02.05.01-49 01, Arthur, J.D., C. Fischler., C. Kromhout., J. M. Clayton, G. M. Kelley, R. A. Lee, L. Li,, M. O'Sullivan, R. C. Green and C. L. Werner, "Hydrogeologic Framework of the Southwest Florida Water Management District, " Florida Geological Survey, Bulletin No. 68, 2008,175 pp.

RAI 02.05.01-49 02, Arthur, J., email communication, November 2, 2009.

RAI 02.05.01-49 03, Scott, T., email communication, November 11, 2009

Associated LNP COL Application Revisions:

As noted in the response to RAI 2.5.1-19 (NPD-NRC-2009-151 dated July 20, 2009), Reference RAI 02.05.01-49 01 will be added to a future revision of the FSAR as a new FSAR reference.

Attachments/Enclosures to Response to NRC:

Attachment 02.05.01-49A, Personal Communication from J. Arthur, 11/02/09

Attachment 02.05.01-49B, Personal Communication from T. Scott, 11/11/09

NRC Letter No.: LNP-RAI-LTR-070

NRC Letter Date: November 2, 2009

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.05.01-50

Text of NRC RAI:

The response to RAI 2.5.1-38, seemingly in response to the part of this RAI asking for the criteria used to distinguish faults in the site vicinity, cites Hanson and others (1999) and lists criteria used to recognize individual paleoseismic events. It is not clear whether these criteria, some of which may not be applicable to specifically distinguishing faults since paleoseismic features do not always delineate specific structures, were applied to delineate faults in the site vicinity as initially asked in RAI 2.5.1-38.

In order for the staff to understand the criteria applied to distinguish faults in the site vicinity, please clarify which of those listed for recognizing individual paleoseismic events were used to distinguish faults in the site vicinity.

PGN RAI ID #: L-590

PGN Response to NRC RAI:

Criteria commonly used to identify and map tectonic faults include:

1) Fault planes or sheared material exposed at the surface;
2) Evidence for displacement or offset of bedrock or Quaternary units observed in outcrop or inferred from mapping relationships;
3) Discontinuities or anomalies in subsurface units that may suggest truncation, displacement, or offset of deposits or bedrock units;
4) Vertically displaced or offset geomorphic surfaces;
5) Deposits and geomorphic surfaces or landforms deformed by folding, tilting, or warping; and,
6) Alignments of microseismicity or clear association with a moderate to large magnitude earthquake.

These criteria were considered in evaluating the postulated faults identified by Vernon (Reference 2.5.3-203) and in the evaluation of the potential for surface faulting at the LNP site (see FSAR Section 2.5.3). A discussion and review of the evidence cited by Vernon (Reference 2.5.3-203) for the existence of faults based on apparent displacements of Eocene-aged bedrock units is provided in the Responses to RAI 02.05.01-19, RAI 02.05.01-38, and RAI 02.05.01-40 (NPD-NRC-2009-151 dated July 20, 2009, NPD-NRC-2009-143 dated July 13, 2009, and NPD-NRC-2009-151 dated July 20, 2009 respectively). Structural features (slickensides and tilted bedding) that Vernon cites as evidence of surface faulting at the outcrop scale have been interpreted to be nontectonic surface deformation related to karst (see the Response to RAI 02.05.03-02 in NPD-NRC-2009-152 dated July 16, 2009). Maps recently developed for the FGS by Arthur et al. (Reference RAI 02.05.01-50 01) are based on the most current lithologic information available. The Arthur et al. study incorporated information from mapping of surface geology with interpretation of subsurface information, primarily water well

and petroleum exploration well data, to develop structure contour maps on various datums. Discontinuities or anomalies that would suggest displacements of these surfaces by faulting were not identified in the LNP site vicinity. Maps of the top of the Ocala Limestone and the Avon Park Formation show no faults. FSAR Figure 02.05.01-232 shows that there are no recorded earthquakes within the site vicinity. The response to RAI 02.05.03-05 (NPD-NRC-2009-152 dated July 16, 2009), which includes proposed revisions to FSAR Section 2.5.3, describes the evidence for the absence of faulting and Quaternary tectonic deformation within the site vicinity and site area.

The following stratigraphic and structural features were listed in the Response to RAI 02.05.01-38 as useful for the recognition and evaluation of paleoseismic events (i.e., individual earthquakes that occurred decades, centuries, or millennia ago):

1) Deposits offset by a fault;
2) Abrupt upward truncation of a fault strand, with younger faults extending to higher stratigraphic levels;
3) Deposits and surfaces deformed by folding, tilting, or warping;
4) Colluvial wedge deposits formed by degradation of fault scarps;
5) Transformed deposits including sediment sheared by faulting and liquefaction deposits;
6) Systematic and abrupt or stepped increases in displacement downsection;
7) Intruded material such as fissure fills and fault gouge; and,
8) Fault planes exposed at the surface.

Many of these observations relate to the assessment of features at an outcrop or locality mapping scale and are specific to the evaluation of the timing and recurrence of past earthquakes as well as the identification of tectonic faulting or related surface deformation. All but numbers 2 and 4, which relate primarily to the assessment of recurrent fault displacement, are pertinent to the identification of tectonic faults. Except for the karst-related deformation features described in the Response to RAI 02.05.03-02, no such features have been identified in the site vicinity.

References:

1. RAI 02.05.01-50 01, Arthur, J.D., C. Fischler., C. Kromhout., J. M. Clayton, G. M. Kelley, R. A. Lee, L. Li,, M. O'Sullivan, R. C. Green and C. L. Werner, "Hydrogeologic Framework of the Southwest Florida Water Management District, " Florida Geological Survey, Bulletin No. 68, 175 pp., 2008.

Associated LNP COL Application Revisions:

No COLA revisions have been identified associated with this response.

Attachments/Enclosures to Response to NRC:

None.

List of Attachments

1. Attachment 02.05.01-47A: Personal communication, S. Upchurch, November 13, 2009 [2 pages]
2. Attachment 02.05.01-47B: RAI 02.05.01-47 Figure 1 (Figure 2-14 from Reference RAI 02.05.01-47 02) [1 page]
3. Attachment 02.05.01-47C: RAI 02.05.01-47 Figure 2 (Annotated Revised Figure 2.5.1-244) [1 page]
4. Attachment 02.05.01-48A: T. Scott personal communication via email, November 13, 2009 [1 page]
5. Attachment 02.05.01-48B: T. Scott personal communication via email, November 13, 2009 [1 page]
6. Attachment 02.05.01-49A: Personal Communication from J. Arthur, 11/02/09 [2 pages]
7. Attachment 02.05.01-49B: Personal Communication from T. Scott, 11/11/09 [1 page]

Attachment 02.05.01-47A

Schaeffer, Jen/SEA

From: tscott [tscott@sdii-global.com]
Sent: Friday, November 13, 2009 11:08 AM
To: Schaeffer, Jen/SEA; Elliott, William/GNV
Subject: FW: Springs in the Waccasassa Flats area

Here is Sam's personal communication.

Tom

Thomas M. Scott, PhD, P.G.
Senior Principal Geologist
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From: Sam Upchurch [mailto:SUpchurch@sdii-global.com]
Sent: Friday, November 13, 2009 10:34 AM
To: Thomas Scott
Subject: Springs in the Waccasassa Flats area

This email is in response to your request for any information available relative to springs in the Levy County area, specifically the Waccasassa Flats/Gulf Hammock area surrounding the Progress Energy Levy County nuclear power plant site.

SDII recently completed the basis documents for Minimum Flows and Levels for the Waccasassa River and its springs (the citation is Water Resource Associates, SDII Global Corporation, and Janicki Environmental, Inc., 2006. MFL Establishment for the Waccasassa River, Estuary and Levy (Bronson) Blue Spring. Technical Report, Live Oak, Florida, Suwannee River Water Management District, 258p. (Report available from the District at <http://www.srwmd.state.fl.us>). Section 2 of that report discusses the geology of the basin and surroundings and presents an analysis of springs in the area. The following are my conclusions relative to springs in the area.

- The springs are limited to the edge of the outcrop belt of the Ocala Limestone. We know of no significant springs within the Avon Park Formation (there are probably some seep springs on bedding planes, but none are of sufficient magnitude to attract attention). I believe that the Levy County springs are within the Ocala Limestone where flow is forced to the surface because of the permeability contrast with the significantly less permeable Avon Park. If you refer to Figure 2-14 in the publication referenced above, Wekiva and Levy Blue Springs fall at the Ocala/Avon

Park contact. There are no named springs within the outcrop area of the Avon Park.

- As a dolostone, the dolomitization of the Avon Park is of interest. The preservation of the plant fossils and thin laminations in many areas of the dolostone lead me to believe that at least some of the dolomitization is penecontemporaneous. This being the case, I would not expect to see large volume reductions such as may occur when older limestone is dolomitized in the subsurface. The result is that the dolomitic part of the Avon Park, such as occurs in the Gulf Hammock area, normally has low porosity and permeability. It is for this reason that groundwater flow is forced up along the Ocala Limestone outcrop belt, Where the Avon Park crops out, there are no major springs, and the area is characterized by large swamps and streams that gain by bank seepage rather than spring discharge.

Sam B. Upchurch, Ph.D., P.G.

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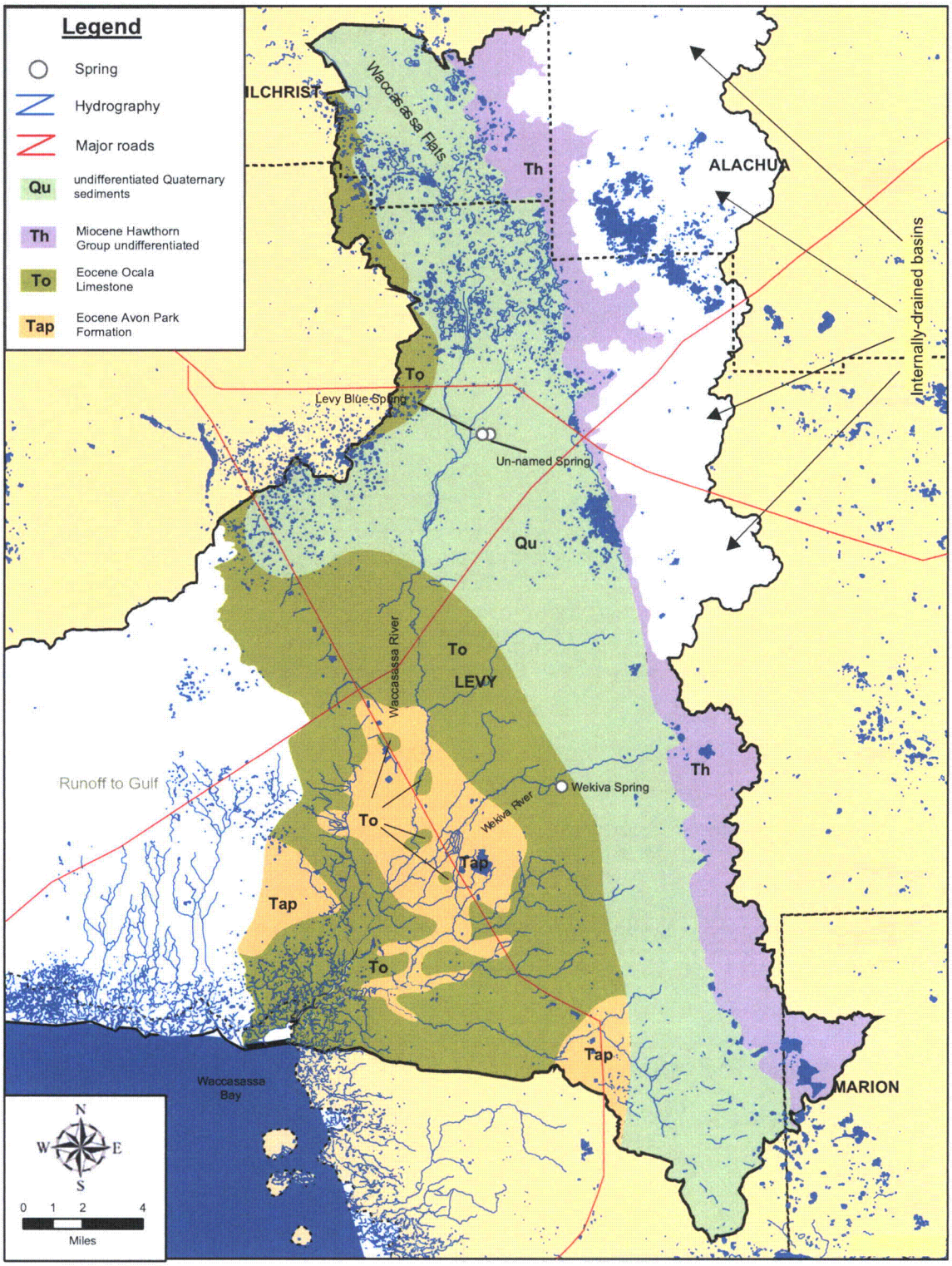
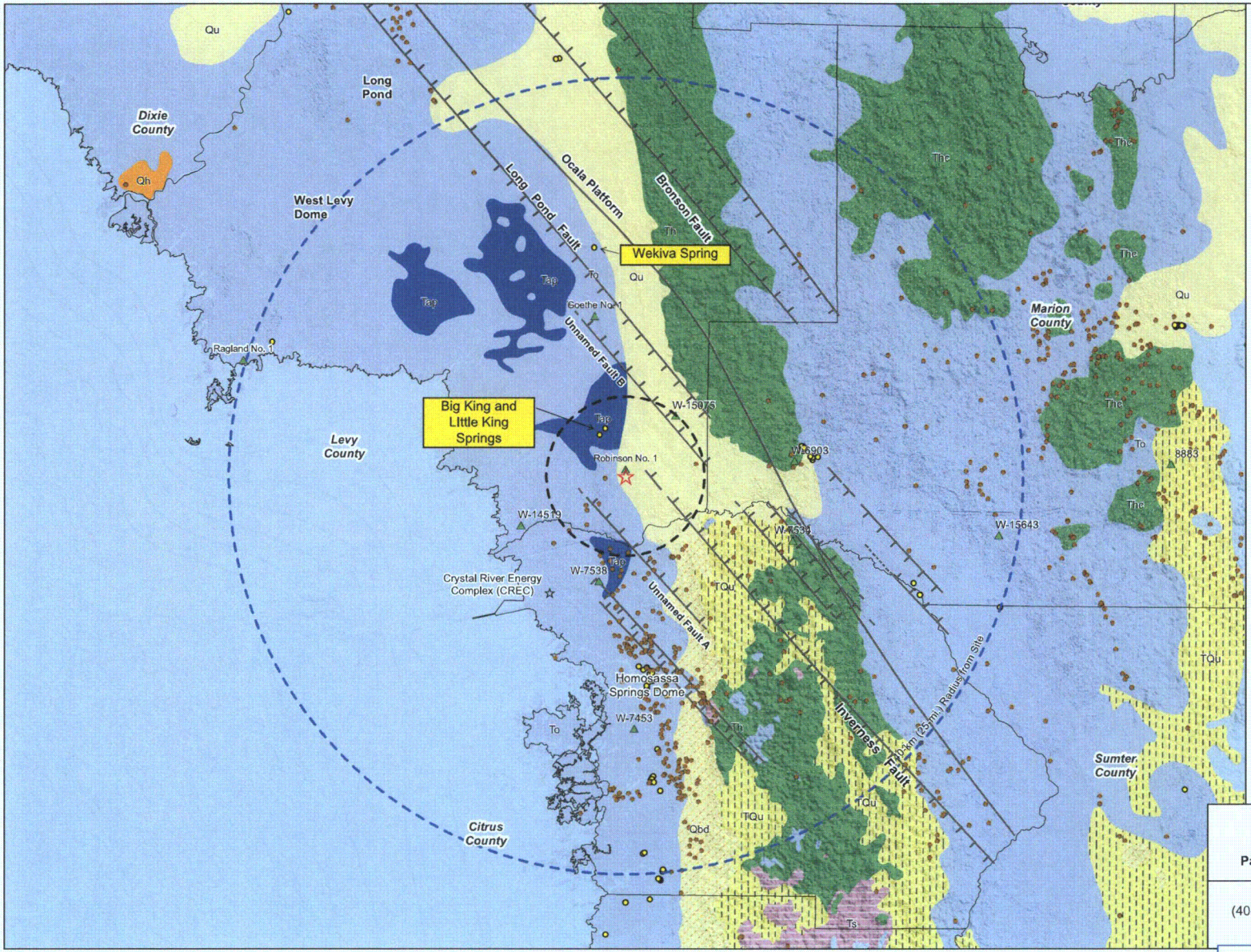


Figure 2-14 Geologic map of the Waccasassa River Basin. Source: Florida Geological Survey.

RAI 02.05.01-47 Figure 1
Figure 2-14 from MFL Technical Report
(Reference RAI 02.05.01-47 02)



N
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LEGEND

- LNP Site
- 8-km (5-mi.) Radius from Site
- 40-km (25-mi.) Radius from Site
- Postulated Structures
  Ticks indicate downthrown side. Dashed lines are less certain.
  Source: Vernon (1951)
- Sinkhole Locations
- Well Locations
  Sources: Florida Geological Survey (2007); Vernon (1951)
- Spring Locations
  Source: Florida Geological Survey (2009)

Geologic Map

- Qh Holocene sediments
- Qbd Beach ridge and dune
- Qu Undifferentiated sediments
- TQu Undifferentiated sediments
- Tp Cypresshead Formation
- The Hawthorn Gp, Coosawhatchie
- Th Hawthorn Group
- Ts Suwannee Limestone
- To Ocala Group
- Tap Avon Park Formation

Source: Scott et al. (2001)

Base Maps: Topography from USGS NED (1999), and Bathymetry from NOAA Coastal Relief Digital Elevation Model (2007)

0 5 10 15
Kilometers

0 5 10
Miles

Progress Energy Florida

Levy Nuclear Plant
Units 1 and 2
Part 2, Final Safety Analysis Report

Site Vicinity Geologic Map
(40-km [25-mi.] and 8-km [5-mi.] Radius)
Figure 2.5.1-244 (Revised)

RAI 02.05.01-47 Figure 2
(annotations to Figure 2.5.1-244)

Attachment 02.05.01-48A
Reference RAI 02.05.01-48 01

Schaeffer, Jen/SEA

From: tscott [tscott@sdii-global.com]
Sent: Friday, November 13, 2009 9:22 AM
To: Schaeffer, Jen/SEA; Elliott, William/GNV
Subject: RE: 2.5.1-48

As the Assistant State Geologist with the Florida Geological Survey (FGS), I supervised the Survey's drilling operations. The primary focus of the FGS drilling program is to collect continuous cores for research purposes. The drillers are trained to obtain as complete a core as possible through slow drilling, lower pressure drilling fluid circulation and core barrel selection. Drilling too quickly often causes the loss of softer zones in the sediments. The drillers maintain drilling logs as the drilling proceeds. They note the percent recovery, drilling conditions, drilling fluid circulation, etc. The FGS drillers are trained to be able to determine if a zone of no returns is due to voids or the loss of soft, unconsolidated to poorly indurated sediments. These notes are useful to the research geologists, helping them to determine what the sediment was that lost in the no recovery events.

Describing cores and quarry exposures during 35 years with the FGS allowed me to develop a very thorough understanding of Florida's geologic framework. The use of the carefully taken drillers' notes and core inspection reveals the highly variable nature of the carbonate sediments as are encountered in the vicinity of the LNP site. The alternating beds of very hard to soft dolostone and limestone are characteristic of the Eocene formations. Interpretation of these individual zones from water well cuttings is not possible due to the drilling process. Core recovery is often difficult due to drilling conditions and, as is the case with the drillers working at the LNP site during the COLA investigation, attempts to drill as quickly as possible. Examination of the LNP cores during the COLA investigation while I was working with the FGS indicated that the speed of the core drilling at the site was very detrimental to core recovery. This was discussed with the geologic consultants along with the discussion that the loss of recovery zones were not necessarily voids. Loss of recovery, loss of circulation and drill rod drop may indicate the presence of voids but attention needs to be paid to the drilling conditions discussed above. Loss of circulation can occur in very porous carbonate. Rod drops can occur in the soft sediments particularly at depth when the weight of the drill string can be excessive. A review of FSAR Table 2.5.4.2-205, "Summary of Karst Features Encountered in Boreholes at South Reactor," drilling results indicates that many of the events interpreted as karst features were likely soft sediment zones.

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Attachment 02.05.01-48B
Reference RAI 02.05.01-48 02

Schaeffer, Jen/SEA

From: tscott [tscott@sdii-global.com]
Sent: Friday, November 13, 2009 9:23 AM
To: Schaeffer, Jen/SEA; Elliott, William/GNV
Subject: RE: 2.5.1-48

As the Assistant State Geologist with the Florida Geological Survey (FGS), I supervised the Survey's Geologic Data Repository. The repository contains cores and wells cuttings from nearly 20,000 sites. During this time, I trained numerous young geologists to describe cores and cuttings.

Water wells are drilled via several drilling methods. Each method is extremely destructive to the rock in that it grinds it into small fragments. Soft sediments are all but removed by circulating drilling fluids, significantly altering the appearance of the sample. At the FGS, training a new geologist to describe samples usually proceeded by having the geologist describe a set of well cuttings from a well with a continuous core nearby. By describing the core after working the cuttings, the loss of some sediment constituents becomes obvious. This approach allows the geologist to understand the sediments despite the loss of soft sediment.

Part of the training was learning how to identify well cutting sets with poor or bad samples and poorly drilled cores. Poor-quality well cuttings samples can be the result of sloppy sampling procedures, well construction difficulties and subsurface conditions. Petroleum exploration well cuttings are notoriously bad in the upper strata above the target depths. Sample gaps often occur where casing is set. Larger gaps happen when samples were not taken or discarded due to poor quality. Large intervals of no samples, as in W-3342, do not indicate a very large cavity but, simply, no samples available. Cavities of the size of the "no samples" zone in W-3342 have not been encountered in Florida's subsurface.

Poorly drilled cores, ones drilled too fast or with too much drilling fluid pressure, often lack preserved soft zones. The drilling technique is responsible for the loss of sediment from these zones. Sonic drilling techniques recover poor cores due to soft sediment loss. Rotary core drilling has the potential to recover the most complete cores. Comparison of closely spaced cores drilled concentrating on core recovery and ones drilled to quickly recover core is dramatic. Recovery from the cores drilled too quickly may be in the 25% range while a core drilled for proper recovery of core may exceed 80%.

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Attachment 02.05.01-49A
RAI Reference 02.05.01-49 02

Schaeffer, Jen/SEA

From: Arthur, Jonathan [Jonathan.Arthur@dep.state.fl.us]
Sent: Monday, November 02, 2009 5:38 PM
To: tscott
Cc: Schaeffer, Jen/SEA; Elliott, William/GNV; Kromhout, Clint
Subject: RE: B-68 maps

Tom,

The faults mentioned in the report are inferred and whether or not to include them was a subject of debate among some report authors. The comments below regarding the possible faults are certainly valid; however, we did not have sufficient well control to support delineation of faults in subjacent units. Geologically it is certainly reasonable that if the Suwannee Limestone faults are present, that the subjacent units would be affected as well. Given that the Suwannee Limestone faults are inferred, and given the aforementioned lack of well control, we opted to not perpetuate the inference beyond the Suwannee features thereby making it implicit that the areas merit further study.

Jon Arthur, Director
FDEP Office of the Florida Geological Survey

The Department of Environmental Protection values your feedback as a customer. DEP Secretary Michael W. Sole is committed to continuously assessing and improving the level and quality of services provided to you. Please take a few minutes to comment on the quality of service you received. Simply click on this link to the DEP Customer Survey. Thank you in advance for completing the survey.
From: tscott [mailto:tscott@sdii-global.com]
Sent: Monday, November 02, 2009 4:15 PM
To: Kromhout, Clint; Arthur, Jonathan
Cc: Jen.Schaeffer@CH2M.com; William.Elliott@CH2M.com
Subject: B-68 maps

Clint and Jon, please see the included comments from the NRC regarding the B-68 maps of the Avon Park, Ocala, and Suwannee. I can write a response for the NRC but a personal communication from y'all would be better since they are your maps not mine.

The response to RAI 2.5.1-38 discusses information used to conclude that no faults occur within the site vicinity and cites map sources from 1978, 1979, 1992, 2001, and 2008, none of which indicate that faults exist in the site vicinity. The response states that structure contour maps drawn by Arthur and others (2008) on the tops of the Oligocene Suwannee Limestone, the Upper Eocene Ocala Limestone, and the Middle Eocene Avon Park, presented in the response to this RAI, show that no faults affect the Ocala and Avon Park horizons. However, the response does indicate that Arthur and others (2008) postulated two potential faults to account for abrupt thickness changes in the Suwannee Limestone as located on their structural contour map drawn on the top of the Suwannee. It is not clear why abrupt thickness changes in the Oligocene Suwannee Limestone are postulated as being due to potential faults when older rock layers underlying that unit (i.e., the Upper Eocene Ocala Limestone and Middle Eocene Avon Park Formation) are reported to show no faulting based on similar maps.

In order for the staff to understand why proposed faults which cut younger (i.e., overlying) Suwannee Limestone do not affect the older underlying Ocala Limestone and Avon Park Formation, please explain the basis for the interpretation that faults occur in the Suwannee Limestone but not in the older units that underlie the Suwannee.

Thanks guys,

T

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Attachment 02.05.01-49B
RAI Reference 02.05.01-49 03

Schaeffer, Jen/SEA

From: tscott [tscott@sdii-global.com]
Sent: Wednesday, November 11, 2009 3:41 PM
To: Schaeffer, Jen/SEA
Subject: Personal Communication - inferred faults

As the Assistant State Geologist from 1985 until 2009, I was the Senior Editor for all publications at the Florida Geological Survey (FGS). During the editing and review of FGS Bulletin 68 (Arthur et al., 2008), I discussed the mapping of inferred faults on the Suwannee Limestone in the northern portion of the Southwest Florida Water Management District. After spending a number of years investigating and discussing faults mapped by Vernon and others (see personal communication for RAI 2.5.1.19), I was wary of the authors including the faults since there was not enough data to connect the two segments and they could not be identified in the underlying Eocene Avon Park Formation and Ocala Limestone. Several of the co-authors were not in favor of including the faults. I discussed this with Mr. Clint Kromhout (co-author) at the time of the review. Dr. Jon Arthur decided to include the faults as mapped regardless of the fact that available data did not support the extension of the fault into older units. There is no recognized surface expression of the inferred faults of Arthur et al. (2008) indicating that the faults, if they exist, are post-Early Oligocene and pre-Quaternary (the age of the undifferentiated sediments overlying the Suwannee Limestone). The data published in FGS Bulletin 68 did not support faults proposed by Vernon and others in the region surrounding the Levy County nuclear power plant site.

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